Navigating Rising Waters: Applying Protection Motivation Theory to Communities Facing Recurrent Flooding along the Shunganunga Creek

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ABSTRACT

Floodplain communities face persistent and compounding challenges as climate change and urban development increase the frequency and severity of flooding events. This case study examines how residents living near the Shunganunga Creek floodplain in Topeka, Kansas, perceive recurring flood risks and respond to current communication strategies. Using 11 semi-structured interviews analyzed through reflexive thematic analysis, we identified four major themes shaping risk perception: socioeconomic inequities, proximity and lived experience, competing hazards, and community dynamics. We then applied Protection Motivation Theory to evaluate how threat and coping appraisals shape residents' ability and willingness to take protective action. Findings reveal that residents often recognize flood risk but lack confidence in their ability to respond effectively, citing financial, informational, and emotional barriers. We argue that existing flood messaging, such as the "Turn Around, Don't Drown®" campaign, does not adequately address the realities of highly vulnerable floodplain populations. We recommend community-driven, locally tailored communication that builds trust, strengthens coping efficacy, and leverages existing social networks to enhance preparedness. These insights offer practical pathways for refining flood risk communication in urban floodplains and emphasize the broader need for communication strategies that adapt to evolving climate risks.

SIGNIFICANCE STATEMENT

Flooding along Topeka, Kansas' Shunganunga Creek is becoming more frequent and places nearby neighborhoods at repeated risk. This study examines how residents living along this specific floodplain perceive flooding threats and why many struggle to prepare despite recognizing the threat. Findings from this case study suggest that some commonly used flood safety guidance does not fully reflect the lived experiences and constraints described by the participants. Residents emphasized the need for communication that moves past general warnings to provide clear, practical, and locally relevant guidance. These insights highlight how tailoring flood risk communication to local needs may better support preparedness in communities facing recurring flood hazards.

1. Introduction

In the heart of the United States, Topeka, the capital of Kansas, is a community facing a pressing issue: the increasing threat of floods. Topeka is situated along the Kansas River and

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other smaller waterways, including the Shunganunga Creek, which spans 17 miles through the city. In May 2007, 11 inches of heavy rainfall flooded neighborhoods in Topeka, displacing hundreds of people and causing extensive property damage (Ryan 2018). The threat has since intensified: Office of Water Prediction (2024a, 2024b) records show that at two Shunganunga Creek gauges, over half of the recent crests and historical peaks, occurred within the past decade, indicating growing urgency to address floods in Topeka.

Anthropogenic climate change drives global changes, with effects evident in extreme events, such as heavy precipitation. As our atmosphere warms, the air can hold more moisture, which increases the likelihood of heavier rainfall events and higher flooding risks in parts of the United States (NOAA 2025). The 5th National Climate Assessment conducted by the U.S. Global Change Research Program (2023) projects significant changes in precipitation patterns for Shawnee County, which includes Topeka, KS. Precipitation on the year's wettest day is expected to increase by 7–10%. The annual number of days with rainfall in the top 1% of historical events is projected to rise by 17–43%, and the total precipitation on those extreme rainfall days is expected to increase by 15–29%. This shift has implications for Topeka, particularly along the Shunganunga Creek, where flash flooding poses a recurring threat. The Intergovernmental Panel on Climate Change (IPCC) supports these concerns, highlighting that human-induced climate change drives more frequent and intense weather extremes, such as heavy rainfall and floods, and that urbanization contributes to higher runoff intensity (IPCC 2023).

A flash flood is a sudden, intense flood that develops within a few hours of heavy rainfall, resulting in rapidly rising water levels in low-lying areas (NWS n.d.-a). These events can turn small creeks into powerful currents, flooding streets, homes, and infrastructure in minutes (NWS n.d.-b). In comparison, a floodplain is a flat or low-lying area adjacent to a river or stream prone to flooding and are natural buffers that absorb floodwaters. Flooding is hazardous in urban areas where absorption is limited. The Shunganunga Creek watershed covers approximately 72 square miles, with over 53% of this area developed, reducing its capacity to absorb heavy rainfall and increasing surface runoff (Ryan 2018). Without updated infrastructure, the combined pressure of climate change and urban development will continue to strain the system’s ability to manage the projected increase in extreme precipitation. This concern is echoed in the Kansas Response Plan, which identifies floods, tornadoes, and other extreme weather events as “high-risk” hazards and outlines strategies for preparedness and response (Kansas Adjutant General's Department n.d.).

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Among these hazards, flooding ranks as the most significant, given its magnitude and potential to disrupt communities statewide.

This study examines the vulnerability of residents living near Shunganunga Creek and evaluates strategies to enhance communication that fosters protective action. The Shunganunga Creek was selected as a focal case because it represents a recurrently flooded, urbanized floodplain where residents face repeated exposure to flash flooding yet remain embedded within existing warning systems. Although findings from this case are not intended to be generalizable, they offer insight into how flood risk communication functions in communities that experience frequent inundation and highlight challenges that may be relevant to other floodplain areas. Applying established frameworks in risk communication, we use qualitative semi-structured interviews to explore how residents make sense of flood warnings, identify barriers to preparedness, and articulate communication needs grounded in lived experience. As flooding risks intensify, understanding these dynamics will be essential for developing communication strategies that protect lives and reduce social and economic impacts in floodplain communities.

2. Literature Review

a. Risk Perception and Its Relevance in Floodplain Communities

Slovic (1978) first defined risk perception as a subjective assessment influenced by personal experiences, emotions, and cultural contexts, rather than statistical probabilities alone. His work introduced systematically organized risks based on characteristics such as dread and perceived control. Compared to other research at the time, Slovic (1987) emphasized that the public's risk perception often differs from how experts assess it and the qualitative ideas that shape individual judgments. For example, risks perceived as uncontrollable or associated with high dread levels, such as nuclear power or chemical spills, typically evoked higher concern, even if their statistical likelihood is low.

Risk perception has expanded from Slovic's (1978) original cognitive model to a multidimensional construct shaped by various factors. Demographic characteristics such as age, income, and education influence how individuals evaluate hazards, while cultural values and social norms shape whether risks are viewed as acceptable or threatening (Douglas and Wildavsky 1982; Lechowska 2018; Siegrist and Árval 2020; Ali et al. 2022). Institutional trust and self-efficacy further affect whether people believe protective action is both necessary and

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feasible (Grothmann and Reusswig 2006; Kellens et al. 2012). Psychological biases also play a central role. Heuristics, or mental shortcuts, can distort judgments under uncertainty, leading people to over- or underestimate risk (Tversky and Kahneman 1974). For example, the availability heuristic encourages people to judge risk based on memorable past events, while optimism bias leads individuals to believe negative outcomes are less likely to affect them personally (O'Neill et al. 2016).

These factors become especially consequential in floodplain communities, where perceptions of risk are shaped not only by individual beliefs and experiences but also by the presence of structural protections that alter how residents interpret their vulnerability. In these settings, reliance on infrastructure can dampen individual preparedness and distort assessments of danger. Levees and dams, for example, may produce what scholars describe as the "levee effect," in which a perceived sense of safety reduces motivation to prepare for flooding (Jean 2023). As Ludy and Kondolf (2012) show, residents living behind flood defenses often assume these structures will provide complete protection, leading individuals and communities to underestimate flood risk and forgo necessary precautions. Such complacency can be particularly dangerous in flood contexts, where delayed evacuation or failure to take precautionary measures can substantially worsen impacts when flooding occurs (Kellens et al. 2012).

