



Review Article: Multi-Hazards and Household Preparedness Planning: Evidence, Gaps and Opportunities

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Abstract.

This paper presents a systematic analysis of peer-reviewed evidence on household preparedness and multi-hazard interrelationships, identifying what constitutes an effective preparedness plan and assessing how far current research
10 integrates multi-hazard thinking. A systematic search of literature published since 2006 yielded 138 relevant studies, assessed by geographical focus, methodological approach, alignment with best practice, and engagement with multi-hazard perspectives. Fifty papers underwent in-depth qualitative analysis. Findings reveal a persistent Global North and quantitative bias in the evidence base: only 18% of case studies originate from low- and middle-income countries, and 66% employ solely quantitative methods. Current understandings of preparedness are therefore narrow, often excluding from low-
15 resource contexts. From the in-depth analysis, we identify key elements of effective household preparedness planning in low-income settings, including shared assets and gender norms. We further show that 45% of studies focus on a single hazard, with limited attention to hazard interrelationships; 62% make no explicit reference to how multiple hazards interact to shape preparedness strategies. We conclude with recommendations for future household preparedness research that (a) adopts a broader definition of the term ‘household’, (b) considers gender, (c) considers the barriers to adoption of
20 preparedness plans, (d) embraces qualitative and mixed-methods approaches and (e) considers multi-hazard interactions between hazards and preparedness strategies. The paper advances understanding of the limited maturity of multi-hazard preparedness research and highlights the need for evidence that links household-level practice with Priority 4 of the Sendai Framework for Disaster Risk Reduction 2015–30 and the mid-term call for inclusive, multi-hazard risk governance.

1. Introduction

25 This article synthesises and analyses existing peer-reviewed literature on household preparedness in the context of multiple, interrelated hazards (hereon referred to as ‘multi-hazards’). We use this literature as a dataset for analysis, with our findings supporting future research and practice on multi-hazard risk management and household preparedness planning, in line with the UN Sendai Framework for Disaster Risk Reduction (2015–2030).



To begin, we examine the two key concepts analysed in this article: ‘multi-hazards’ and ‘household preparedness’, and specifically household preparedness plans (Sect. 2). We then detail how these concepts shaped our systematic literature review and meta-analysis. Building on this foundation allows us to examine how integrating emerging multi-hazard science into the often-overlooked area of household preparedness planning, rather than focusing solely on individuals or organisations, may either reinforce or challenge established principles of preparedness, thereby informing disaster risk management policy and practice.

To shape this analysis, the research questions guiding the literature review asked what supports the uptake of preparedness actions by households, and the extent to which the multi-hazard concept is embedded in the literature on household preparedness (Sect. 3). The results of this analysis (Sect. 4) are detailed by key characteristics of the peer-reviewed literature to date, concluding with a discussion section where key themes are synthesised (Sec.5).

2. Background

2.1 Preparedness Policy and Disaster Risk Reduction (DRR)

The term preparedness has been used in vernacular English language for centuries (Coppola, 2006), but entered civil defence and regulatory frameworks in the mid-20th century, was institutionally formalised by agencies like the Federal Emergency Management Agency (FEMA), and later standardised by organisations like the UN Office for Disaster Risk Reduction (UNDRR). In disaster studies, preparedness gained traction during the Cold War when the United States (US) Department for Civil Defence developed policies in anticipation of nuclear war with the USSR (Alexander, 1997). Collier and Lakoff (2008) trace how such ‘preparedness’ logic was gradually applied to other hazards, such as hurricanes, earthquakes, and floods. In turn, terms such as “preparedness”, “vulnerability”, “capacities”, and “systems-thinking” which originated in military defence planning entered the lexicon of geological hazard disaster management (Donovan, 2017). Collier and Lakoff (2008) highlight that the goal of preparedness as practised in civil defence was not to try and prevent disasters from happening, but rather *to be prepared to manage the consequences* of these events.

As preparedness concepts matured, the social and behavioural sciences began to study and thus inform disaster preparedness practice. Much of this work, often using quantitative methodologies, examined – and sought to measure – what motivates individuals to prepare for disasters. A prominent example of how social science shapes contemporary disaster studies today is the ‘Theory of Planned Behaviour’ which seeks to identify how attitudes, norms, and perceived control determine an individual’s intention to prepare for a disaster, and this theory has recently been applied to studies including Vrselja, Pandzic and Glavas (2023); Tohan *et al.* (2024); Heinkel *et al.* (2022); Ng (2022); Wang *et al.* (2023). Another related concept is “outcome expectancy”, the belief that individual preparedness actions will effectively reduce risk (Paton, 2003). These



popular social and behavioural science frameworks emphasise individual agency (Lindell and Perry, 1992), as such, it is less understood *why* and *how* certain socio-cultural systems enable or constrain people to prepare for disasters.

60 Critiques of preparedness often highlight the contradiction between governments urging individuals to prepare, and the broader policies and socio-economic systems that create inequalities resulting in households not having the resources needed to adequately prepare for disasters. Without due care, this individualised preparedness paradigm can disproportionately expose marginalised groups to hazards (Wisner *et al.*, 2003; McGowran *et al.*, 2024; Kelman, 2020b; Kelman, 2020a). Preparedness continues to dominate the work of resource-constrained disaster risk reduction personnel, who frequently
 65 regard tackling the political and socio-economic inequities that marginalise households as *beyond their mandate* (UNDRR, 2023). The Sendai Framework thus situates its demand for preparedness within a wider call to prepare for disasters in a way that centres the concept of “building back better”, addressing the root causes of disaster risk (UNDRR, 2015). UNDRR (2016) define the term preparedness to mean:

70 The knowledge and capacities developed by governments, response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters

Here, preparedness is recognised as a contributor to risk reduction. Debate remains about how best to interpret and define preparedness, specifically at a ‘community’, ‘household’ and individual level as these concepts are socio-culturally situated (Nojang and Jensen, 2020). While the exact definition of ‘household’ remains under debate, there is a consensus that ‘household preparedness’ saves lives (Walch, 2018; Walch, 2019), as households are generally the first to experience and
 75 respond to disasters (Eiser *et al.*, 2012). Moreover, there are well-established tenets of how to enable household preparedness such as Sutton and Tierney’s (2006) report on disaster preparedness, offering an overview of the key logics underpinning preparedness (Table 1), at a time when DRR policy was evolving through the UN’s Hyogo Framework for Action (2005-2015). Sutton and Tierney (2006) synthesised decades of academic and grey literature and has been widely accepted as ‘standard practice’ to inform preparedness at a household, organisational and community level (Castañeda *et al.*, 2020;
 80 Hémond and Robert, 2012).

Table 1. Principles of Preparedness, by Sutton and Tierney (2006)

Title	Principle (Sutton and Tierney, 2006)
1. Plans must be continuously improved	1) Formal plans are only one element in comprehensive preparedness strategies.
2. Beyond Planning	2) Plans mean little in the absence of other elements of preparedness.
3. Ongoing Process	3) Preparedness is a process, not a product.



4. Realistic Assumptions	4) Preparedness efforts must be based on realistic assumptions concerning social behaviour during crises.
5. Bottom-Up Collaborative Approach	5) Preparedness requires collaboration, not top-down direction – although clear guidance does help.
6. Practitioner-Guided	6) Planning activities should be guided by those who will actually carry out plans.
7. Inclusive and Multi-Organisational	7) Efforts should be comprehensive and inclusive, and should promote multi-organisational participation.
8. Overcoming Barriers to Implementation	8) Preparedness advocates must overcome constraints, limitations, and sometimes outright opposition.
9. Risk and Vulnerability-Based, alongside Low Probability and High Consequence	9) Preparedness should be risk- and vulnerability-based, but should also consider low probability/high consequence events.
10. Adaptive & Innovative	10) Preparedness efforts must be designed in ways that help responders and victims anticipate surprise – e.g. through fostering the ability to adapt, improvise, and innovate.
11. All-Hazards Focus and Special Considerations for Specific Perils	11) Preparedness efforts should have an “all hazards” focus, while also incorporating special considerations associated with individual hazards. Preparedness activities should not be organised around specific perils.

85 The 11 principles detailed in Table 1 acknowledge the multi-scalar responsibility for preparedness, they also highlight that ‘planning’ in isolation cannot deliver meaningful disaster preparedness. Consequently, the household preparedness literature has increasingly focused on identifying the factors that facilitate or hinder preparedness across varied geographical, socio-cultural, and economic settings, with growing evidence and recognition that qualitative research is uniquely positioned to uncover the contextual, behavioural, and relational dynamics shaping preparedness practices (Castañeda *et al.*, 2020; Heidenstrom, 2020; Than *et al.*, 2023/12/28; Hung, 2018; Huntsman, Wu and Greer, 2021; Nojang and Jensen, 2020; Osman and Altıntaş, 2023; Tohan *et al.*, 2024).

