

Household Flood Preparedness in Bengaluru, India through the Lens of Augmented Protection Motivation Theory (PMT)

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Introduction

This study addresses a critical gap in disaster preparedness research by examining how structural inequalities and urban governance shape households' capacity to prepare for flooding and influence individual risk perception, particularly in cities in the Global South.

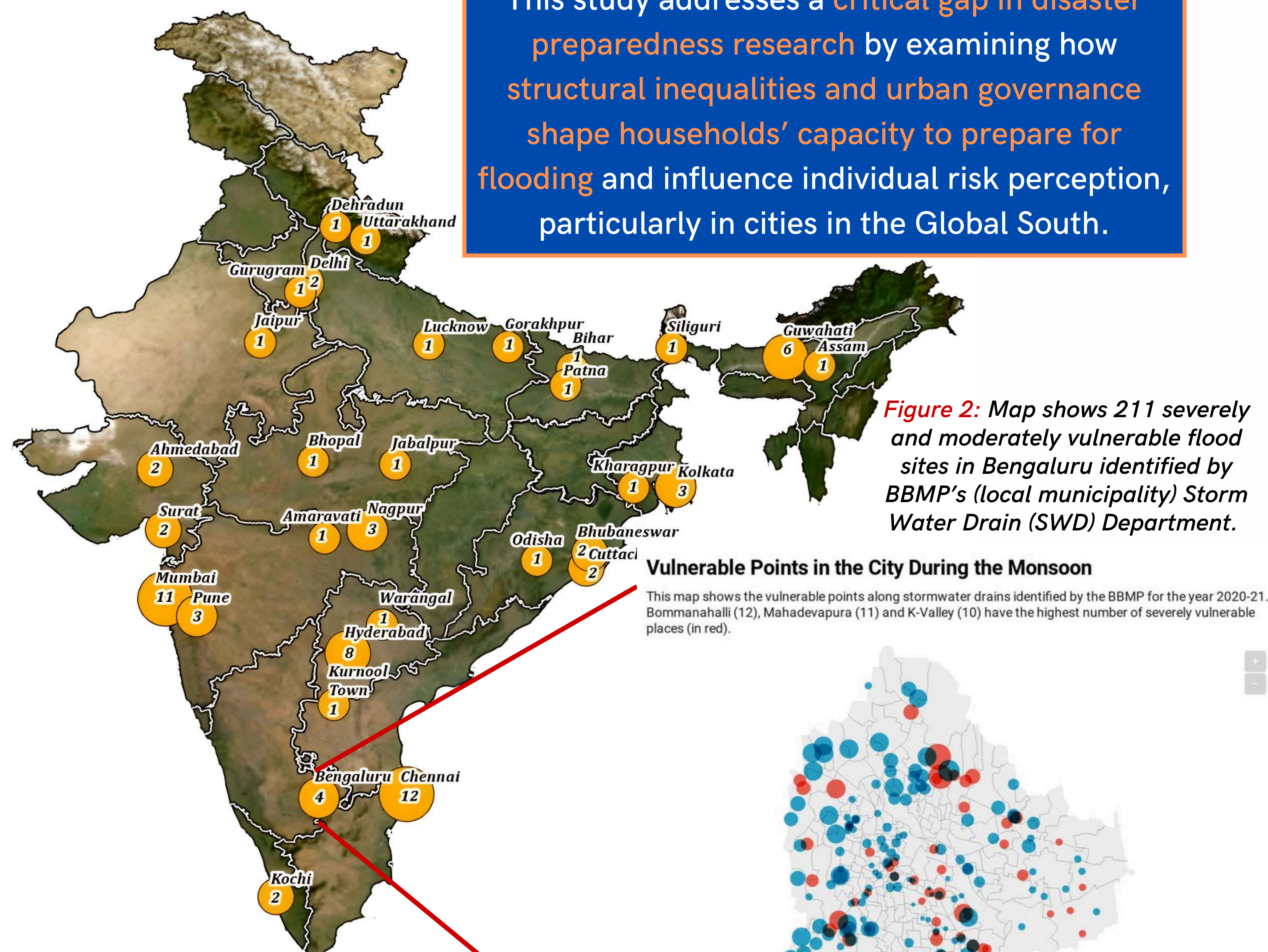


Figure 2: Map shows 211 severely and moderately vulnerable flood sites in Bengaluru identified by BBMP's (local municipality) Storm Water Drain (SWD) Department.