Proximity to recurrent flooding further shapes how residents perceive and respond to flash flood risk. People who live in or near floodplains generally perceive higher levels of risk and are more likely to take protective action than those living farther away (Ali et al. 2022; Lechowska 2018; Grothmann and Reusswig 2006). Proximity, however, is not only geographic. It also includes psychological dimensions that influence how individuals relate to environmental threats. When flooding feels close in space, time, or social connection, residents tend to view the risk as more personally relevant and are more inclined to prepare (Duan et al. 2019). Conversely, when flooding feels distant, even in areas with known exposure, the perceived urgency to act often diminishes (Duan et al. 2019).

Beyond proximity, lived experience with flooding plays an important role in shaping risk perception. Individuals who have personally experienced flooding often report heightened concern and greater motivation to prepare for future events (Grothmann and Reusswig 2006). In contrast, residents without direct flood experience may underestimate their vulnerability and

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place greater confidence in structural protections such as levees or dams (Ludy and Kondolf 2012). Importantly, these experiences do not always align neatly with official flood designations. Some residents in flood-prone areas have never experienced flooding firsthand because of protective infrastructure, while others who have experienced flooding may not live within formally designated flood zones (Lechowska 2018).

Economic conditions further complicate how flood risk is perceived and acted upon. Flood-prone areas often attract residents because of lower housing costs, making affordability a central factor in where people live (Jean 2023). For many households, financial considerations outweigh safety concerns, particularly when resources for preparedness are limited. Lower-income residents are less likely to take protective measures due to financial constraints and reduced access to risk information (Ali et al. 2022). These households are also disproportionately vulnerable because flood insurance may be unaffordable, unavailable, or tied to costly elevation requirements, leaving residents with few viable recovery options (Deria et al. 2020; Burby 2001). Although the National Flood Insurance Program was designed to mitigate these losses, participation remains low, especially among those facing the greatest financial barriers (Burby 2001). Beyond insurance, broader socioeconomic inequities limit access to hazard education and community outreach, constraining residents' ability to make informed preparedness decisions (Botzen et al. 2009; Xu et al. 2024).

b. Protection Motivation Theory

While risk perception provides important insights into how individuals and communities evaluate flood threats, it does not fully explain the underlying processes that lead to protective action. To address this gap, Rogers (1975) developed Protection Motivation Theory (PMT), a theory designed to explain how people respond to perceived threats by weighing both the danger posed and their capacity to act effectively (Fig. 1). PMT has become particularly useful for understanding decision-making in contexts of uncertainty, such as natural hazards, because it captures not only cognitive evaluations of risk but also the motivational role of fear and efficacy beliefs (e.g., Sutton et al. 2021; Rainear and Lin 2020).

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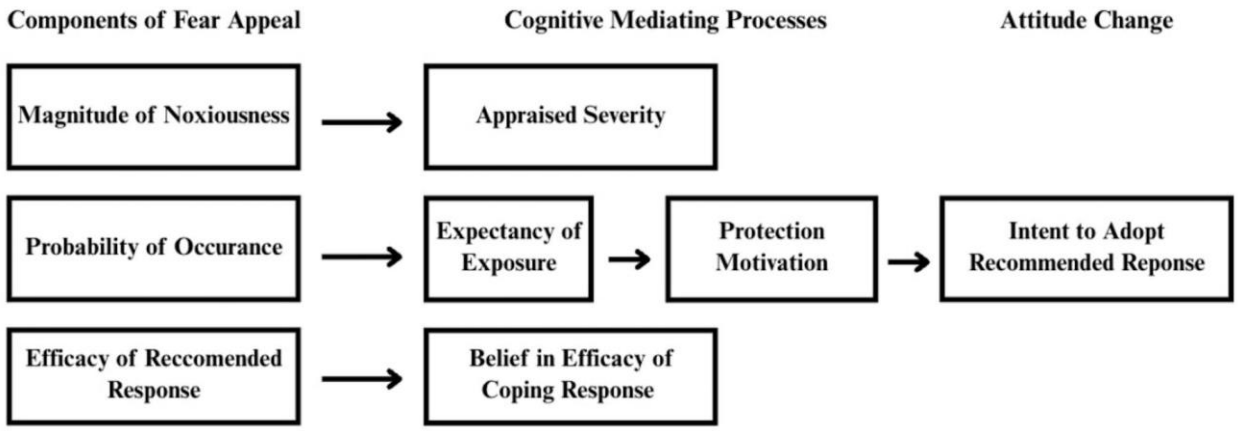

Fig. 1. Schema of Protection Motivation Theory.

At its core, PMT emphasizes two interrelated processes: *threat appraisal* and *coping appraisal*. Threat appraisal refers to how individuals judge the severity of a hazard and their personal vulnerability to it. Severity reflects the anticipated magnitude of harm, while vulnerability reflects the perceived likelihood of experiencing that harm directly (Rogers 1975). These judgments combine to influence whether people see a risk as significant enough to warrant action. For example, individuals who view flood damage as highly destructive and believe themselves personally susceptible are more likely to consider protective measures (Neuwirth et al. 2002).

Coping appraisal, on the other hand, involves assessments of response and self-efficacy. Response efficacy refers to the belief that a recommended protective behavior, such as elevating a home, purchasing flood insurance, or evacuating, will meaningfully reduce the risk. Self-efficacy refers to an individual's confidence in their own ability to perform those behaviors successfully (Neuwirth et al. 2002). Together, these judgments determine whether individuals feel capable of responding effectively. Research has consistently shown that when people believe protective strategies will work and that they themselves can implement them, they are significantly more likely to take proactive measures (Bubeck et al. 2012).

Fear arousal is also central to PMT, as emotional responses to a hazard heighten the salience of threat and coping appraisals (Neuwirth et al. 2002). Fear can motivate individuals to carefully weigh the costs of inaction against the benefits of preparedness. However, PMT also makes clear that fear alone is insufficient. Unless people also believe they can act effectively, fear-based messages may lead to avoidance or defensive actions, like denial or fatalism, rather than

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protective behavior (Kellens et al. 2012; Bubeck et al. 2012; Weyrich et al. 2020). This balance is critical when designing communication strategies for natural hazards, such as extreme floods.

The components of PMT provide a strong foundation for developing risk communication that moves beyond simply describing threats to actively motivating protective behavior. Messages grounded in PMT are most effective when they underscore the severity and relevance of the hazard while also reinforcing that recommended actions are both feasible and effective (Neuwirth et al. 2002; Weyrich et al. 2020). Yet despite the value of PMT, relatively little work has examined how different combinations of threat and coping information in risk communication influence behavior in floodplain communities, where local conditions, economic constraints, and cultural values can shape responses in distinctive ways (Botzen et al. 2019).

c. Current Flash Flood Risk Messaging

Flash flood risk communication plays a critical role in ensuring that residents in flood-prone areas can respond quicky and effectively to life threatening hazards. The distinction between alerts and warnings clarifies how risk messages function: alerts capture attention and signal that a threat exists, whereas warnings convey specific, actionable instructions. Mileti and Sorensen (1990) emphasize that warning communication operates as a social process, one in which people often seek confirmation from official and unofficial sources before deciding how to respond (Wood et al. 2018). Because individuals rarely act on a single warning, effective messages must remain consistent, credible, and reinforced across multiple channels to support timely public action (Mileti and Peek 2000).