90 Yet, there has been limited work exploring how Sutton and Tierney (2006) ‘principles for household preparedness plans’ can be implemented in practice. This evidence gap is significant, as there is consensus that critical differences in household outcomes emerge between those who implement preparedness measures—such as stockpiling goods and developing a plan—and whether household members are, in reality, adequately prepared for a disaster (Brown, Largey and McMullan,



2021). Wachinger *et al.* (2013) suggest that a key factor explaining the gap between implementing measures and actual preparedness is an individual's *intention* to prepare. We propose that one tangible expression of this 'intention to prepare' is the development of a household preparedness plan. The importance of preparedness plans - particularly at the household level - is evident across Sutton and Tierney's eleven principles, which highlight their relevance across multiple dimensions of preparedness (see also: Levac *et al.*, 2012).

2.2. Multi-Hazards and Preparedness

The concept of "multi-hazards" emerged as a critique to the assumption that hazards occur in isolation from one another (Kappes *et al.*, 2012; Kappes, Keiler and Glade, 2010; Gill and Malamud, 2014; Gill, 2025). Gill (2025) details how the multi-hazard concept has evolved, and its incorporation in intergovernmental agreements over more than 30 years. Proponents have evidenced how hazards can co-occur and interrelate in complex ways and argue that disaster management policy and practice should accommodate and be responsive to these complexities. A range of hazard interrelationship types exist, typically organised into three categories as set out in Table 2. These types of hazard interrelationship can combine and generate complex, multi-hazard events.

Table 2. Types and Examples of Hazard Interrelationships (adapted from Ciurean *et al.* (2018), Gill *et al.* (2022), and Gill *et al.*, 2025).

Hazard interrelationship type	Description (from Gill <i>et al.</i> , 2025)	Hypothetical Example
Triggering	One hazard event causes one or more other hazard events to occur, which may then trigger additional hazardous events	An earthquake results in the destabilisation of a slope generating a landslide.
Amplification	One hazard can change the likelihood and/or magnitude of additional hazards in the future.	Wildfires increase the likelihood of debris flows.
Compound	Two or more hazards may impact the same region and/or time period with impacts different (greater, lesser) than their sum. These compound relationships can take different forms, including (i) multiple (triggered) hazards occurring simultaneously, or (ii) two independent hazards impacting the same region and/or time period (or in close	A volcanic eruption may coincide with a tropical storm (with the combined impacts being greater than the sum of their parts).



succession).

This multi-hazard approach differentiates itself from a *multiple (or multi-layer) single hazards approach*, which overlooks hazard interrelationships and thus may underestimate hazardousness and risk (Kappes *et al.*, 2012). Amidst calls for a greater emphasis on multi-hazard approaches, preparedness literature and related policy continues to promote an ‘all-hazards’ or ‘hazard-agnostic’ approach (Penta *et al.*, 2017). The ‘all-hazards’ approach emphasises the building of generic preparedness and response systems that are applicable to any hazard, drawing on years of discourse which argues that certain actions, assets and resources can build preparedness to a range of different hazard scenarios and emergencies (Penta *et al.*, 2021). One benefit of this approach is that it is perceived as resource efficient, and thus popular with government policymakers and low-resource organisations (Penta *et al.*, 2017). Most policy frameworks for disaster and emergency management adopt the ‘all-hazards’ terminology, particularly in the USA. For example, the eleventh and final preparedness principle advocated for by Sutton and Tierney (2006, p. 36) notes:

Preparedness efforts should have an “all hazards” focus, while also incorporating special considerations associated with individual hazards. Preparedness activities should not be organized around specific perils.

Despite its popularity, questions remain about whether an “all-hazards” approach to household preparedness planning can adequately prepare populations for the increasing disaster complexity, intensity and the cascading impacts (Bodas, Kirsch and Peleg, 2020). Table 3 gives an overview of the key preparedness approaches for different hazard concepts (Penta *et al.*, 2017; Sutton and Tierney, 2006, p. 36; Bodas, Kirsch and Peleg, 2020).

Table 3. Examples of Preparedness Approaches

Preparedness Approach	Description
Hazard Agnostic/ All Hazard	A preparedness action that is likely to improve preparedness for a broad range of hazards e.g., enhanced social networks.
Hazard Agnostic/ All Hazard with some named hazards	As above but with some consideration of top hazards faced in a region e.g., enhanced social networks that can deliver trusted early warnings)
Single-Hazard	A preparedness action that is specific to a hazard or narrow range of hazards (e.g., fixing furniture to the walls for earthquake preparedness).
Multi-layer single hazard	Preparedness for all hazards that are likely to impact a specific region e.g., owning sandbags for floods, fixing furniture to the walls for earthquakes in an area where both floods and earthquakes are likely to occur.



Multi-hazard Preparedness	Preparedness actions that consider cascades and interactions of hazards and potential effects on preparedness that are likely to occur in a region - may be a combination of the above types of preparedness actions e.g., identifying multiple tsunami evacuation routes that are not landslide-prone.
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125 In this paper, we consider how research on household preparedness engages with hazard-specificity, and whether the multi-hazard concept, with its emphasis on hazard interrelationships, has theoretical and practical implications for household preparedness planning. More broadly, we assess how the literature on preparedness has—or has not—evolved since Sutton and Tierney (2006). Their core preparedness principles synthesised decades of research and therefore provides a critical foundation for analysing preparedness discourse and tracing its evolution over time. Building on this foundation allows us to

130 examine how integrating emerging multi-hazard science into the often-overlooked area of household preparedness planning, rather than focusing solely on individuals or organisations, may either reinforce or challenge established principles of preparedness, thereby informing disaster risk management policy and practice.

3. Research Questions and Methodology

This paper adopts a systematic literature review and analysis approach to answer the following two research questions (RQ):

- 135 RQ1 - What are the characteristics of the development of a ‘good’ household preparedness plan and what factors support the uptake and use of these?
- RQ 2 - To what extent is the ‘multi-hazard’ concept embedded into household preparedness literature?

Our method was informed by Grant and Booth (2009) and the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) protocol (Tricco *et al.*, 2018). In our work, we systematically searched for and appraised:

- 140 I. Sutton and Tierney’s (2006) Principles of Household Preparedness
- II. Hazard typology
- III. The success of the household preparedness plan

Searches were performed in Web of Science Core Collection using two separate Boolean operator enquires for RQ1 and RQ2. We selected the Web of Science ‘Topic’ search, which includes (i) Title, (ii) Abstract, (iii) Author Key Words and (iv)

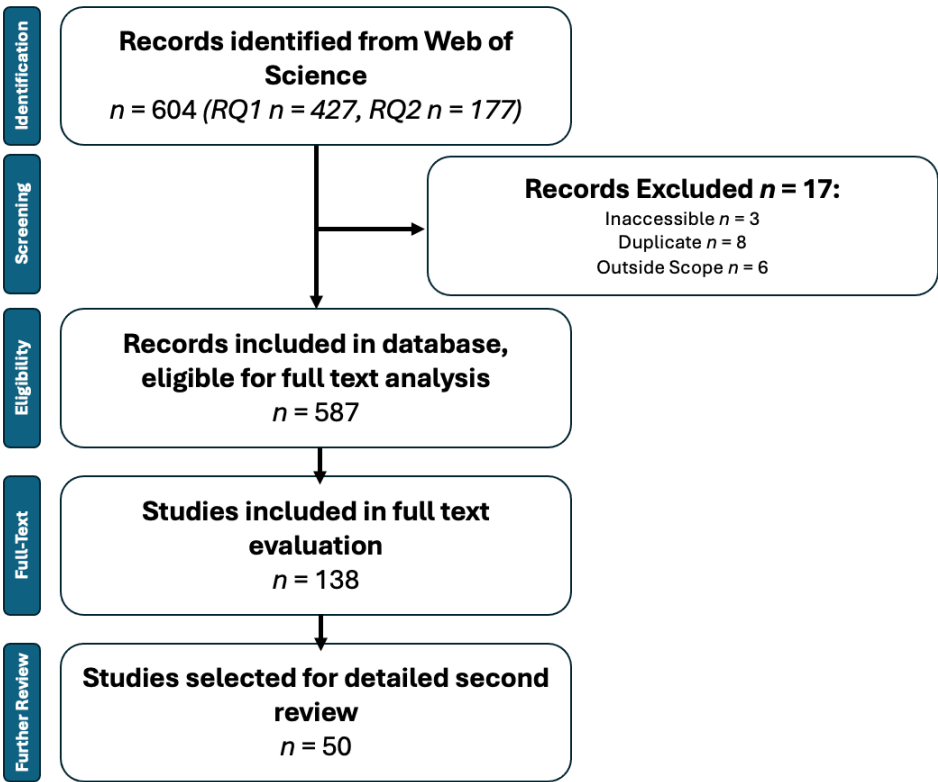
145 Key Words Plus (a set of additional keywords that are algorithmically generated from the titles of the references cited by an article), and we ordered the literature results by the ‘Relevance’ filter. To narrow the scope of the review, the search was limited to peer-reviewed academic articles, including review papers. This ensures a focus on rigorous and replicable research and supports the replicability of our search process.