Vulnerable Points in the City During the Monsoon

This map shows the vulnerable points along stormwater drains identified by the BBMP for the year 2020-21. Bommanahalli (12), Mahadevapura (11) and K-Valley (10) have the highest number of severely vulnerable places (in red).

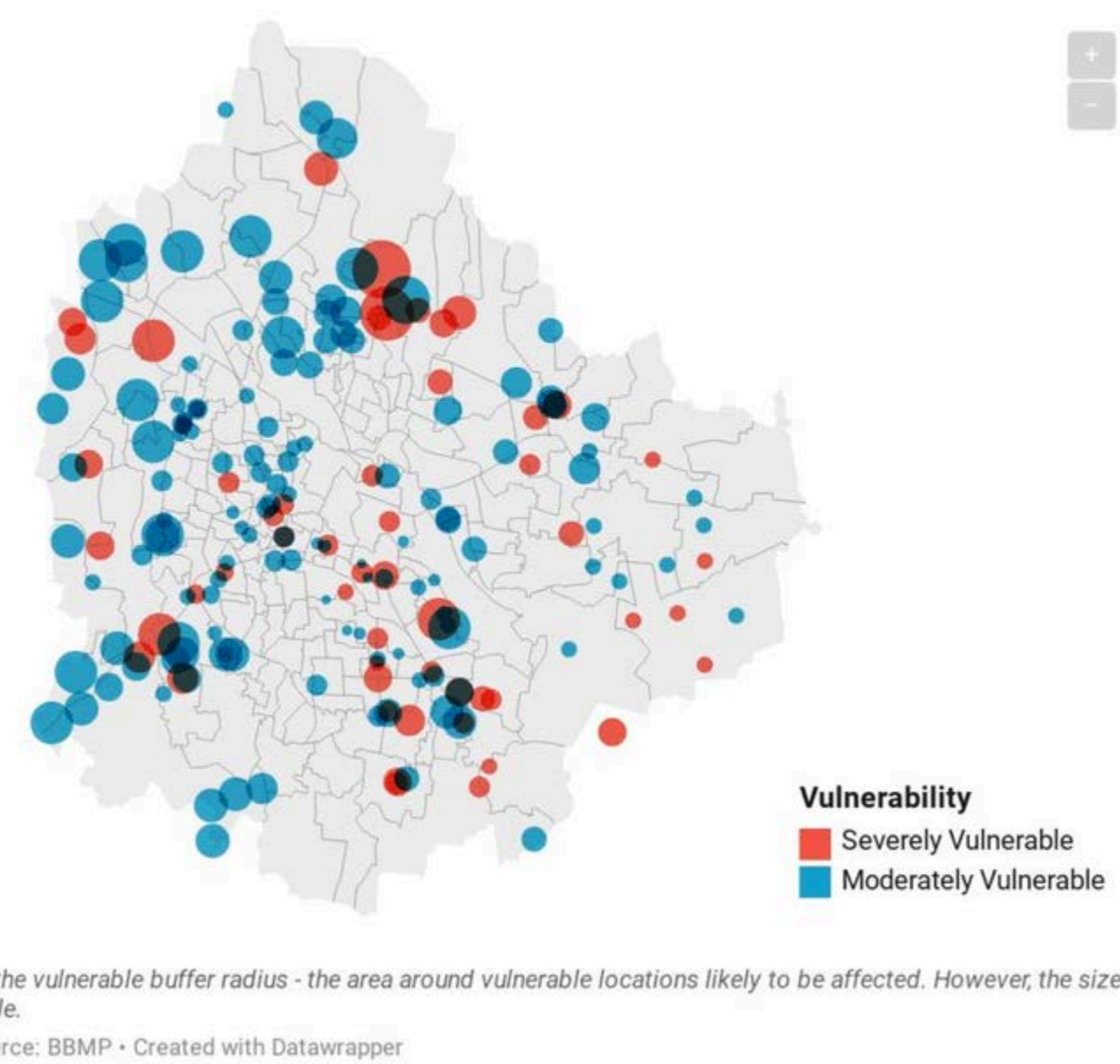
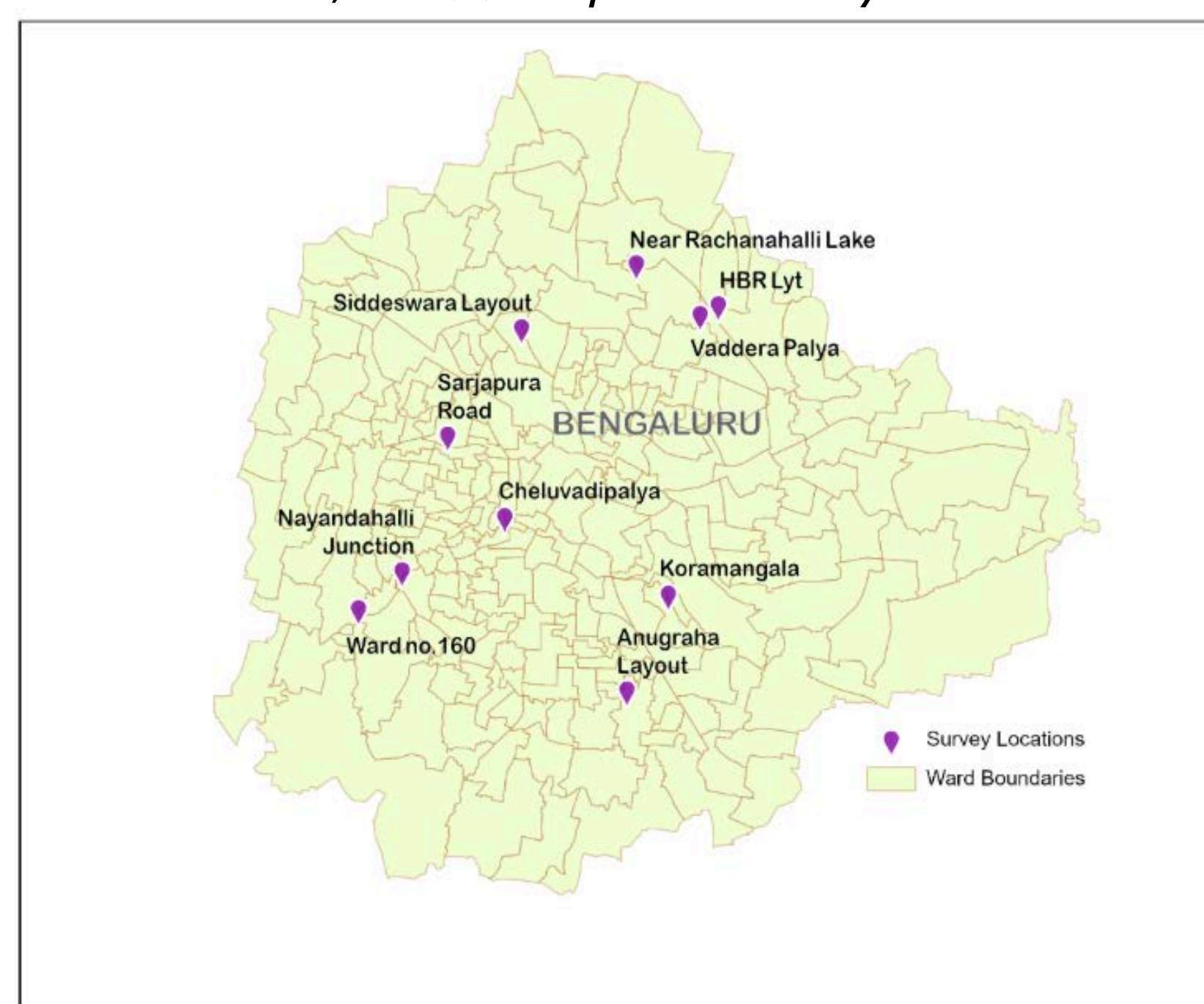