In practice, flash flood messaging strategies combine warning systems with educational campaigns to reach diverse audiences. Mobile, broadcast, and social media channels represent some of the main communication sources during a flash flooding event (Sutton and Kuligowski 2019). However, short-format alerts, while effective at capturing attention, can sometimes lack the detail needed to guide protective behavior (Bean et al. 2015). Outside of formal warning systems, the NWS leads public educational campaigns, such as Turn Around, Don’t Drown® (TADD), to teach the public about the dangers of walking or driving through floodwaters and emphasize the importance of staying informed during flash flood events (Fig. 2; NWS n.d.). However, regardless of these campaigns being visible to the public, they can fail to resonate with

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residents due to messages being seen as repetitive, impersonal, or disconnected from their lived experiences (Grothmann and Reusswig 2006; Stephens et al. 2024).

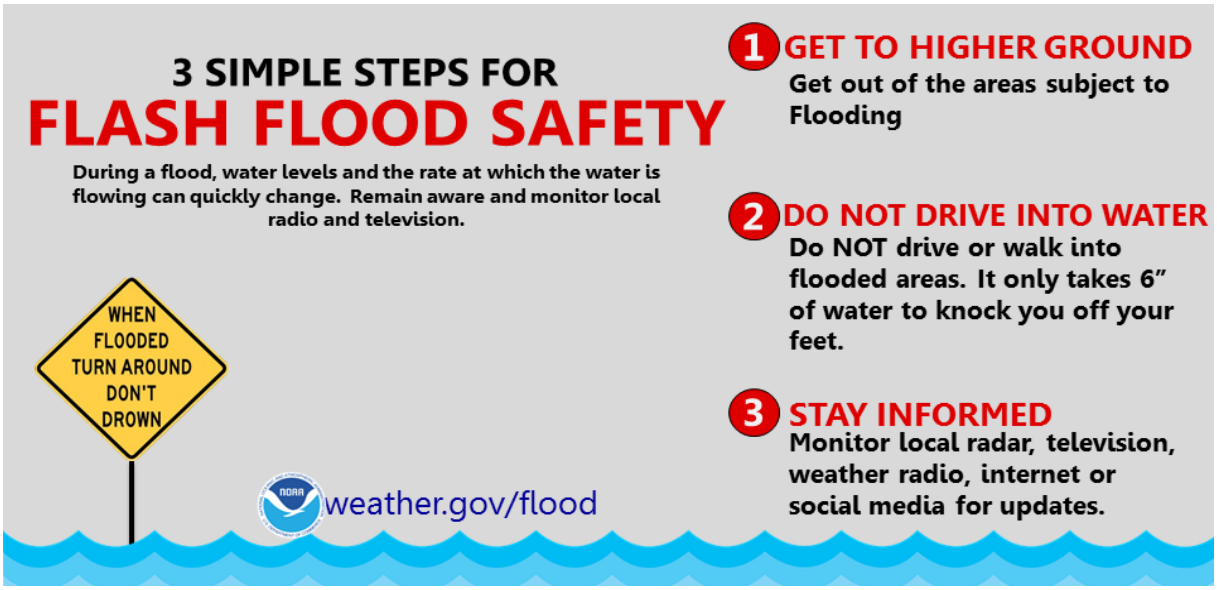

Fig. 2. NWS Turn Around Don't Drown® (TADD) Campaign

Improving flash flood risk communication requires rethinking existing strategies to align with the needs of the audience. The public and even end users, such as emergency managers, can hold inaccurate or incomplete understandings of how flash floods evolve, how exposure occurs, or the protective actions needed, which can lead to confusion during rapidly changing events (Lazrus et al. 2016). Flash flood risk communication has been found to be successful when it has local context, is actionable, and consistent across platforms (Intrieri et al. 2020; Geddes et al. 2024). People-centered warning systems that use participatory design and integrate local knowledge strengthen trust and credibility (Perera et al. 2020; Bucherie et al. 2022). Message comprehension also improves when warnings include visual elements, such as maps, symbols, or color-coded guidance, that help people quickly interpret risk (Sutton and Fischer 2021). Ultimately, risk communication is shaped by social and cultural contexts (Douglas and Wildavsky 1982) and by collaboration with communities and local leaders who co-produce more inclusive and context-specific messages (Stephens et al. 2024). Yet existing research often stops short of examining how these communication principles play out in communities that face flooding repeatedly and under constrained local conditions.

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This study addresses the presented gaps by examining how residents of the Shunganunga Creek floodplain perceive flood risks and how communication strategies can be improved to encourage protective action. Because risk perception shapes how people evaluate hazards, understanding these perceptions is critical for developing guidance that resonate with community concerns and priorities (Grothmann and Reusswig 2006; Bubeck et al. 2012). At the same time, perception alone does not explain why some individuals act while others do not. PMT addresses how threat appraisal and coping appraisal work together to influence behavioral responses. The primary research questions guiding this study rest on the premise that clear, concise, and actionable messages are more likely to prompt immediate responses, thereby reducing the risks associated with flooding (Neuwirth et al. 2002; Rainear and Lin 2020; Sutton et al. 2021). By examining how residents of the Shunganunga Creek floodplain perceive flood risks and respond to current communication efforts, we seek to answer the following research questions (RQs):

> **RQ1:** How do various factors at the individual, community, and societal levels shape residents' perceptions of flooding risks in the Shunganunga Creek area?
>
> **RQ2:** How can current flood risk communication messages be improved to enhance threat and coping appraisal, thereby motivating residents to take protective actions?

3. Method

a. Participants

This case study involved 11 community members, age 18 or older, living near or along the Shunganunga Creek floodplain. Although the number of participants is small, it is methodologically appropriate given the extremely localized nature of the at-risk population. As shown in Fig. 3, the Shunganunga Creek watershed forms a narrow, highly developed flood corridor in Topeka, Kansas, where exposure is concentrated within a small geographic area. Specifically, the respondents live within part of the floodplain measuring approximately 5.21 square miles, along the 17-mile stretch of the Shunganunga Creek (Fig. 3). Because the community itself is compact and socially vulnerable, we employed Patton's (2001) critical case sampling to identify individuals most likely to provide rich, information-dense accounts of flood experiences along the Shunganunga Creek floodplain. Research on qualitative sampling demonstrates that saturation can often be reached with 8–12 interviews, particularly in homogenous or geographically-bounded populations (Guest et al. 2006). Consistent with

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qualitative standards emphasizing depth and theoretical insight rather than statistical generalizability, our interviews achieved thematic saturation, with recurring patterns and perspectives staying consistent across participants (Tracy 2024).