The search criteria used in our study were as follows: for RQ1 we used the Boolean search string "Preparedness" AND "Household" AND "Plan between the years of 2006-2025, returning 427 articles. The date parameters were chosen to reflect research since Sutton and Tierney's (2006) Principles of Preparedness. For RQ2 we used the Boolean search string "Household" NEAR "Preparedness" AND *Hazard* for all years, returning 177 returns. The search returns resulted in a total of 604 papers, which we sorted in Web of Science by 'search term relevance' (based on number of appearances of search terms in title and abstract), allowing us to prioritise studies most central to the overall topic. Because the two search strings produced a broadly overlapping set of studies, many of which addressed both household planning and hazard-specific preparedness, we combined the search results to manage duplication and ensure consistent screening criteria. Although combining the searches may have reduced distinctiveness between RQ1 and RQ2 datasets, we judged this approach appropriate given the conceptual overlap between the two questions and our aim to capture the full spectrum of household preparedness literature.

The sole exclusion criteria used in screening was that articles must relate to 'natural' hazards using Gill and Malamud (2014) categorisation of 21 natural hazards across geophysical, hydrological, atmospheric, biophysical, and shallow Earth processes. Six articles were excluded on 'non-geological' hazards such as terrorist attacks, financial crises and household preparedness for at-home childbirth. Eight articles were removed through the duplicate removal process, and three articles were removed due to library inaccessibility, leaving a remaining 587 articles.

After analysing 138 papers, the researchers reached the thematic repetition point of data saturation and continued research yielded diminishing returns for analytical value (Booth, 2016; Dixon-Woods *et al.*, 2006). Following this, 50 articles deemed critically relevant were selected for further review. This process is summarised in Fig. 1.



170 **Figure 1.** Flowchart illustrating the systematic literature review conducted in this study, detailing the identification, screening, and inclusion process, along with the number of articles at each stage.

4. Results

Here we present information extracted from the 138 papers identified from the systematic search in Web of Science (outlined in Sect. 3). Building on this foundation allows us to examine how integrating emerging multi-hazard science into the often-overlooked area of household preparedness planning, rather than focusing solely on individuals or organisations, may either
175 reinforce or challenge established principles of preparedness, thereby informing disaster risk management policy and practice.

We first present simple metrics of the studies, by methods used (Sect. 4.1 Trends in Research Methods Used) and geography (Sect. 4.2 Geography of Case Studies) to synthesise how and where evidence is being generated. We then assess the database of literature by considering the degree to which it aligns with Sutton and Tierney (2006) Principles of Disaster Preparedness
180 (Sect. 4.3 Principles of Disaster Preparedness) to evaluate whether, and to what degree, the evolution of multi-hazard science and associated discourse has integrated with research exploring household preparedness in recent years. In Sect. 4.4 Household Preparedness Checklists, we evaluate evidence underpinning household preparedness plans, specifically the



advancements of ‘checklist style’ assessments, examining socio-cultural and economic perspectives informed this approach. In Sect. 4.5 Decision-Making Processes, we consider the strengths and weaknesses of the adaptation of checklist style household preparedness plans. Finally, in Section 4.6 Hazards, we synthesise which hazards are studied most prominently, and the extent to which the multi-hazard concept is integrated into household preparedness research.

4.1 Trends in Research Methods Used

The first finding in this study relates to the prominence of the research methodologies deployed in this study. Figure 2 depicts the 138 articles in the database, as categorised into six types of social research methodologies.

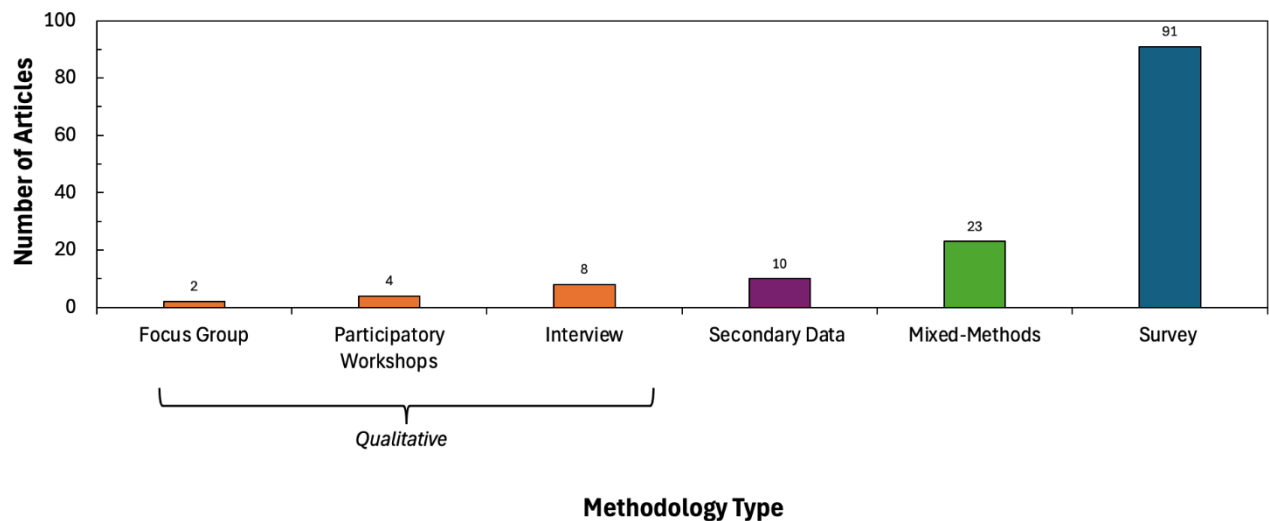


Figure 2. Analysis of Methodology Type

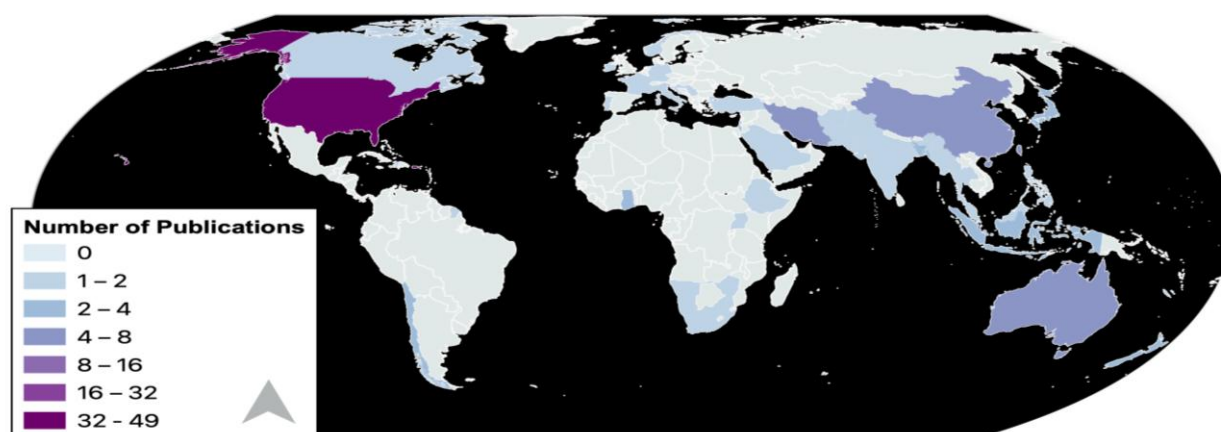
We found that 66% (91) of the papers examined use solely quantitative methodologies (i.e., surveys). Many papers acknowledge the limits of the quantitative approach used in their study, and often recommend that more qualitative, interpretative research would provide the evidence needed to strengthen household preparedness. We found that only 10% of the papers in the database had deployed solely qualitative methods in their process of inquiry, including interviews, participatory workshops and focus group discussions. As a result, much of the literature lacks the contextually grounded insights offered by qualitative studies to understand how preparedness is defined and supported within diverse household settings.

4.2 Geography of Case Studies

Our analysis indicates that the majority (64%) of studies on household preparedness focus on the Global North, and particularly the USA (49 of 138 papers, or 35%, reviewed in this study) (See **Figure 3**.Fig.3.). In contrast, the country with



the second most publications is Australia, with eight (or 6%) of the 138 papers reviewed. Only 25 articles featured case studies in countries deemed to be in lower and lower-middle income countries according to the OECD.

