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Community Engagement for Disaster Risk Reduction (CEDRR) V.1

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Abstract

Household-scale adaptation to climate-amplified risks is widely assumed to follow from greater awareness or concern, yet most evidence for this relationship derives from single-timepoint analyses. This study uses longitudinal mixed-methods data from more than six hundred re-engagements with households in two flood-prone Australian municipalities, testing whether awareness, concern, or learning predicts implemented adaptation. Cross-sectional models reproduce familiar associations between experience, awareness, and self-reported preparedness, confirming that standard designs generate a structural false positive that overstates the behavioural relevance of awareness-concern. Longitudinal models challenge this pattern. Once learning is incorporated, neither risk awareness nor climate concern predicts adaptation or spillover effects to non-participants. Normative learning is the strongest correlate of adaptation, while relational learning correlates with spillover. Qualitative evidence shows that these forms of learning reflect shifts in responsibility, capability, and social connection rather than increased concern or information retention. The findings establish a learning-centred model that replaces the awareness-to-adaptation model to explain how and why adaptation depends on deeper changes in meaning and social orientation that develop over time. Reorientation of household engagement towards relational and normative learning is therefore recommended to support adaptation that is both effective and diffusive.

Study protocol for a method of community engagement for disaster risk reduction (CEDRR) at the household scale: a two-engagement longitudinal intervention

Background
International challenges in supporting flood-prone households to voluntarily adopt risk-reduction behaviours underscore the need for new forms of community-engaged research. Existing approaches remain limited because they often assume that household inaction stems from a deficit of risk knowledge and that providing more technical or scientific information will, on its own, motivate the uptake of protective measures. In practice, flood preparedness is shaped by a more complex interplay of social, experiential, emotional, and structural factors, requiring research methods that move beyond information-transmission models toward relational, dialogic, and community-embedded engagement.

Introduction
Flooding is one of the most devastating climate hazards, and rising precipitation and sea levels are increasing risk for many households and communities (Tabari, 2020). While household-level actions, such as elevating assets, improving drainage, or preparing emergency plans, can meaningfully reduce vulnerability (Abebe et al., 2020), adoption of these measures remains very uneven, and what actually motivates people to act is not well understood. Much research has leaned on Protection Motivation Theory, which frames threat appraisal and perceived capacity as central to adaptation decision-making, and has promoted awareness campaigns and risk-perception surveys as primary tools (Bubeck et al., 2012; Grothmann & Reusswig, 2006). Yet such one-off surveys often assume that concern or intention equals behaviour, a link that may not hold, leading to overestimation of adaptation uptake (Bubeck et al., 2013). Instead, social dynamics like norms, values, responsibility, and relational ties may play a crucial role (Pelling & High, 2005). To explore these processes, our study uses longitudinal mixed-method data from over 600 flood-prone households in Melbourne, with dialogic interviews at two time points to trace learning (cognitive, normative, relational) and actual implementation of adaptive behaviours. We find that while concern drives cognitive and relational learning, it does not predict action; normative learning is the most reliable predictor of behaviour; and adaptive practices often 'spill over,' as participants share their learning and actions with neighbours and community. These results challenge the dominant narrative that awareness and perception are sufficient endpoints in adaptation policy, and instead highlight the importance of normative change and community spillover in scaling household resilience.

Objective
To evaluate how sustained, longitudinal engagement influences households' adoption of flood risk-reduction measures.

Methods
Flood-prone households were sampled from all properties within Kingston and Darebin councils in Greater Melbourne that fell within the 1% annual exceedance probability flood zone, as determined by Melbourne Water modelling. These councils were selected due to their comparable population sizes and similar numbers of properties exposed to Waterway and Drainage System flood risk. Data collection began after receiving human ethics approval and relied primarily on door-knocking, with the initial sampling frame of more than 18,000 households reduced to 9,261 accessible dwellings by excluding apartments with restricted access and non-