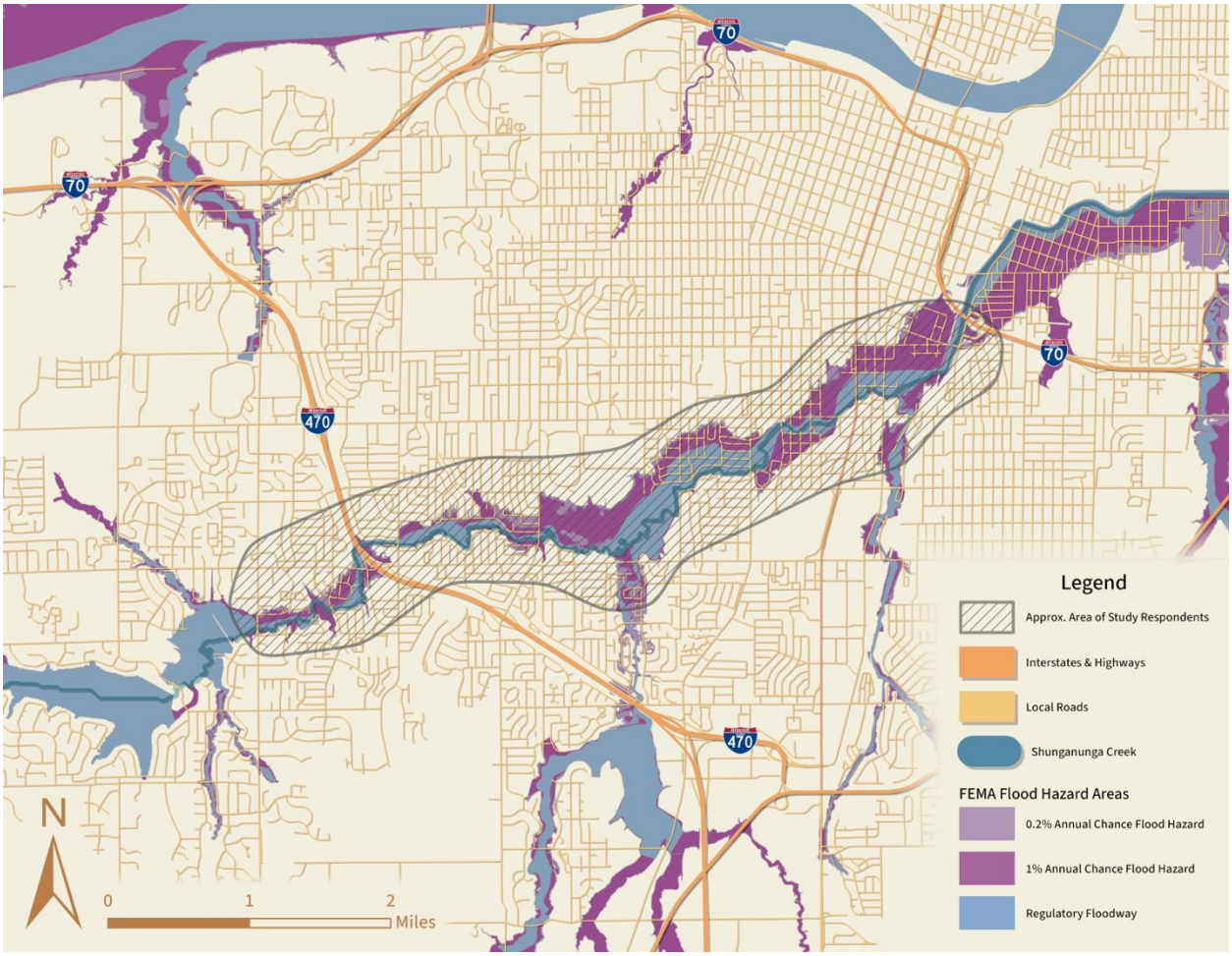

Fig 3. Study area along the Shunganunga Creek floodplain in Topeka, Kansas. The hatched region indicates the approximate residential corridor from which study respondents were drawn. FEMA flood hazard designations illustrate how flood risk is geographically concentrated within a narrow, highly developed corridor, helping to contextualize the localized nature of the sample.

Among the 11 Shunganunga Creek residents who took part in the study, just over half identified as male (55%) and the remainder as female (45%). Racially, the group was predominantly white (91%), with Black participants comprising the remaining 9%. These participant characteristics align well with recent U.S. Census Bureau (2023) data for the broader Topeka area, which reports a population that is 47.9% male, 52.1% female, 71% white, and 9.7%

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Black. Participants varied in their time in the region, spanning anywhere from 20 years to 72 years, with a median time of 38 years.

b. Procedures

The first author, who was raised in Topeka and has long-standing personal ties to the Shunganunga Creek area, led the recruitment effort. Because of this familiarity, the first author was able to engage directly with local residents through community-specific Facebook groups where people living along the creek regularly share information and resources. Recruitment flyers were posted in these Shunganunga-focused community pages, as well as on the first author's personal Facebook and Instagram accounts, to reach individuals who live along the floodplain. The first author conducted all interviews via Zoom to maximize convenience and accessibility. With participants' verbal consent, each session was recorded for precise transcription and analysis, except for one interviewee who declined recording. In that case, the first author documented the conversation with detailed notes.

We used a semi-structured interview format, which combines a consistent set of guiding questions with the flexibility to follow participants' experiences and probe for deeper insight (Kakilla 2021). The interview protocol covered four areas: (1) participants' lived experiences with local hazards, (2) their flood risk perceptions, (3) their views on community resilience, and (4) their recommendations for improving future communication and preparedness. Guided by PMT, participants ranked common hazards, discussed their vulnerability to floods, and evaluated their confidence in taking recommended protective actions. They also viewed the NWS TADD campaign graphic (Fig. 3) and reflected on its clarity and relevance. We then asked about community resilience and concluded with questions about communication needs and policy suggestions. The full questionnaire can be found in the Appendix.

c. Thematic Analysis

The data was analyzed using a qualitative, reflexive thematic analysis, following Braun and Clarke's (2006) strategy: (1) become familiar with the data; (2) code or label data extracts; (3) develop themes or patterns; (4) generate and review themes; (5) specify, define, and name overall themes; and (6) write up. The first author conducted all data analysis and utilized NVivo, a qualitative data analysis software package, to assist with this process. First, the first author transcribed the audio files and revised them for clarity to become familiar with the data. Second,

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the first author employed a latent approach to coding, interpreting the underlying meanings and themes within participants' responses through the lens of PMT. This method enabled the analysis to extend beyond surface-level content, allowing for the identification of nuanced perceptions, emotions, and motivations. Third, themes were created by inspecting the codes. Fourth, the themes were reviewed to ensure they accurately represented the data. Fifth, the themes were defined. Lastly, a write-up connected the analytic portion with the data and ensured that the examples and research questions aligned.

d. Validation Strategies

The authors implemented validation strategies developed by Cresswell and Poth (2018) to ensure that these findings accurately represent the participants' statements. In qualitative research, validation is the "attempt to assess the 'accuracy' of the findings, as best described by the researcher, the participants, and the readers" (Cresswell and Poth 2018, p. 259). It is suggested that researchers apply at least two of the nine validation strategies to validate the accuracy of their findings. In this research, we implemented three strategies seen in Table 1.

Validation Strategy	Author Use
Reflexivity	Addressed interviewer bias by acknowledging her values, biases, and experiences. The first author is a Topeka resident who is familiar with local communication processes and a trained meteorologist. The ties foster rapport but risked scientific and positional bias; however, the recognition increases the study's credibility.
Member Checking	The team ensured the accuracy and credibility of the data collected. All participants received emails summarizing findings and highlighting where their quotes were used, which allowed them to validate or challenge the interpretations, ensuring their voices were accurately represented. Most residents replied and none wanted changes.
Thick Description	Implemented thick description by providing detailed accounts of the participants and their experiences to give a comprehensive understanding of the perspectives represented

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	in the study. Enables a viable comparison across groups and fosters a deeper understanding of the Shunganunga Creek communities.

Table 1. Validation strategies from Creswell and Poth (2018).

3. Findings

a. Risk Perceptions in the Shunganunga Creek (RQ1)

Residents' views of flood risk along Shunganunga Creek reflected a layered mix of individual, community, and wider societal factors. While several participants described flooding as a serious local hazard, many saw it as less urgent than tornadoes or winter storms. Economic resources, personal flood histories, and the strength of neighborhood support networks all shaped how people judged and responded to rising water. Gaps in awareness and preparedness further widened these differences. The following sections unpack four themes that together explain the community's flood risk perceptions; definitions for each theme appear in Table 2.