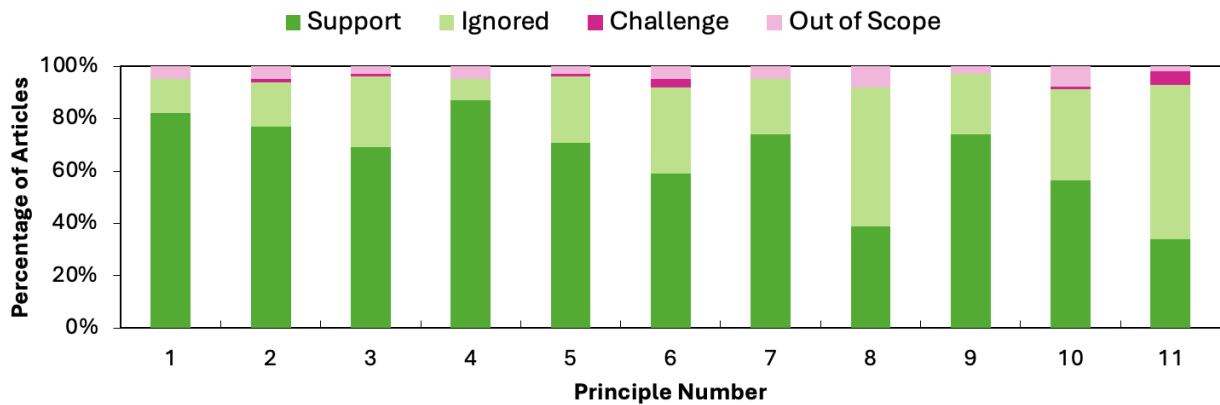


205 **Figure 3.** World map showing number of articles which use a case study from a specific country

Our analysis also suggests a lack of research specifically on rural areas, as 16 (or 12%) of papers focused on rural populations, with 58 (or 42%) on urban areas and 62 (or 46%) on mixed or unspecified areas. Typically, the scale of analysis is coarse ‘regional’ administrative units comprising urban and rural areas (for example, a whole federal state). Resultingly, the evidence that is currently informing multi-hazard approaches and household preparedness planning is mostly generated in high-income urban settings.

4.3 Principles of Disaster Preparedness

Fig.4. details how each of the 138 peer-reviewed articles analysed in this study aligned with the 11 principles of preparedness set out in Sutton and Tierney (2006), in terms of their (i) support of the principle, (ii) lack of consideration (‘ignoring’) the principle, (iii) challenge of the principle or (iv) the principle being out of the paper’s scope.



Principle No.	Description
1	Plans must be continuously improved
2	Beyond Planning
3	Ongoing Process
4	Realistic Assumptions
5	Bottom-Up Collaborative Approach
6	Practitioner-Guided
7	Inclusive and Multi-Organizational
8	Overcoming Barriers to Implementation
9	Risk and Vulnerability-Based, alongside Low Probability/High Consequence
10	Adaptive & Innovative
11	All-Hazards Focus and Special Considerations for Specific Perils

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Figure 4. Sutton and Tierney’s (2006) principles of disaster preparedness showing for each principle, the % of 138 articles which support, ignore, or challenge the principle, or the principle being out of scope of the paper.

Figure 4. indicates that the initial principles (1 to 5) were generally well-supported in the literature analysis, with Principle 4 (making realistic assumptions) receiving the strongest endorsement at 84%. In contrast, Principle 11 which states that disaster preparedness must have an ‘all-hazards’ approach was supported least in the literature analysed in this study, with only 34% of papers arguing that preparedness efforts should have an ‘all-hazards’ focus and 59% of papers ignoring this concept. Similarly, Principle 8, which states that ‘preparedness advocates must overcome constraints, limitations, and sometimes outright opposition’, was not considered in 53% of papers.

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4.4 Household Preparedness Checklists

As part of our analysis, we examined whether studies assessed household preparedness using predefined ‘checklists’, a common method in which preparedness is measured by the presence of specific items, such as a flashlight, batteries, and a

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three-day supply of food and water. Checklist-based assessments reflect the assumption that a generic set of actions or supplies can prepare households for any hazard – a narrative derived from the ‘all-hazards’ approach embedded in much of the preparedness literature.

230 In 35 of the 138 studies reviewed (26%), researchers determined household preparedness by asking whether households had used their own checklists to implement preparedness plans. Within these 35 papers, twenty-four illustrative household preparedness plans and assessments used in the research process were published to support transparency and replicability. These 24 illustrative plans depicted checklists tailored to ‘all-hazards’, taking a hazard agnostic approach, and included disaster supplies items such as (i) having a 3-day supply of non-perishable food, water, and prescription medications; (ii) a
 235 working, battery-powered radio and batteries; (iii) a working, battery powered flashlight and batteries and (iv) an evacuation plan.

Finally, we also analysed and summarised, using a 4-point Likert scale, the extent to which researchers or research participants reported the usefulness of implementing household preparedness plans – where a scoring of 4 indicated that they were deemed very useful. We found that 13 of the 120 eligible studies (11%) scored 4, with the majority (44%) scoring 2.

240 This indicates that although certain components of household preparedness plans were deemed useful for building preparedness, overall, there is limited evidence that dominant approaches to designing and implementing household preparedness plans are meaningfully enhancing people’s actual preparedness for disasters. As a result, there are very few studies published in academic literature which report successfully supporting household preparedness. This evidences the need to better understand what motivates households to create and implement a preparedness plan.

245 Studies which deployed methodologies other than checklist use often explored how demographics correlated to household preparedness. Typical methods used secondary datasets such as FEMA surveys, comparing variables like (i) trust of institutions, (ii) literacy and formal education attainment, (iii) past experiences of disaster, (iv) gender, (v) income, (vi) disability, and (vii) age, with reported levels of preparedness (see Han *et al.* (2017b); Chaney *et al.* (2013); Kurkjian *et al.* (2016).

250 4.5 Decision-Making Processes

Our analysis identified a range of evidence that socio-cultural norms shape preparedness literacies and activities. For example, many papers noted that in more community-oriented cultures, risk-mitigation behaviour may be influenced more by a person’s social context, such as shared social norms and rules, rather than individual perceptions (Zaremohzzabieh *et al.*, 2021). Other papers highlighted prior experience as a significant predictor of household preparedness (Shah *et al.*, 2020;
 255 Kirschenbaum, 2002). Other studies in our analysis concluded that households with seniors and disabled individuals are more likely to engage in preparedness efforts (Martins *et al.*, 2019). Finally, previous research has demonstrated that one key factor in improved disaster preparedness is the strength of an individual’s social support network (i.e., social capital)



(Gargano *et al.*, 2015). Below, we outline three key factors identified as key determinants of preparedness in our in-depth analysis of 50 papers.

260 4.5.1 Gender and household preparedness

Many papers evidenced how men and women prioritised preparedness activities differently, illustrating the role of gendered social norms (Ekenga and Lan, 2019). For example, Ekenga and Lan (2019) found that women were 29% less likely to self-report owning a ‘checklist’ of household preparedness items and 11% less likely to have a 3-day supply of medication than men. However, research has evidenced the differences in women’s preparedness priorities that may be missed by using pre-
265 defined checklists. A study in Florida sought to explore the gendered dimension of preparedness further and found that women typically engage in more interpersonal preparedness activities, such as preparing toys for their children and supporting neighbours to evacuate (Hung, 2018). Additionally, in heterosexual households, wives tended to favour shared responsibility of household preparedness, while husbands tended to favour individual responsibility (Hung, 2019).

4.5.2 Socio-Economic Determinants of Preparedness

270 Several studies in our analysis examined socio-economic determinants of preparedness. For example, Gaisie, Han and Kim (2021) conceptualised household preparedness in Ghana’s urban informal settlements as constituting interconnected human, economic, social, and physical capitals. Within this context, a resident’s tendency to cooperate or volunteer in community initiatives was identified as a key motivation to take household preparedness measures. Similarly, research with low-income households in disaster-prone areas of Mexico found that preparedness for geohazards was of secondary concern in contrast
275 to other, more immediate challenges of living in informal settlements (Reininger *et al.*, 2013). Taken together, this body of work highlights how different dimensions of social and economic life shape household preparedness in ways that extend beyond physical resources alone.

4.5.3 Animal Ownership as a Determinant of Preparedness

There is a consensus that across both high- and low-income countries there is a divergent yet equally crucial role that
280 animals play in influencing the adoption of preparedness activities for disasters (Edmonds and Cutter, 2008; Federico and Banks, 2020; Thompson, 2018; Thompson, Trigg and Smith, 2017). These studies found that households in the United States and Australia were not willing to evacuate unless they could bring their pet to a shelter. Animals were found to be a critical resource in increasing preparedness for droughts in Ntabazinduna, Zimbabwe (Belle, Sithabile and Ogundeji, 2017).