residential properties. To maximise recruitment efficiency, kernel density analysis was used to identify neighbourhoods with the highest concentrations of at-risk households. When residents answered the door, they were invited to schedule a 20-30 minute remote initial engagement, and compensation procedures differed by council: Kingston participants received a $50 gift card, while in Darebin a $50 donation was made to a nominated community organisation because past experience suggested many gift cards went unused. Darebin also implemented a supplementary invited community-recruitment pathway in which local groups and participating individuals invited others to join the study, with organisations receiving $25 for each completed initial and follow-up engagement. The initial engagement followed a dialogic, non-educative format designed to prompt critical reflection on participants' prior awareness, lived experiences, perceived flood risk, and existing adaptations. Afterwards, they were emailed a summary of recommended adaptations and reminded of the follow-up engagement planned for four to six months later, a timeframe selected to balance sufficient opportunity for implementing actions with the need to minimise recall decay. The follow-up consisted of a brief 10-minute conversation asking participants whether they enjoyed the engagement, learned anything, undertook any risk-reduction actions, or discussed flood risk with others. Of the 9,261 households approached, 2,428 answered the door, 834 agreed to participate (plus 42 via follow-up letters), and community recruitment generated another 450 sign-ups. Ultimately, 982 people completed the initial engagement and 641 completed the follow-up, with the analysis in this study based on participants who completed both.

Aim

This study aims to assess how participatory flood-risk reduction engagements influence household flood-preparedness actions and whether these actions spill over to other hazards or to non-participants. The specific objectives are to:

1. Evaluate the feasibility and acceptability of delivering participatory flood-risk reduction engagements, using participant feedback collected at both initial and follow-up timepoints.
2. Determine the impact of participation on household adaptation behaviours four months after the initial engagement.
3. Identify the key drivers of household flood-risk reduction behaviours, including learning processes, perceptions, prior experience, and normative influences.
4. Assess spillover into broader preparedness, examining whether engagement prompts adaptations beyond the targeted flood-risk actions (i.e., all-hazards preparedness).

Equipment

As part of CEDRR's commitment to relationship building, our research team undergo training that includes practicing a friendly style of engagement. This helps researchers refine their patience, humility, curiosity, and active listening skills before engaging participants (Kammoora et al., 2024).

Step-by-step methodology

1. Site Selection and Sampling

- Select study locations based on shared characteristics relevant to the research aims (e.g., similar population profiles or risk exposure).
- Identify the target population using an authoritative data source or modelling system.

- Refine the sampling frame by excluding inaccessible or non-relevant properties to create a feasible list of households for contact.

2. Recruitment Procedures: Primary method (e.g., door-knocking, outreach events, direct contact)

- Use spatial or demographic analysis to prioritise high-density or high-relevance areas for recruitment.
- Invite households or individuals to schedule a later engagement session through a preferred communication method.

Incentives

- Offer compensation or donations to enhance legitimacy and improve recruitment and retention.
- Adjust incentive formats based on local context or participant preferences.

Secondary Method Invited approach

- Engage community organisations, networks, or social groups to help recruit additional participants.
- Provide compensation or fundraising incentives to encourage their involvement.

3. Initial Engagement

- Conduct an initial session (e.g., via phone, online, or in person) that is dialogic and reflective rather than purely informational.
- Explore participants' existing awareness, lived experiences, perceptions, and any prior actions taken related to the study topic.
- Provide follow-up materials and notify participants of a planned second engagement at a later date.

4. Follow-up Engagement

- Conduct a shorter follow-up session after an appropriate time interval, allowing participants enough time to act but not so long that recall diminishes.
- Assess Impact: participants' reflections on the engagement, any learning, actions taken, or discussions held with others.
- Use these follow-up responses to understand behavioural change or emergent impacts over time.

5. Qualitative Data Processing

- Record all engagements for accuracy and analytic consistency.
- Apply a two-phase thematic analysis approach:

- **Deductive coding:** identify themes or behaviours anticipated by the existing framework or literature.

- **Inductive coding:** identify emergent themes not captured by predefined categories.

- Use multiple coders to strengthen inter-coder reliability, refine codebooks, and resolve discrepancies through discussion.
- Convert qualitative codes into a structured dataset suitable for mixed-methods analysis.