Theme	Definition
Socioeconomic Inequities	Socioeconomic inequities in the Shunganunga Creek area often result in disproportionate impacts on lower-income neighborhoods, where aging infrastructure, high flood insurance premiums, and limited recovery resources increase vulnerability. Although residents frequently recognize these risks, structural and financial barriers often prevent them from responding.
The Role of Proximity and Lived Experience	Individuals who live closer to Shunganunga Creek and have experienced flooding events in the past are more aware of flood risk than those who have not.
Competing Hazards Diminish Flood Risk Perception	Due to the variety and severity of storms in Northeast Kansas, all residents chose hazards such as tornadoes, wind, and winter storms above flash floods due to their impacts.
Cultural Norms and Community Dynamics	Local culture in the surrounding community of the Shunganunga Creek shapes attitudes

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	toward flooding, with some communities feeling more organized and supported than others.

Table 2. Themes that answered RQ1: How do various factors at the individual, community, and societal levels shape residents' perceptions of flooding risks in the Shunganunga Creek area?

1) SOCIOECONOMIC INEQUITIES

Flooding disproportionately affected lower-income communities in Topeka, where residents faced high flood insurance costs, limited recovery resources, and infrastructural deficiencies. Neighborhood structural layouts restricted mobility, increasing vulnerability during flash flooding events. This constraint was evident in the experience of Sarah, a mother and lifelong Topeka resident who has spent nearly four decades living in low-income neighborhoods across the city. Reflecting on her current neighborhood, she explained that its design offers few safe evacuation options when waters rise: "Oh, I think the impact would be severe there. In the little neighborhood that I live in, there are only a few ways in and out, and many streets don't connect all the way through." For residents like Sarah, flood risk is not an abstract threat but one that is evaluated through everyday concerns about mobility, access, and the practical feasibility of leaving safely during an event.

Outside of infrastructure, many residents highlighted how systemic inequalities in urban planning and economic opportunities contribute to flood risk in low-income communities. A born and raised Topekan, Riley has experienced weather hazards ranging from flooding to wind storms living near the Shunganunga Creek. She has seen firsthand how specific neighborhoods bear a heavier burden from weather hazards due to their placement in the city:

> I see how Shunga[1] affects the communities, especially in [inner city community] and the surrounding areas. That's not personal to me, but I see how it affects the community. I see how that area, specifically the lower income parts of Topeka, are affected more than just environmentally, like how it's placed in Topeka, but also like the areas and neighborhoods.

[1]Local residents often refer to Shunganunga Creek simply as "Shunga," a synonymous nickname that we use interchangeably with the full name at various points in the manuscript.

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The compounded effect of limited economic mobility left some residents with few options for leaving the floodplain. Some residents expressed that flood insurance is inaccessible, forcing them to rely on community aid or government programs. Despite awareness of flood risk, financial limitations prevented some residents from making home modifications to prevent future damage from flash flooding. Alice has lived in Topeka for over 40 years and has spent most of that time along the Shunga. She has become a mother and a grandma and has experienced a multitude of flooding events. As someone who cares deeply about her family, she expressed frustration about knowing what needs to be done but not having the resources to act:

> We know that every time it rains hard, the water starts creeping up, but what can we do? Raise our houses? We can't afford that. The city says they don't have the money, either, so we just wait and hope.

Alice's experience highlights a different dimension of flood risk perception: the normalization of vulnerability under persistent economic constraint. Although she recognized the danger posed by repeated flooding, she described feeling limited in her ability to reduce that risk. Over time, repeated exposure to flooding without meaningful institutional support appeared to shape how her and many of our participants interpreted the hazard itself.

2) The Role of Proximity and Lived Experiences

Living closer to the creek and having prior flooding experiences also shaped residents' risk perceptions. Those with firsthand experience were more likely to recognize the dangers and prepare accordingly, but residents often underestimated the potential impacts that flash flooding brought to their area. Linda, a lifelong Topeka resident of 65 years, has lived both near and away from the Shunganunga Creek over the course of her life. Her risk perception has lowered due to her moving further away from the creek. Now, she pays less attention to flash flooding along the Shunga and its impacts due to them not directly impacting her:

> I feel like it won't affect me now, which I guess it could at some point, but I think I would pay more attention to it. If we were still over there on [street by the creek], I would definitely be paying more attention to it than I do. I'm nowhere near there [now]. I think that's probably why I hesitate; I'm not fearful of it.

Linda's account illustrates how physical distance can dampen perceived vulnerability, even among residents with decades of lived experience. As proximity to the creek decreases, flash

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flooding became easier to dismiss as a background risk rather than an immediate concern. This suggests that risk perception is not only shaped by past experience, but also by how closely Shunga residents feel connected, spatially and psychologically, to the hazard in the present.

3) Competing Hazards Diminish Flood Risk Perception

All participants had experience with multiple weather hazards, but the events they found most disruptive or emotionally salient tended to shape which risks felt most urgent. Although flash flooding was familiar, tornadoes and winter storms often emerged as more front-facing threats, leading residents to prioritize preparedness for those hazards instead. Riley described how a traumatic tornado experience reshaped her family's approach to severe weather:

> [My family] was in a traumatic tornado event. It was the last bad tornado that hit western Kansas. Because of that, my dad has always been overly prepared for storms. I think that, geographically, some rural areas are much more prepared for storms [than floods]. They have tornado shelters, basements, and storm doors that have real protection.

Across interviews, residents consistently described relying on past experiences to gauge which hazards deserved the most concern. When one hazard carries strong emotional weight and visible preparedness cues, other risks, such as flash flooding, may fade into the background, even as their frequency and impacts increase.

Although flooding, tornadoes, and winter storms all occur regularly in the region (Kansas Adjutant General's Department n.d.), residents often viewed flooding as less immediate because it unfolds more gradually and receives less public attention. As a result, flood preparedness was frequently deprioritized, even in neighborhoods with repeated exposure to rising water. Michael, who has lived along the Shunganunga Creek for nearly 40 years and has long emphasized weather safety through his Eagle Scout training, explained how this imbalance shapes public awareness: "People around here see tornadoes on the news every spring. We get sirens, alerts, and drills for tornadoes, but no one really talks about what to do in a flood. That's why it's not on people's minds." His reflection captures a broader pattern across interviews: tornado risks are reinforced through visible warnings and routine preparedness cues, while flood risks are discussed far less frequently. This disparity makes flooding feel less urgent, not because it is less dangerous, but because it is less present in everyday communication and risk messaging.

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4) Cultural Norms and Community Dynamics

The culture surrounding Shunganunga Creek shaped attitudes toward flooding. Those with a strong sense of community felt more organized and had strong aid networks. Those who did not lacked collective preparedness. Sarah had witnessed a flash flood firsthand and expressed that she is lucky there is a small hill near where she lives to protect her home from water. However, due to this, she acknowledged that she only has a general idea of how to protect herself during a flood and noted that their neighborhood association did not proactively address flood risks, leaving individual residents like herself responsible for their own protection: "It wasn't something that my neighborhood association said, 'Hey, we live close to the Shunga. Let's do a here's how you would pile sandbags if needed." Without organized community guidance or communication from neighborhood leaders, there may be a limit of residents' understanding of protective behaviors to mitigate flash flooding threats.