4.6 Hazards

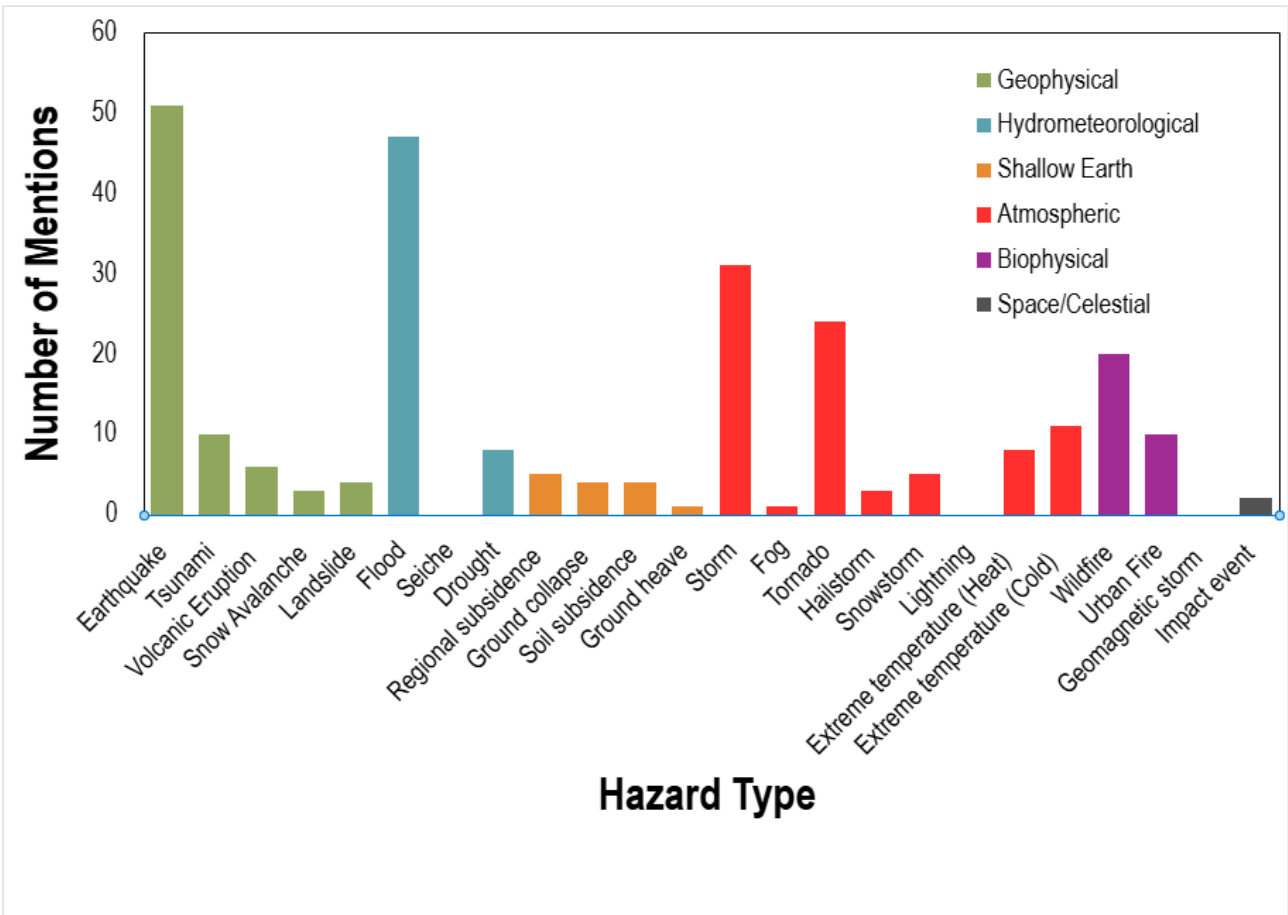


Figure 5. Distribution of reviewed preparedness literature by hazard type (hazard categorisation from Thompson et al., 2025, adapted from Gill and Malamud, 2014)

Figure 5. shows a dominance of earthquake, flood, storm, tornado and wildfire hazards. No literature was identified for three hazards (seiche, lightning and geomagnetic storm). Unsurprisingly, the hazard focus of studies broadly reflected the physical geographies of hazards. Earthquake-affected countries like New Zealand, Iran and Türkiye typically explored earthquake preparedness (Yilmaz and Yildirim (2023); Jamshidi *et al.* (2016), whereas literature on the US typically reflected on hurricane and storm preparedness (Clay *et al.*, 2020; Halim *et al.*, 2021; Martins *et al.*, 2018). 45% of the papers analysed focused on a single hazard. Most papers in this analysis were unclear, or even agnostic in their stance concerning the importance of the hazard in question to preparedness planning.

As indicated in Section 2.2, many scholars argue that preparedness planning should take an ‘all-hazards’ approach. Thus, for this review, papers were broadly categorised in terms of their stance towards Principle 11 of Sutton and Tierney (2006). The results of this categorisation are that, of the 138 papers reviewed, 34% (49) either explicitly or implicitly supported the logic



of an ‘all-hazards’ approach. For 62% (86) of the papers, the research design and methodology did not clearly articulate an understanding of the hazard–preparedness relationship; therefore, these papers were classified as not addressing the principle. For three of the papers a discussion of the relationships between hazards and preparedness was deemed to be out of the scope of the study as they solely focused on analysing household preparedness plans, but did not make reference to any hazard typology (Nurse-Clarke and Heagele, 2023; Najafi *et al.*, 2020; Osman and Altıntaş, 2023). Seven of the papers contained sentences or arguments that seemed to pose a challenge to all-hazards planning, but these were not often fully developed, as discussed below. This distribution highlights both the prevalence of the all-hazards framing in household preparedness research and the persistent lack of explicit engagement with hazard typologies, limiting the capacity to assess critically the applicability of multi-hazard approaches to preparedness across diverse contexts.

Sutton and Tierney’s (2006) framework offered limited analytical traction in positioning the preparedness literature within a multi-hazard context. This stems from an inherent ambiguity in Principle 11, which simultaneously endorses an “all-hazards” approach and recognition of hazard-specific nuances. This dual directive complicates attempts to categorise studies systematically. Section 5.3 therefore provides a more interpretive examination of how the reviewed literature negotiates this tension and the implications of emerging multi-hazard perspectives for balancing these competing logics of preparedness.

5. Discussion

In this section we address our two research questions by synthesising and examining the factors that influence household preparedness and assessing the extent to which the literature on household preparedness engages with the multi-hazard concept.

5.1 Household Preparedness Plans

Research question 1 asked ‘*What are the characteristics of the development of a ‘good’ household preparedness plan and what factors support the uptake and use of these?*’. To answer this question, we evaluated the literature against Sutton and Tierney’s (2006) established set of principles of household preparedness. Using this framework allowed us to identify shifts in household preparedness research over time and to conceptualise the diverse dimensions that underpin effective preparedness planning.

Finding 1: Broader definitions of a household are required

Our analysis suggests household preparedness checklists typically focus on the preservation of inanimate objects and property, usually neglecting other important factors such as household surroundings, community, and animals. One implication of this is that this narrow consideration of what counts as a family (and household) overlooks the common reality that a pet is a family member in many households, or that livestock are a critical resource for survival, and as such are



invaluable to the household. Many farmers' livelihoods are destroyed when livestock are killed by hazards, yet this crucial component is often absent from government household preparedness guidance. Moreover, for many indigenous communities there is no delineation between household and community owned items, as it is the community who are responsible for assets such as livestock. The delineated categories of house, community and associated assets expose the normative assumptions of what comprises a family, and its associated assets and priorities.

Finding 2: Checklist approaches downplay the preparedness priorities of women

Our evidence suggests that women tend to prioritise intrapersonal, household, and community caregiving responsibilities in household preparedness, and favour a shared responsibility approach for its implementation. In contrast, men often prefer individual responsibility for household preparedness activities, with a focus on structural and material aspects. Thus, if current evidence is generated through a patriarchal understanding of household preparedness in surveys derived from checklists, women-headed households may be inaccurately reported as ill-prepared. As a result, policymakers may unknowingly rely on data that does not accurately reflect the realities of household preparedness, particularly for women-led households.

Finding 3: Preparedness plans need to consider the wider context of barriers to adoption

Our analysis suggests that the contents and design of a preparedness plan are of secondary importance to the processes of creating and, crucially, updating and maintaining the plan (Kirschenbaum, 2002). These broader, process-oriented considerations are reflected in the additional principles of disaster preparedness outlined by Sutton and Tierney (2006).

We found that Principle 8 (*overcoming constraints, limitations and opposition*) was one of the least supported of Sutton and Tierney's (2006) Principles, only considered in 38% of papers reviewed. This reflects a preparedness literature that is generally technocratic and unilateral, and rarely engages with how institutions, policy and socio-cultural norms and politics shape household preparedness literacies. Similarly, Principle 7 (*comprehensive, inclusive, multiorganisational participation*), appeared to have broad support as it was implied by 74% of papers, but it was rarely reflected in the empirical methods or practices described in those studies. Whilst inclusive collaboration is widely endorsed in theory, it is not being translated into practice.