6. Statistical Modelling

- Conduct statistical modelling in a suitable software environment.
- Progress from descriptive to more complex multivariate models.
- Examine pathways of influence by treating key outcomes (e.g., behaviours, actions, decisions) as dependent variables and testing the role of theoretically informed predictors (e.g., awareness, experience, perceptions, prior behaviours).

Procedure Study Design and Setting

Apply Protocol to a Case Study:

Study Population
Households across the case study areas of Kingston and Darebin Council, Victoria will be invited to participate in the study if they meet the following eligibility criteria:
- Aged 18 years or over
- Live in Kingston and Darebin
- Competent English speaker

Recruitment
Participants will be recruited through a combination of door knocking and an invited participant elicitation strategy. Recruitment will focus on households located within the 1% Annual Exceedance Probability (AEP) flood zones identified through Melbourne Water modelling. This multi-method approach is designed to maximise coverage of flood-prone households while ensuring recruitment processes remain feasible, community-centred, and ethically grounded.

Targeted door knocking participant elicitation
Melbourne Water's modeled 1% Annual Exceedance Probability (AEP) flood extents for waterways (WW) and regional drainage systems (DS) were used to identify properties at risk of flooding across Kingston and Darebin. These two councils chosen for their similar population sizes (163,000 and 155,000) and the presence of more than 9,000 flood-exposed properties in each area. Because engaging all 18,000+ at-risk properties was infeasible given known limitations of door-knocking (e.g., resource demands and restricted access), the sampling frame was refined to residential properties within the 1% AEP zone that were accessible to in-person door knocking recruitment. Non-residential sites, gated complexes, multi-level apartments with restricted access, and properties under construction were removed. To account for modelling uncertainty and maximise recruitment opportunities, a 50-metre buffer was applied around each identified flood-risk property, allowing neighbouring households to be approached when primary addresses were non-responsive. The study aimed to approach 95% of households at

risk of DS flooding and 25% of those at risk of WW flooding, balancing feasibility with the need for comparative analysis across flood types. After all exclusions were applied, door-knocking was conducted at 9,261 accessible properties.

Invited participant elicitation
Invited methods of participant elicitation involve partnering with local community organizations in the case study area to recruit their members to participate. Once a not-for-profit community organization agrees to participate, the CEDRR team introduces the project to members at community organization events. After these events, a representative to act as a focal point for the partnership is agreed upon. A project manager – often the president or secretary of the community organization – then invites their members to participate by emailing them an online registration form created using Qualtrics. This process encourages community organizations to act as intermediaries, choosing to recruit participants on behalf of the research team with the aim of raising funds for their organization. Similar to the targeted door knocking sample, community organisation members that participate in CEDRR will raise AU$25 for each initial engagement completed and an additional AU$25 for each completed follow-up engagement.

Study Procedure
All participants will be asked to register to participate by completing an online consent form. There also will be an option to fill out a paper questionnaire if a prospective participant does not have access to (or does not wish to use) an internet enabled device. This online consent form will ask the following:
1. Home address
2. First name
3. Contact details
4. Convenient time to schedule the initial engagement

All participants that meet the eligibility criteria and agree to the online consent form will enter the study and be able to complete the initial engagement over Zoom or Teams on their personal device during a convenient time that they select. If a person does not have internet access (or chooses not to) they can complete the initial engagement over the phone. Initial engagements are not meant to be educative but instead, allow researchers the time needed to get to know participants by asking them about their past experiences of risk, their perceptions of household risk, and their propensity to take risk reduction actions. Additional questions explore perceptions of community connectedness, previous risk reduction actions, and willingness to adopt future risk mitigation. CEDRR engagements will include four components:

1. Discussing participants risk taking profile.
2. Personalized discussions between the researcher and participant about household risk (i.e., All-Hazards)
3. Establish perceptions of community connectedness
4. Demographics

All participants are invited to a participate in the same follow-up engagement four months later to measure impacts. Initial engagements are transcribed in real-time using Otter.AI. At the conclusion of each engagement, participants are thanked for their time and, when requested, are sent risk reduction resources via a ‘thank you’ email, which also reminds them of the follow-up engagement scheduled for 4 months later. All participants will be

asked to complete a 10-minute follow-up engagement four months after the initial engagement. A four-month time interval was chosen to allow enough time for impacts to emerge.