Repeated flooding once forced a nearby elementary school to close after one wing became chronically water-logged during heavy rain. Growing up near the neighborhood, Riley remembered how those events prompted her family to keep flashlights handy and turn on the weather radio whenever storms approached. She also realized that many households lack such resources and worried that limited access to hazard-education programs, community support, and emergency shelters leave her neighbors exposed: "Overall, the effects of weather in Topeka and the lack of education, community resources, and emergency shelter-type resources affect the community as a whole. That makes me worried for Topeka when weather events occur."

However, not all local residents expressed the same unpreparedness or lack of support as others. Aaron, a resident who has lived along the Shunganunga Creek for 25 years, expressed that when community support is available, there is a greater sense of security in the face of a flooding event. When his house flooded in 2007, his community's help during the flood helped him recover:

> When I use the word community, it is not just where you live. Right? The community is the people that are in your corner. That's the community that helps guide you and raises you… Do we still have that sense of community? I must say no… It's different. We're scared to talk to folks.

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While Aaron's experience differs from some of the interviewed residents, his experience emphasized the need for strong social networks to aid during a flash flooding event. At the same time, his recognition that these networks have weakened overtime reflected a shift in cultural dynamics that may leave residents feeling more isolated during a flash flood.

b. Protection Motivation Theory in the Shunganunga Creek (RQ2)

Effective flood risk communication ensures that residents understand, evaluate, and take necessary protective actions. However, existing strategies often failed to resonate with individuals due to a lack of localized, relatable messaging, insufficient guidance on practical protective measures, and an absence of emotional support for those with past flood-related trauma. Participants recommended community-driven approaches to help bridge these gaps by integrating local expertise and fostering trust. The following themes in Table 3 outline key strategies for improving flood risk communication, answering RQ2.

Theme	**Definition**
Enhancing Threat Appraisal Through Clear and Relatable Messaging	Clear and relatable messaging enhances threat appraisal by delivering accurate, localized information about flood risks in a way that resonates with residents' lived experiences along Shunganunga Creek.
Strengthening Coping Appraisal through Accessible Measures and Actionable Guidance	Accessible measures and actionable guidance strengthen coping appraisal by equipping residents with practical, easy-to-implement protective actions and resources, ensuring they feel confident in their ability to reduce risks and manage potential flooding impacts.
Address Heightened Anxiety and Trauma from Previous Floods	Acknowledging past experiences and addressing the anxiety and trauma caused by previous floods while providing emotional support resources and fostering trust through empathetic, resilience-focused messaging improves flood risk communication and helps communities prepare.
Leverage Community Knowledge, Resources, and Networks	Implementing community knowledge, resources, and networks can enhance flood risk communication by integrating local expertise, fostering collaboration, and

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	leveraging existing relationships to disseminate information more effectively and build collective resilience against flooding.

Table 3. Themes that answered RQ2: How can current flood risk communication messages be improved to enhance threat and coping appraisal, thereby motivating residents to take protective actions?

1) Enhancing Threat Appraisal Through Clear and Relatable Messaging

Clear and relatable messaging enhanced public understanding of flood risks and encouraged protective behaviors. Many residents emphasized that trusted sources should easily interpret and communicate flood warnings. In his interview, Bryce explained that he recently moved from his childhood home along the Shunganunga to an apartment building with friends adjacent to the creek. Due to his experience with frequent extreme weather hazards, he expressed that people are more likely to take warnings seriously if the message is delivered by someone they trust:

> If you have people who know how to connect with people personally and relate to them, show them that I'm not some random scientist from New York telling you what to do with your life. I am somebody like you who lives in a house down the road and who is in the same boat as you. I think that relationship would help a lot.

Bryce's comment reflected a common pattern across participants: residents respond more strongly when messages come from individuals who understand local concerns and who feel embedded in their community.

Many residents emphasized that personal connections and clear communication could significantly enhance the public's response to flood threats, but vague or impersonal warnings can undermine preparedness. Ethan, who has spent his whole life in Topeka and recently moved next to the Shunganunga, said that the lack of specificity in flood warnings makes him uncertain whether he is at risk:

> I, however, don't find [warnings] very helpful since they are so vague. When I receive them, it just gives the name of the town or city affected, and that's it. They don't specify which area the flooding is occurring in.

If warnings do not clearly identity who is at risk, residents reported interpreting that ambiguity on their own, which can lead to hesitation or dismissal of the threat, ultimately reducing the effectiveness of flash flood risk communication.

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2) Strengthening Coping Appraisal through Accessible Measures and Actionable Guidance

To strengthen coping appraisal, residents emphasized the need for clear, step-by-step flood preparedness guidance that would give them practical tools to protect themselves. Shunga residents identified the NWS, local news outlets, and social media as their primary sources of weather information but noted that these channels rarely provided tailored direction on what actions to take if one lives in a floodplain. When preparedness guidance felt vague or fragmented, residents reported uncertainty about how to respond effectively. Matthew, who was born and raised in Topeka and experienced flooding along the Shunganunga Creek during his childhood, described how the absence of clear guidance from local authorities made it difficult to translate awareness into action:

> Having that checklist of [flood recommendations] is important, and then you can do the other [actions] if you have time to do them. A quick 3 or 5 top priorities to do in this emergency… and communicating that ahead of time, I think [would be] helpful.

Like Matthew, many participants viewed preparedness as essential but felt they lacked accessible, actionable instructions to support effective response. This gap weakened coping appraisal by leaving residents unsure whether they could carry out recommended protective actions, even when they recognized the threat posed by flash flooding.

Shunga participants also emphasized the role of education in shaping their confidence to respond effectively to flooding. Many argued that without clear, accessible instruction, residents remain uncertain about what actions are realistic or appropriate when floodwaters rise. Several called for neighborhood-level education efforts, such as workshops or targeted outreach, that would prepare Shunga residents before an event occurs. Janet, who experienced a severe flood in 2007, recalled being awakened by firefighters urging her to evacuate as water rapidly approached her home. Although she complied, she described feeling unprepared and overwhelmed, returning later to extensive damage in her lower level. Reflecting on that experience, she stressed the need for a more systematic approach to flood education for those living in floodplains:

> I don't know if you can mandate it, but at least something that would go through. What do you do in a flood if it happens? Are people aware of those kinds of things? There should

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be some mechanism for when people reside or choose to reside in a floodplain that they know what to do in case it happens.

As someone who experienced a major flooding event, Janet was not just worried about her individual actions, but her neighbors as well. Her suggestion, among others in the community, highlights that preparedness in the Shunga region is a shared community need that should be supported by structured educational systems.

3) Address Heightened Anxiety and Trauma from Previous Floods

Many residents who have experienced a traumatic flooding event carried emotional burdens that shaped their response to future flood risks. Janet described how memories from the 2007 flood resurfaced during subsequent flood events, bringing anxiety that lingered well beyond the immediate threat. Reflecting on that experience, she explained:

> Well, I suppose I was trying to stay calm because I had the kids here. I wasn't frightened, but I think because I lived through it before. When you live through catastrophes, you kind of get that PTSD stuff going on.

As Janet describes, trauma can intensify attentiveness, but may also lead to avoidance or overwhelming feelings, complicating the protective decisions residents must make. In these cases, flood risk communication must contend not only with informational gaps but also with the emotional weight residents carry from prior events.