Teo *et al.* (2019) combined a Likert scale-based survey of risk perceptions with demographic data in Australia, recognising that government distrust among non-English speaking refugees affected preparedness (Hansen *et al.* (2013); (Marlowe and Bogen, 2015). However, Teo *et al.* (2019) recommendations reduced this issue to language barriers, suggesting unilateral multilingual messaging strategies and community network engagement for education, without reference to the structural inequities which diminish governmental trust. Similarly to Jamshidi *et al.* (2016), Teo *et al.* (2019) do not consider the potential of qualitative approaches to capture the contextual nuances which shape these perceptions of institutions and experiences which create or hamper trust. Ultimately, without a person-centred approach, analysis may attribute inadequate



disaster preparedness to cultural or ethnic difference. These interpretations dismiss how preparedness behaviours are shaped by structural conditions produced through histories of colonialism and are reinforced today through systemic inequities which create disparities in resources and trust in authorities. Societal trust in institutions is fundamental to achieving effective hazard preparedness, as demonstrated in the context of biohazards such as COVID-19 (Wang *et al.*, 2023).

More nuanced engagement with themes of inclusivity (Principle 7) and wider constraints (Principle 8) are somewhat limited by the dominant methodological approaches identified in this review. These principles are socially and culturally relational, politically shaped, and cannot be solely reduced to demographic characteristics (age, ethnicity, gender, etc), household assets and self-reported perceptions of risk and preparedness. When preparedness scores are low according to these metrics, unilateral education campaigns and improved multi-institutional coordination are often recommended as solutions without examining the histories and socio-cultural and political contexts which result in inequities which prevent household preparedness.

Creating contextually situated household preparedness mechanisms can support the disaster risk management community-of-practice in achieving the targets set out in the Sendai Framework, which emphasises inclusive, context-specific approaches that build trust and empower all sectors of society, particularly those made most vulnerable, to actively participate in risk reduction efforts. Qualitative research has an important role to play in such efforts.

Finding 4: Qualitative Evidence Is Foundational, Not Supplemental, to Effective Preparedness

Because few studies use qualitative methodologies, we know little about disaster preparedness literacies; *how* preparedness strategies are developed and *why* certain actions and approaches are chosen. We argue that qualitative evidence is not simply supplemental but foundational for preparedness planning, as it reveals the lived experiences, power dynamics, and relational factors that shape how preparedness is understood and enacted.

We conducted a qualitative evidence synthesis as part of this study, evaluating the qualitative research methodologies deployed in research to date, informed by the CASP Qualitative Studies Checklist (Critical Appraisal Skills Programme, 2023). We did this systematically to evaluate the rigour, credibility, and relevance of qualitative research, investigating why and how particular conditions enable preparedness in context-rich, experience-focused studies. When evaluating these qualitative studies using the CASP framework, at times, the methodological detail and rigour was confused or limited. Some examples include (i) conflating distinct qualitative methods, such as interviews and focus groups; (ii) failing to clearly describe the methods of analysis used; and (iii) offering insufficient transparency about how a claimed participatory approach was implemented in the study design. On the other hand, we also identified innovative and rigorous qualitative methodologies. For example Heidenstrom and Hansen (2020) and Heidenstrom (2020) three-pronged methodology which included (i) unstructured performative interviews, (ii) go-along methods, and (iii) photography with material elicitation, provides a framework of how to design and implement innovative methodologies to explore the everyday practices which



support household preparedness. Heidenstrom and Hansen (2020) refer to this as ‘embodied preparedness competencies’,
390 defined as the practical knowledge of how to act during a blackout (p. 1), differentiating this from the formal planning
process i.e. ‘family emergency plan and kit, and stock supplies’.

Our review identified community-based participatory interventions which aim to involve households, such as Jamshidi *et al.*
(2016); Heidenstrom (2020). Another resource which provided rich insights was by Jensen (2014) whose ‘Holistic Individual
Preparedness Model’ comprises of six contextually responsive theoretical dimensions of preparedness, namely, knowledge,
395 subsistence, loss minimisation, mental and physical adaptive capacity, social integration, and information source integration.
This empirically grounded, culturally responsive model can support contextually situated household preparedness planning
across both time and space (Nojang and Jensen, 2020). However, we found that researchers typically overlooked qualitative
methods which could have captured contextual nuances such as whether communities felt involved or heard in institutional
decision-making and subsequent guidance, and whether an intervention fostered trust in its outcomes. Without qualitative
400 insight into how household understand and negotiate risk, preparedness efforts risk remaining superficial or misaligned;
qualitative evidence, therefore, is needed to inform contextually responsive practice which communities have ownership of
to enable the sustainability of preparedness practice (Yadav *et al.*, 2022; Donovan, Morin and Walshe, 2023).

Overall reflections on RQ1: Whose Preparedness Counts?

Knowledge is shaped by the social, political, cultural and historical context in which it is produced and as such, research
405 findings are interpreted through the researchers’ ontological positioning, rather than being a ‘universal truth’ (Agrawal,
1995; Jasanoff, 2004). As researchers, we align with this paradigm, and find that the practice of recognising and integrating
socio-culturally situated ways of knowing is not yet integrated into preparedness literature (Heidenstrom and Hansen, 2020;
Nojang and Jensen, 2020), as most preparedness research has been conducted in so-called “Global North” contexts,
particularly the USA. Consequently, dominant theories of household preparedness are shaped by the social and material
410 conditions of high-income settings, making them less meaningful for households operating under different resource and
institutional constraints. In turn, policy and practice based on this theory is likely to be more applicable to the Global North,
and can become misaligned, or even harmful, in low-resource settings, where preparedness literacies may take different,
culturally and materially grounded forms.

Heagele *et al.* (2022) seek to address these issues in their study which used expert elicitation to inform a universal definition
415 of Household Emergency Preparedness for measuring preparedness in the Global North and South. However, the authors
found that most expert participants were sceptical of a ‘global all-hazards instrument’, arguing that the instrument would
have to be responsive “to specific communities, according to the disaster scenarios expected and capability of responders”
(p. 573), with participants suggesting that, for example, ownership of a snow-shovel is not a useful indicator of preparedness
for tropical climates.



420 Taken together, our analysis evidences that universal indicators of preparedness are not only limited by difference in
 resource availability but also social, political, and cultural contexts. Several papers identify that levels of trust and people's
 expectations regarding what the state will or will not provide have significant effects on the preparedness actions people can
 avail of (Sullivan-Wiley and Gianotti, 2017). For example, Joffe *et al.* (2019) compare earthquake and fire preparedness in
 the USA and Turkey showing that cultural and social norms have varying, effects on preparedness. They caution against
 425 simple assumptions about linear causal relations such as a strong sense of community always increasing preparedness.
 Building on Paton *et al.* (2010), Joffe *et al.* (2019) argue that preparedness concepts rooted in individualist worldviews from
 the USA may not translate to more communalist contexts that are arguably more widespread. Other studies highlight
 context-specific dynamics. Gaisie, Han and Kim (2021) find that a *lower* level of trust in authorities might lead to higher
 levels of preparedness because people perceive they ultimately need to “fend for themselves”. Whereas Brata *et al.* (2024)
 430 illustrate that preparedness emerges most effectively through the co-creation of trust and clearly negotiated responsibilities
 between residents and governing institutions. Taken together, these studies illustrate that the socio-cultural and political
 context shaping preparedness literacies and accessibility is, in turn, central to how preparedness is defined and practiced.
 However, this is frequently neglected in research that treats preparedness as a uniform, measurable outcome rather than a
 practice shaped by context.

435 Our results detail how much of the evidence to date sought to quantify preparedness in terms of people's access to material
 items, understanding of risk information, and their own self-reported perceptions of risk. This highlights an urgent need for
 researchers to generate qualitative, context-attentive research that can reshape how preparedness is understood and
 supported.

5.2 Multi-Hazards and Household Preparedness

440 Research question 2 investigated to what extent the ‘multi-hazard’ concept is embedded into household preparedness
 literature. We will review the existing data's alignment with Sutton and Tierney's Principle 11 of Disaster Preparedness,
 which advises that an ‘all-hazards’ approach be adopted, while recognising that hazard specificity is also important.

There is a wealth of discussions of how best to secure a balance between hazard specific and all-hazards planning. Several
 lines of evidence suggest the need to consider hazard specificity in preparedness planning (Chai *et al.*, 2021; Becker *et al.*,
 445 2013; Collins *et al.*, 2021; Sullivan-Wiley and Gianotti, 2017; Han *et al.*, 2017a; Than *et al.*, 2023; Rego *et al.*, 2018;
 McNeill and Ronan, 2017). For instance, in a study of ‘fast onset disasters’ – focusing on flash flood and landslides disaster
 response simulations, Kusumastuti *et al.* (2022) identified a notable gap: communities were well-prepared for these hazards
 but far less so for earthquakes. As a result, the authors advise that disaster preparedness activities should focus on multiple
 hazards to minimise community loss. Similarly, Heinkel *et al.* (2022) addresses preparedness in relation to flooding,
 450 cyclones and earthquakes in Yangon, Myanmar and finds differing levels of preparedness and understanding for each hazard.