Figure 1: Singh, H., Nielsen, M., & Greatrex, H. (2023). Causes, impacts, and mitigation strategies of urban pluvial floods in India: A systematic review. *International journal of disaster risk reduction*, 103751.

Data & Methods

Figure 3: Map showing the ten survey data collection sites selected in Bengaluru. Sites were selected from BBMP's list of flood-prone locations and had to meet the following criteria: (1) classified as severely vulnerable, (2) either the largest or one of the largest severely vulnerable buffer radiuses within that zone, and (3) is a predominantly residential area.



316 survey responses collected both qualitative and quantitative data

Thematic Analysis

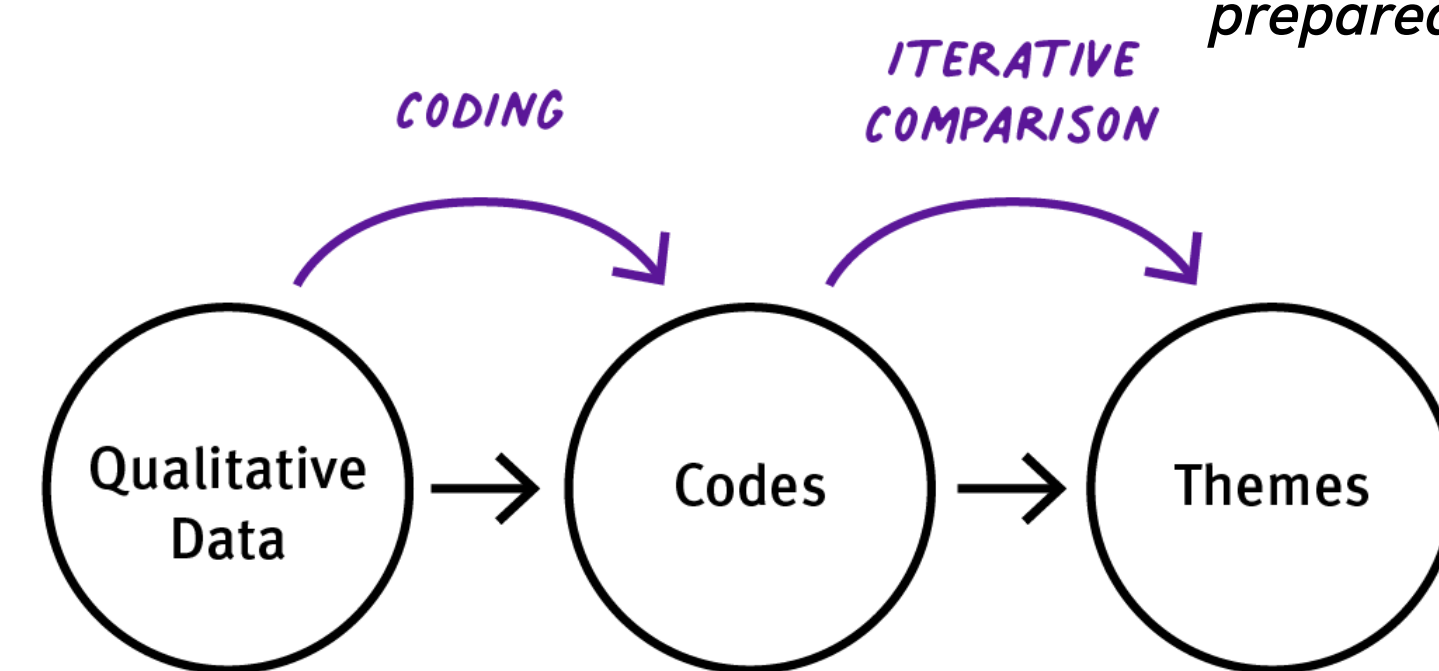


Figure 4: Open-ended responses such as questions focused on daily water and flood-related experiences were thematically coded (method described above).

Findings

1) How does chronic flood exposure shape THREAT APPRAISAL in a rapidly urbanizing context?

- Indoor flooding and sewage overflow were the strongest predictors of taking preparedness action.
- Flood risk was experienced as routine disruption and not as a one-time disaster in recent years.
- Transportation, health, and sanitation impacts shaped perceived severity.

3) How does OWNERSHIP APPRAISAL influence responsibility and institutional trust to take flood preparedness actions?

- Renters were significantly less likely to invest in flood preparedness.
- Financial and time constraints limited long-term adaptation.
- Most preparedness actions were reactive, temporary, and focused on household-level coping rather than long-term preparedness.