As families and relationships change overtime, so do the needs of residents, creating new layers of responsibility that can shape how they interpret warnings and decide whether they can act quickly. Caring for young children or aging parents, for example, may make the threat feel more urgent but difficult to navigate. All residents that we interviewed expressed the need to protect their loved ones and, if possible, their property during a flood. Linda experienced such a severe flood that FEMA had to boat her and her family out of their house (Fig. 4). She described her helplessness when they could not reach some family members due to the rising floodwaters:

> [Linda's husband] got up and went to get [the rest of our family members]. And he called me, and he said, 'I can't get to them.' And I was like, 'What do you mean you can't get to them?' And he couldn't get past [a street where the creek flooded.] He couldn't get to them. So he said, 'There's nothing we can do. We can't get to them.'

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When family safety feels uncertain, emotional strain may intensity during rapidly evolving flash flooding events. These experiences may not only shape immediate reactions, but also how residents interpret future flash flood warnings, often elevating anxiety and making preparedness feel urgent but emotionally complex.

Fig. 4. 2007 Shunga Flood, submitted by Linda with permission.

4) LEVERAGE COMMUNITY KNOWLEDGE, RESOURCES, AND NETWORKS

According to participants, integrating community knowledge, resources, and networks can enhance flood risk communication by leveraging local expertise, collaboration, and trusted relationships. Many residents emphasized that having trusted community figures and organizations is critical in relaying important flood preparedness messages because people are more likely to take warnings seriously from people they trust. During his 20 years in Topeka, Bryce has only experienced minor flooding events along the Shunganunga Creek. However, he expressed that his neighbors, who were deeper into the floodplain, had different experiences from his. As a person deeply connected to his community, he suggested bringing neighborhoods together through grassroots organizations, sponsoring a community event, and communicating with Shunga residents about flood risks can increase overall awareness and preparedness:

> Print out a couple of hundred pamphlets and put them in people's mailboxes and doors and say, ‘If you would like to be informed about the risks that you might face living in

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this [floodplain] community and some steps that you might take if you want to talk to a weather expert.'

Like Bryce, many residents believe that preparedness may improve when information is shared through familiar community networks instead of solely through formal institutions. Creating or using this existing neighborhood networks may allow communities to strengthen their awareness and collective readiness for recurring flash flooding events.

Beyond printed flyers and brochures, participants emphasized the importance of neighborhood leaders in raising awareness and coordinating response. Many noted that formal warning systems often fail to reach everyone, particularly residents who are less connected to official channels. In practice, Shunganunga Creek residents frequently turn to churches, civic clubs, and neighborhood groups for timely information, mutual aid, and post-flood cleanup support. Participants viewed these trusted networks as more responsive and better attuned to local needs than distant agencies alone. Matthew, a local resident, described how caring for older family members and children heightened the need for advance planning rather than reactive decision-making during flood events. Reflecting on this challenge, he noted, "I feel like it takes experiencing some of that, and then implementing a new plan is reactionary. Then we'd get really good at reacting to disasters when, instead, I think we should be trying to prevent them." "His perspective reveals a broader theme across interviews: residents see community-based leadership and proactive planning as essential components of effective floodplain resilience.

Participants also recommended forging stronger partnerships among government agencies, nonprofits, and neighborhood leaders to create a comprehensive foundation for flood preparedness, and they emphasized that community-led programs had equipped residents to reduce risks and speed recovery. Linda is a Topeka resident who has been living for almost 70 years in the Shunga but recently moved to a nearby retirement home. During her time, she has experienced many types of weather phenomena. She suggested getting residents to be more proactive during a flash flood: "If we had more community meetings or outreach efforts before flood season, people would be more prepared. Right now, we rely too much on last-minute warnings, but by then, it's often too late to take meaningful action." Linda's experience reinforces the need from many Shunga residents who want proactive, community-based

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preparedness efforts that prioritize planning and outreach instead of reactive responses during a flash flooding event.

5. Discussion and Conclusion

This study examined how residents living along the Shunganunga Creek floodplain perceive recurring flood risk and how current communication strategies shape their ability and willingness to take protective action. Drawing directly from in-depth interviews, our findings revealed that while residents generally recognize flooding as a real and recurring threat, many struggle to translate that awareness into preparedness due to structural, socioeconomic, emotional, and communicative barriers. Below, we synthesize these findings through the lens of risk perception and PMT, explicitly distinguishing what this study contributes relative to prior research and outlining practical implications for flood risk communication in resource-constrained settings.

a. Theoretical Contributions

Our findings demonstrate that flood risk perception among Shunganunga Creek residents is shaped by a convergence of lived experience, proximity, socioeconomic conditions, and competing hazard priorities. Shunga residents generally recognized flooding as a real hazard, but they did not consistently perceive it as the most urgent or actionable threat. Participants frequently ranked tornadoes and winter storms as higher priorities, even while acknowledging that flooding occurs more often and affects their neighborhoods directly. This observed pattern suggests that frequency alone did not guarantee salience for our participants; instead, residents relied on visibility, messaging, and past traumatic experiences to judge urgency.

This finding supports prior research showing that competing hazards can diminish attention to floods (e.g., Slovic 1987; First et al. 2022). However, our interviews extend this work by demonstrating how this dynamic plays out in a community where flooding is normalized through repeated exposure. For several participants, floods were understood as something to ***endure*** rather than ***prevent***, especially when past events did not result in immediate loss of life. This normalization weakened threat appraisal over time, even as objective risk increases.

Proximity and lived experience further shaped these risk perceptions. Residents who lived directly adjacent to the creek or who had experienced severe flooding expressed heightened awareness, but this did not always translate into sustained preparedness. In contrast to

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assumptions that flood experience automatically increases readiness (Ludy and Kondolf 2012; Lechowska 2018), our findings show that repeated exposure without visible improvement in outcomes can instead foster resignation in floodplain communities. This extends prior work suggesting that lived experience can produce either engagement or learned helplessness, depending on available resources and institutional support (Grothmann and Reusswig 2006; Bubeck et al. 2012; O'Neill et al. 2016).

Applying PMT also allowed us to examine not only whether residents perceived flood risk, but why that perception often failed to result in action. Our findings indicated that threat appraisal was generally moderate to high among Shunganunga Creek residents, especially those living closest to the creek or with prior flood experience. However, coping appraisal was consistently weaker. Participants frequently questioned whether recommended actions would reduce harm (low response efficacy) or whether they personally could carry them out (low self-efficacy). Importantly, this was not due to apathy, but to past experiences in which preparation did not prevent damage or where recovery was slow and unsupported. In this context, fear did not motivate action. Instead, it often amplified stress and avoidance behaviors.

Our study, then, provides important context to PMT by showing how emotional fatigue and flood-related trauma interact with coping appraisal. Several residents described lingering anxiety from prior floods that resurfaced during heavy rain events, complicating decision-making. When warnings triggered fear without offering clear, achievable steps, residents felt overwhelmed rather than mobilized. This finding supports previous PMT work that have emphasized balancing threat information with efficacy-building messages (Bubeck et al. 2012; Botzen et al. 2019) and highlights the need for communication strategies that acknowledge emotional as well as material constraints (Grothmann and Reusswig 2006; Deria et al. 2020).

b. Addressing Communication Gaps Identified by Residents

Shunganunga Creek participants consistently described existing flood warnings and campaigns as vague, impersonal, or poorly aligned with local realities of recurring inundations. Generic warnings that referenced entire counties left residents uncertain about whether the message applied to their floodplain community. Without geographic specificity or contextual detail, residents were forced to interpret risk on their own, often erring toward inaction due to lower reported response and self-efficacy. Trust and familiarity, however, strongly shaped how

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Shunganunga residents received and interpreted messages. Our participants reported greater willingness to attend to information shared by local figures, neighborhood leaders, or community organizations than by distant agencies. This does not imply complete distrust of official sources but rather reflects the value of communicators who understand local conditions and constraints.