In a mixed-methods, comparative study, Mabuku *et al.* (2018) examined flood preparedness in Zambia and Namibia, noting that existing research and practice in the region has tended to focus instead on droughts and fires, resulting in variability in knowledge and support across hazard household preparedness. Despite clear evidence of uneven household preparedness across hazards, many studies offer little clarification of how their hazard-specific findings relate to broader “all-hazards”
455 planning, leaving the concept underspecified and inconsistently applied.

As such, research to date does not necessarily argue against Sutton and Tierney’s Principle 11 but perhaps suggests that the emphasis should be placed on the latter half of the principle, i.e., hazard specificity, rather than on understanding and focussing on actions that might enhance preparedness to all-hazards. This supports long-running preparedness scholarship about the required level of hazard specificity in preparedness planning across scales (Bodas, Kirsch and Peleg, 2020). The
460 strength of such an approach relates to cost-effectiveness and its broad application, with the weakness relating to the contextual relevance of preparedness plans across a variety of risk profiles and regions. Nevertheless, scholars assert that the all-hazards approach is built on a substantive body of evidence that there are actions which can be taken that increase preparedness to ‘all-hazards’ (Penta *et al.*, 2021).

On the other hand, hazard-specific planning that is responsive to place-based hazards and risks is agued as being more
465 effective, but requires more resources and capacity, and perhaps the decentralisation and devolution of power and resources. One possible implication of this is that studies which are designed to inform low-resource preparedness *interventions* are more likely to take an ‘all-hazards’ approach, whilst conceptual and high-resource *studies* might be more inclined towards a more hazard-specific approach. This corroborates Quarantelli (1994) long-standing observations relating to disciplinary and professional divides in the study of disasters and emergencies (Donovan, 2017).

There was a considerable omission of multi-hazard *interrelationships* in the evidence analysed for this paper (see Fig. 6.), in
470 the context of preparedness planning, particularly at the household level. Figure 6 details how the literature conceptualises single versus multi-hazard. Collins *et al.* (2021) provide one exception to this with their investigation into how the effects of the COVID-19 pandemic influenced people’s preparedness planning for hurricanes in Florida. They found vaccines availability influenced people’s willingness to use evacuation shelters, and as they were an outlier in their engagement with
475 multi-hazard-preparedness relationships. Nonetheless, Collins *et al.* (2021) offer no further reflections on what multi-hazard interrelationships and compound events mean for household preparedness planning and policy.

A second illustration of multi-hazard research and preparedness is by Sullivan-Wiley and Gianotti (2017). The authors conducted this research in recognition that studies which explore multiple, co-occurring hazards and associated risks are rare, and have focussed primarily in high-resource settings, citing Perry and Lindell (2008) and (Lindell and Hwang, 2008). Their
480 research in Uganda concluded that factors that shape risk perception are specific to particular hazards, and that the protective [preparedness] actions taken by their participants are based on a relational understanding of these multiple hazards. Despite



this, Sullivan-Wiley and Gianotti (2017) discuss only briefly the consequences of hazard *interrelationships* and hazard co-occurrence for their participants. In a systematic review of this topic, Brown, Largey and McMullan (2021) conclude that “people are motivated to take different levels of preparedness action depending on the hazard type” and that “it is therefore
485 important that we focus not only on hazard-specific preparedness but also examine how overall risk perception in relation to a range of hazards impacts overall household preparedness”. As such, while participants experience and make sense of hazards as cooccurring and interrelated, there is little research which captures these experiences.

Joffe et al (2016, 2019) intervention sought to understand and improve “multihazard preparedness”, considering multi-hazard interrelationships with respect to household preparedness. Their study addressed the specific multi-hazard
490 interactions between earthquakes and (urban) fires to both understand and improve how people in different urban contexts (Seattle and Istanbul) prepare for these interconnected hazards. Whilst the intervention was novel and demonstrated positive impact on preparedness levels in the participating community, the outputs dwell very little on multi-hazard interrelationships beyond earthquakes and fires, omitting important hazard interrelationships in these contexts (Thompson *et al.* (2024). Furthermore, there is no discussion in either of the papers of how they understand the ‘multi-hazard preparedness’ in their
495 study, and whether it differs from ‘all-hazard preparedness’, what it would mean to consider more than two hazards, and what specific challenges planning for “*multi-hazards*” creates for preparedness planning, as opposed to preparing for multiple, single hazards.

Sutton and Tierney’s (2006) explanation of the balance between ‘all-hazard preparedness’ and hazard specificity provides a useful anecdote to explain what the theoretical and practical implications of this lack of attention to multi-hazard
500 interrelationships in the preparedness literature. In their explanation of Principle 11, Sutton and Tierney compare the hazard events of a hurricane and a release of hazardous chemical materials. They explain how the actions required to prepare for a hurricane and the release of toxic gas from a factory are qualitatively different: hurricane preparedness planning tends to revolve around evacuation, whilst sheltering-in-place is understood as more applicable when hazardous chemical materials are released. If Sutton and Tierney’s explanation included a consideration of multi-hazard interrelationships, it would also
505 involve a narration of a hurricane damaging a factory leading to the release of hazardous materials, or a hazardous materials leak occurring shortly before or after a hurricane. Ideally, the narration of these hypothetical multi-hazard scenarios would inform some discussion of how these tensions might be navigated in preparedness planning.

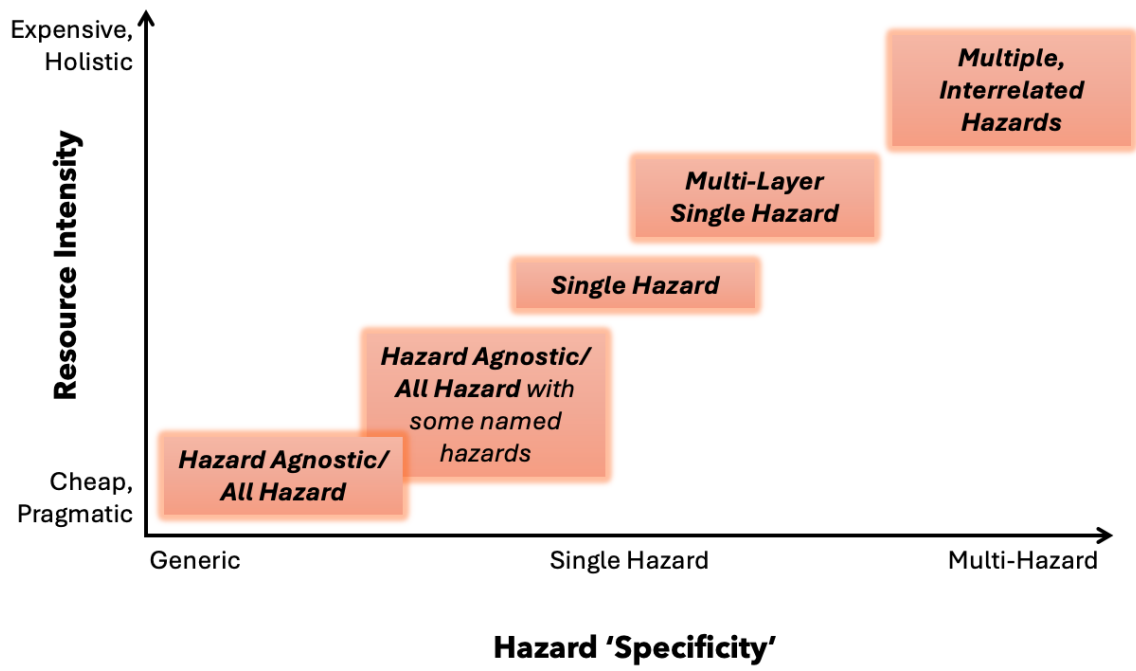


Figure 6. Conceptual diagram of how different bodies of literature address the concept of single versus multi-hazard, building upon the definitions in Table 3.

5.3 Improving Multi-Hazard Household Preparedness

In response to both Research Questions 1 & 2, our analysis suggests that it is necessary to have contextually situated household preparedness plans, enabling responsiveness to the socio-cultural and multi-hazard contexts. Qualitative methods will be crucial to achieving this.

More widely, our analysis aligns with calls for place-specific and people-centric approaches to disaster risk governance. Our research findings conclude that interdisciplinary approaches are required to understand the complex material and discursive processes that generate risks and shape responses to them (Donovan, Morin and Walshe, 2023; Johnson *et al.*, 2025; Robson, Dahal and Toll, 2025). This might involve using participatory methods to map out hazard interrelationships (Thompson *et al.*, 2024), using storylines (British Geological Survey, 2025) or using GIS and other visualisations to illuminate the social and cultural contexts of preparedness (Taylor *et al.*, 2020).