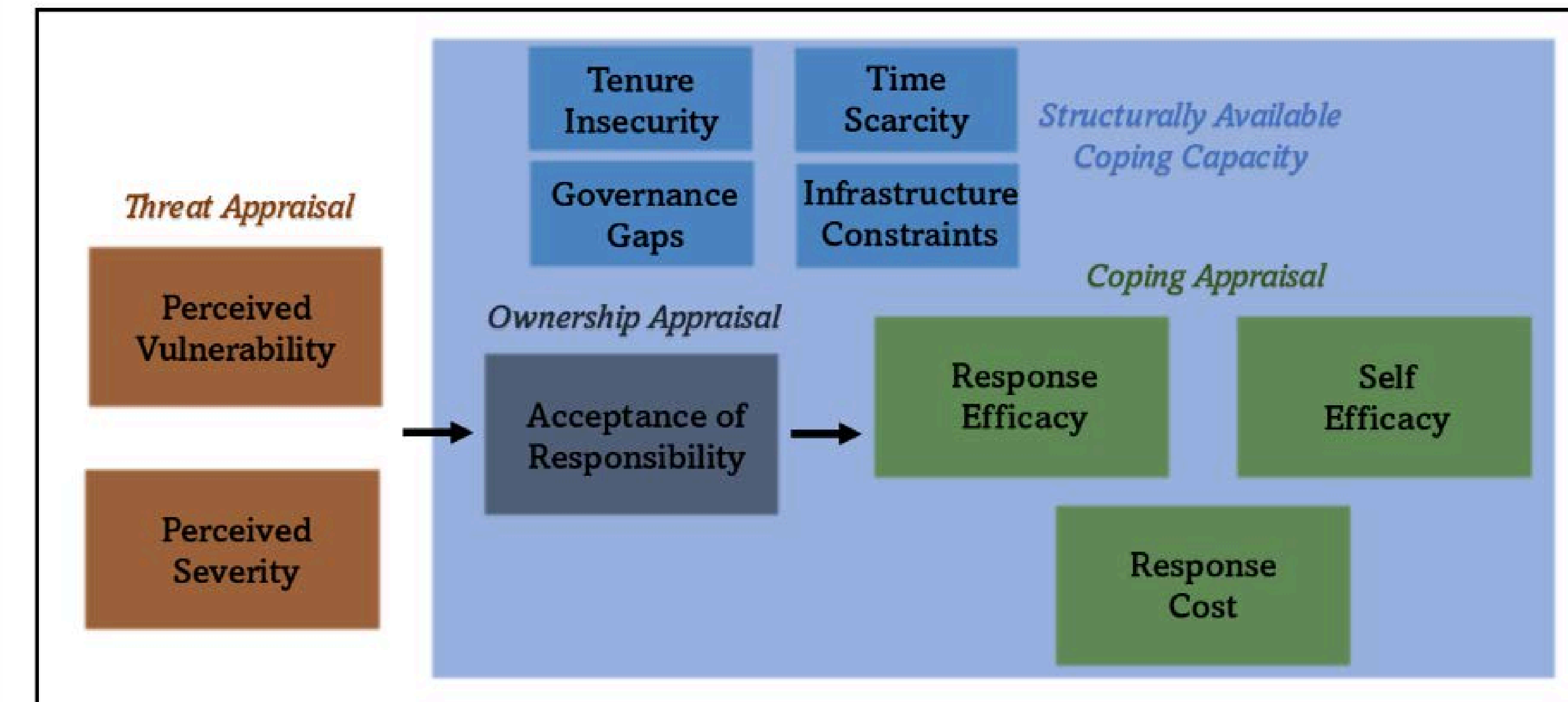


Figure 6: This study extends Oakley et al.'s (2020) conceptualization of Augmented PMT by proposing that structurally available coping capacity should be considered when assessing individual flood risk and preparedness behavior (new additions to the framework are in the blue box).

2) How do structural constraints shape COPING APPRAISAL in Bengaluru?

- Most respondents believed flood mitigation should come from government programs.
- Awareness of formal flood plans was extremely low.
- Collective community support increased preparedness behavior.

Applications

- Findings can help urban planners and municipal agencies identify how tenure insecurity, infrastructure capacity issues, and governance barriers limit household flood preparedness in rapidly urbanizing cities. Understanding community perceptions of risk can also inform equitable flood adaptation strategies, especially as cities such as Bengaluru develop their climate action plan.
- Extending Augmented Protection Motivation Theory to include structurally available coping capacity offers a framework for studying disaster preparedness in contexts marked by inequality and uneven urban development.

FUTURE WORK

Future research could test the proposed theoretical extension across larger samples, longitudinally in Bengaluru as recent climate adaptation and flood mitigation plans are implemented, and across different geographical areas.

Figure 5: Elastic net regression was used to identify predictors of two household flood behaviors: taking protective action and spending money on flood preparedness or recovery. Elastic net was chosen because the survey contained many correlated binary and categorical predictors. Predictors included preparedness behaviors and barriers to take protective action.

Elastic Net Regression:

Bridging the Gap Between Ridge and Lasso

Ridge Regression	Minimize:	Lasso Regression
Minimize $RSS + \alpha (\lambda \sum \beta_i + (1-\lambda) \sum \beta_i^2)$		
- α (alpha): regularization parameter		
- λ (lambda): mixing parameter		
Minimize $RSS + \alpha$		Lassise $RSS + \alpha$
- $\lambda_1 \beta_i $		- $\lambda_2 = \sum \beta_i^2$
- L_2 penalty: $\sum \beta_i^2$		- L_2 penalty: $\sum \beta_i^2$