Prior research shows that warnings are more effective when they include location-specific information and contextual cues that help people assess personal relevance (Mileti and Peek 2000; Sutton et al. 2021). Our findings support this work and demonstrate that, when such specificity is absent, Shunganunga residents turn to informal social networks to interpret flood risk. This reliance on neighbors, family members, and community organizations reveals both the adaptive strengths of community-based sensemaking and its potential vulnerabilities when official messaging fails to meet local informational needs (Trujillo-Falcón et al. 2024).

In short, participants did not ask for more frequent warnings; they asked for clearer, more actionable guidance delivered through channels that felt relevant to their lives. This distinction matters for agencies operating under staffing and budget limitations. Rather than requiring resource-intensive system changes, our findings point to relatively low-cost, scalable adjustments that could meaningfully improve flood risk communication in the Shunganunga Creek area. We present the following recommendations based on participant feedback, acknowledging that the advice may only be pertinent to the participating community since this is a qualitative study:

1. *Refine, not replace, existing messages*. Enhancing geographic specificity and clarifying who is most at risk in the floodplain area can be achieved within current warning systems without creating new products.
2. *Shift from generic avoidance messaging to layered preparedness guidance*. Campaigns like TADD remain important, but residents in floodplains need additional guidance for situations where avoidance is not feasible. Simple checklists, prioritized actions, or neighborhood-specific tips can strengthen coping appraisal along the Shunga.
3. *Leverage community networks already in place*. Churches, neighborhood associations, schools, and civic groups represent trusted communication pathways that do not require agencies to build new infrastructure. Partnering with these networks will allow local and regional agencies to extend their reach without increasing staffing demands.

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4. *Integrate communication before flood season*. Pre-season outreach, even if limited, can help normalize preparedness behaviors and reduce cognitive load during emergencies. This can also help raise awareness of floods, especially as other hazards are currently perceived as riskier in the local area.

At the time of publication, the research team is actively sharing these findings with local leadership and community stakeholders in Topeka. These leaders have been receptive to speaking with team, especially since the first author was born and raised in the Shunganunga Creek neighborhood. We hope these conversations eventually become actionable policies that are made *by* the community *for* the community.

d. Limitations and Future Research

We recognize that this study's findings are specific to the Shunganunga Creek floodplain and may not be fully generalizable to other flood-prone areas with different social, economic, and geographic conditions. Although many participants referenced socioeconomic vulnerabilities, we did not collect such data. This prevented a deeper analysis of how demographic factors intersect with participants' experiences, and future research should incorporate these variables to better capture such relationships. We also acknowledge limited participation from key stakeholders, which may constrain the depth of qualitative insights and the applicability of our suggested policy recommendations. Future research could also build on these findings by collaboratively testing or prototyping communication strategies with residents and local stakeholders to assess feasibility, clarity, and relevance before broader implementation.

Finally, the number of interviews reflects both the size of the geographically bounded population and practical challenges associated with recruitment. Because the Shunganunga Creek floodplain covers a small residential area (Fig. 3), the pool of eligible participants was limited. Recruitment was also shaped by several access-related barriers, including difficulty reaching residents with inconsistent internet access and hesitancy among some to participate in an online interview with researchers they did not know personally. These challenges limited the number of completed interviews, even though we scheduled 20 sessions and ultimately conducted 11. Importantly, the interviews we conducted reached thematic saturation, indicating that additional interviews were unlikely to generate substantially new themes (Tracy 2024). Future research would benefit from in-person engagement strategies to reach residents who were not accessible through our digital recruitment methods.

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e. Conclusion

As the climate changes, communication strategies must adapt to meet the evolving needs of floodplain residents who face recurring complex challenges. We can work to ensure that all residents, regardless of socioeconomic inequities or physical limitations, are prepared to respond effectively to flood threats by transitioning toward more personalized risk communication strategies, expanding public reach efforts, and fostering long-term community engagement. Transforming communication strategies is about delivering information and empowering residents with the knowledge and resources they need to protect their lives, homes, and futures. By doing so, we can transform risk into resilience by building systems that warn communities and enhance their capacity to recover, adapt, and thrive.

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Data Availability Statement

Due to the conditions outlined in the university IRB study protocol and adherence to our confidentiality agreements with study participants, neither the interview data nor additional information about the interview participants can be made available.

Appendix

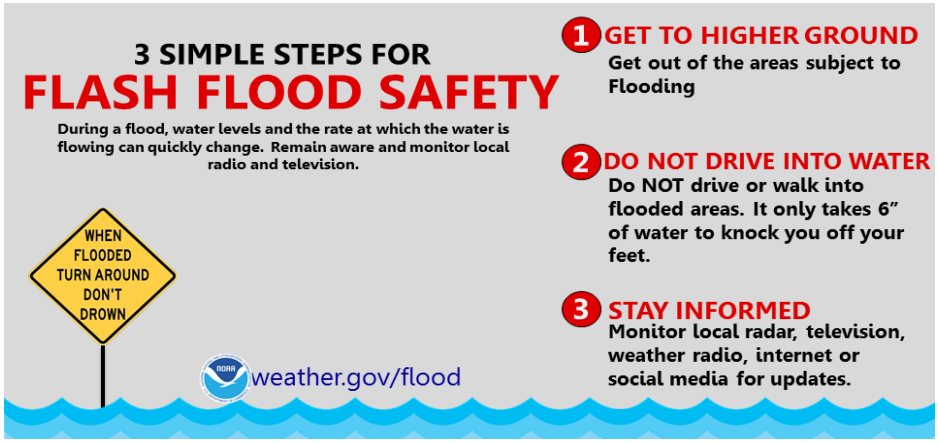
Interview Questionnaire for Study

Ice Breaker

- How long have you lived in Topeka? What kind of weather disasters have you experienced while living in this area?

Risk Perception of Floods (Protection Motivation Theory)

- According to the most recent Kansas Response Plan, here is a list of common weather disasters experienced in the Topeka area: **tornadoes**, **wind storms**, **floods**, **winter storms**, and **wildfires**. Could you rank them according to what you believe personally poses the most significant risk to you? Do you feel more or less vulnerable to some hazards more than others? Why?
- When you ranked flooding in terms of risk, what specific concerns or experiences led you to place it where you did? If a flood were to occur in your area, how severe do you think the impacts would be for you and your community?
- Have you received any communication or warnings about flood risks in your area? If so, how clear and helpful was it that you found that information?
- If you were to receive a flood warning, how confident would you be that you could take action to stay safe? Are there steps you believe you could take to protect yourself, or do you feel uncertain about what actions to take?
- According to the National Weather Service, these actions are recommended during flood warnings: (1) Get to higher ground; (2) Do not drive into water; (3) Stay informed. Do you think the actions recommended would help keep you safe? Why or why not?



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Community Resilience

- How would you describe your community's ability to recover from floods? What are its strengths and weaknesses?
- For members that have lived in Topeka for most of their lives: Have you noticed any changes in how the community prepares for or responds to floods over time?
- Could you describe factors that you believe contribute to building resilience to floods within your community? These could include but are not limited to community support, local infrastructure, and emergency services.

Communication and Solutions

- What kinds of communication about flood risks would be most helpful to you? Are there specific ways to better communicate warnings or safety information?
- If you had the chance to recommend policy changes to improve flood preparedness or recovery, what would they be? Are there specific actions you believe local or state officials should take to protect your community better?

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