An email or text message will be sent to all participants to invite them to complete the same follow-up engagement. These follow-ups aim to ascertain whether the initial engagement was enjoyable, whether they learned anything, whether participation prompted them to take any action to reduce their household risk, whether they told anyone about the experience, and whether participants have any suggestions about how the engagement could be improved. Questions concerning potential spillover effects are established by asking whether participants spoke to non-participants about risk reduction after the initial engagement, and whether they were aware of anyone having taken action.

Feasibility and acceptability measures

Feasibility will be evaluated through participant recruitment and retention rates, engagement fidelity, and the impacts measured during follow-ups. Recruitment and retention rates will be estimated by:

- Recording the number of participants who were targeted by the doorknockers
- Recording the number of participants from the invited approach
- Recording the number of participants retained at the four-month follow-up
- Reasons for exclusion will also be recorded.

Engagement fidelity will be assessed through impacts on enjoyment, learning, actions taken and spillover effects. Acceptability will be measured by obtaining feedback from participants during the initial and follow-up engagements. This includes participants rating their enjoyment of the engagement on a ten-point Likert scale, with higher scores indicating higher levels of enjoyment. All participants will also be invited to provide feedback on engagement acceptability by discussing the question design, content, engagement delivery, barriers to participation and the potential for future implementation during follow-ups.

Time taken

Recruitment of 1000 participants will take 12 months. During this time frame, 1000 initial engagements will be completed. Four months after each initial engagement is completed, follow-up engagements will take place. This means that data collection is expected to take 18 months in total.

Sample size

As this is an experimental approach to community engagement involving an entirely self-selected sample, a power calculation has not been undertaken for sample size estimation. We are primarily interested in determining estimates of feasibility and acceptability, as well as outcome variability to inform the planning of a larger, sufficiently powered randomized controlled study. A sample of 1000 participants will allow relative precision when estimating feasibility outcomes – e.g. allowing for a conservative 25% dropout, there will be 750 participants in the follow-up interviews, which meets the threshold for a sufficiently precise estimate of the variance of the SRQ change to use in future studies (Julious, 2005).

Quantitative data analysis

Quantitative analyses will be used to analyse implementation and adherence indicators, such as recruitment and attrition rates, enjoyment of participation, and number of contacts and dropouts. Rates will be reported

descriptively. All outcomes will be summarized descriptively using mean, standard deviation and median for continuous variables, and rates and percentages for categorical variables. Mechanisms of change from baseline initial engagements will be contrasted with impacts measured during follow-up engagements using statistical modelling in R (4.2). Analyses will progress from univariate, to bivariate, to multivariate. Linear and logistic regressions will also be used as the primary method of modelling the impact of multiple predictors on either number of actions taken (counts) or binary outcomes. To explore the paths through which the engagement had an impact on risk reduction behaviors, models will run the influence of (1) cognitive learning, (2) normative learning; and (3) relational learning as outcomes, and then models where behavior change was a product of various types of learning.

Qualitative data analysis

Qualitative data from the follow-up engagements will be analysed following Braun and Clarke's (2006) method of thematic analysis. This thematic analysis approach involves both deductive and inductive features. Deductive coding will be done to measure the qualitative types of learning that took place. To do so, we adapt Baird et al. (2014)'s conceptual framework of learning to the context of household risk reduction.This framework identifies cognitive learning as the acquisition of new or the re-evaluation of prior risk knowledge; second, normative learning, which concerns a change in approach to risk reduction practice; and third, relational learning, or a changed understanding of how communities, authorities or others influence household risk reduction. We also measure whether participants took action to reduce risk at their household and or told others about their risk reduction behaviors (i.e., spillover effects). Inductive analysis includes identifying the actions taken and potential spillover effects. To optimize coding accuracy, coded examples for each theme and sub-theme will be shared with the lead researcher and other members of the research team to come to a consensus of a codebook. The data from different group of participants will be compared and contrasted.

Data availability statement

Due to ethical limitations, we are unable to share the raw data.

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