A key challenge facing such interdisciplinary approaches will be achieving nuanced and place-specific interventions at scale, or, in other words, across a foreseeably infinite number of different social, material and cultural contexts. Incorporating a



multi-hazard lens into preparedness planning can help to inform all-hazards planning whilst also highlighting scenarios where certain preparedness actions might generate negative trade-offs. In that sense, it helps to find a way through the false binary of hazard-specific or all-hazards planning by feeding into a preparedness-planning process where synergies and trade-offs are explored and acted on. Incorporating a critical analysis of multi-hazard interrelationships in preparedness planning might generate deeper understandings of potential disaster impacts and thus more effective and efficient preparedness strategies. In turn, these strategic shifts might provoke policy and practice change in other domains of disaster risk management and development planning.

Scaling socio-culturally situated and place-specific approaches to policy and practice remains a persistent challenge, particularly when accounting for the micro-scale geographies of risk (McGowran *et al.*, 2024; Blackburn, 2014). Critical literature on these challenges exist, often framed through concepts of social contracts, inequalities and disasters, offering insights into how best to balance scale, power and responsibility in multi-hazard preparedness planning and disaster risk management (Pelling *et al.*, 2022; Siddiqi and Canuday, 2018; McGowran *et al.*, 2024). This task is urgent amid increasing sociological and ecological vulnerabilities. A person-centred, multi-hazard approach which integrates a plurality of human and environment literacies provides a pathway towards localised and culturally situated ways of knowing and doing, and by extension, away from prevailing practices which sustain inequity and environmental degradation (Perry, 2021).

5.4 Limitations

Our analysis only reviewed academic publications, and as such, it does not consider evidence generated in non-academic studies which inform disaster management and preparedness programming. This may represent a significant gap given the wide array of grey literature on this topic that has been built around humanitarian operations and programming on disaster preparedness (e.g., the work of the International Federation of the Red Cross and Red Crescent). Future research might look to analyse the extent to which this grey literature and the programming it informs incorporates multi-hazard thinking. Our study is also limited by the fact that it was restricted to English language academic articles and may therefore overlook evidence from other literatures on multi-hazard household preparedness. This limitation is difficult to overcome given our position in the anglophone academy but does reinforce arguments made throughout about the need to create greater space for reflections on the roles played by language, culture, politics and power in household preparedness planning.

While efforts were made to achieve data saturation, it is possible that additional academic papers offering alternative perspectives were not captured in this review. As an interdisciplinary team working across earth sciences, human geography, sociology, and education, our approach inevitably reflected particular disciplinary orientations and interpretive frames. Moreover, by focusing on literature published after 2006, some earlier foundational studies and theoretical contributions may have been excluded. These limitations highlight the evolving and partial nature of knowledge production within the field.



6. Conclusion

The main goal of this research was to gain a better understanding of research and practice on household preparedness planning and the integration of the multi-hazard concept, in line with the Sendai Framework. Our analysis found that research to date has primarily been quantitative, with only 10% of studies deploying qualitative methodologies. We found that, generally, household preparedness is assessed according to whether people have completed a hazard-agnostic disaster supplies checklist, rather than examining the social and cultural literacies which shape preparedness measures, and the economics and politics which enable them. Research has typically been conducted in high-and upper-middle-income countries, with conclusions informed by higher socio-economic households. Finally, research has typically focused on single hazards, such as earthquakes, floods, storms, tornadoes, and wildfires, with a lack of literature on what the consequences are for compound, cascading, and co-occurring hazards on low-income household preparedness.

Combining these themes, some key conclusions emerge:

- There is some consensus that it is best to consider ‘all-hazards-in-a-place’ when thinking through individual and household preparedness planning.
- Building on this ‘all-hazards’ approach, it is also important to consider preparedness actions that are specific to certain (multi-)hazard scenarios, accounting for trade-offs and synergies between actions.
- There is an absence of evidence on what compound, cascading, and co-occurring hazards mean for household preparedness planning.
- Understanding the implications of multi-hazard disaster risks *and* what preparedness means across different socio-cultural geographies will require qualitative, place-based research methodologies attentive to histories, power relations, and lived experience. Such approaches can generate situated insights that, through engagement with social theory, can move beyond technical generalisation toward relational forms of knowledge that speak across contexts while remaining grounded in place.

These results suggest that the vast proportion of research underpinning decision-making for household preparedness policy and practice interventions do not capture the contextual nuances and in-depth experiences of people’s engagement with (and literacies of) their local area and the hazards therein. An implication of this is the possibility that conclusions may mistakenly place blame on culture for inadequate disaster preparedness, which in turn can perpetuate marginalisation and an absence of trust in authorities. Our analysis highlights the importance of documenting low-income household experiences of what works for multi-hazard household preparedness and thus broadening the evidence base of the preparedness literature, making it more readily applicable to the majority world. Our paper adds to the rapidly expanding literature on ‘multi-hazards’, by connecting it more explicitly to social-science literature on household preparedness. This study lays the groundwork for future research into preparedness in multi-hazards in low-income settings and will be of interest to scholars, practitioners and policymakers working to implement the Sendai Framework across scales.



585 Author Contribution

Funding acquisition: JG, FT; Conceptualisation: All authors; Data curation: MG, PMcG; Formal analysis and investigation: MG, PMcG; Visualisation: MG, PMcG, FT; Writing – original draft preparation: MG, PMcG; Writing – review and editing: All authors.

Competing Interests

590 The authors declare that they have no conflict of interest.

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References

- 595 Agrawal, A. (1995) 'Dismantling the divide between indigenous and scientific knowledge', *Development and change*, 26(3), pp. 413-439.
- Alexander, D. (1997) 'The study of natural disasters, 1977–97: Some reflections on a changing field of knowledge', *Disasters*, 21(4), pp. 284-304.
- 600 Becker, J. S., Paton, D., Johnston, D. M. and Ronan, K. R. (2013) 'Salient Beliefs About Earthquake Hazards and Household Preparedness', *Risk Analysis*, 33(9).
- Belle, J., Sithabile, M. and Ogundeji, A. A. (2017) 'Assessing communal farmers' preparedness to drought in the Umguza District, Zimbabwe', *International Journal of Disaster Risk Reduction*, 22, pp. 194-203.
- Blackburn, S. (2014) 'The politics of scale and disaster risk governance: Barriers to decentralisation in Portland, Jamaica', *Geoforum*, 52, pp. 101-112.
- 605 Bodas, M., Kirsch, T. D. and Peleg, K. (2020) 'Top hazards approach – Rethinking the appropriateness of the All-Hazards approach in disaster risk management', *International Journal of Disaster Risk Reduction*, 47.
- Booth, A. (2016) 'Searching for qualitative research for inclusion in systematic reviews: a structured methodological review', *Systematic reviews*, 5(1), pp. 74.
- Brata, A. G., Patnasari, Y., Resosudarmo, B. P. and Halimatussadiah, A. (2024) 'Trust in government and flood preparedness among households in developing countries' megacities: the case of Jakarta, Indonesia', *Environment Development and Sustainability*, pp. 24.
- 610 British Geological Survey (2025) *Online repository of storylines on multi- risk decision- making*. Available at: <https://zenodo.org/records/16366883>.
- Brown, G. D., Largey, A. and McMullan, C. (2021) 'The influence of expertise on perceived and actual household disaster preparedness', *Progress in Disaster Science*, 9, pp. 100150.
- 615 Castañeda, J. V., Bronfman, N. C., Cisternas, P. C. and Repetto, P. B. (2020) 'Understanding the culture of natural disaster preparedness: exploring the effect of experience and sociodemographic predictors', *Natural Hazards*, 103(2), pp. 1881-1904.
- Chai, L., Han, Y., Han, Z., Wei, J. and Zhao, Y. (2021) 'Differences in disaster preparedness between urban and rural communities in China', *International Journal of Disaster Risk Reduction*, 53, pp. 102020.
- 620 Chaney, P. L., Weaver, G. S., Youngblood, S. A. and Pitts, K. (2013) 'Household Preparedness for Tornado Hazards: The 2011 Disaster in DeKalb County, Alabama', *Weather Climate and Society*, 5(4), pp. 345-358.



- Clay, L. A., Goetschius, J. B., Papas, M. A., Trainor, J., Martins, N. and Kendra, J. M. (2020) 'Does Preparedness Matter? The Influence of Household Preparedness on Disaster Outcomes During Superstorm Sandy', *Disaster Medicine and Public Health Preparedness*, 14(1), pp. 71-79.
- 625 Collier, S. J. and Lakoff, A. (2008) 'Distributed Preparedness: The Spatial Logic of Domestic Security in the United States', *Environment and Planning D: Society and Space*, 26(1).
- Collins, J., Polen, A., McSweeney, K., Colón-Burgos, D. and Jernigan, I. (2021) 'Hurricane risk perceptions and evacuation decision-making in the age of COVID-19', *Bulletin of the American Meteorological Society*, 102(4), pp. E836-E848.
- Coppola, D. P. (2006) *Introduction to international disaster management*. Elsevier.
- 630 Critical Appraisal Skills Programme (2023): *CASP Qualitative Studies Checklist*. Available at: <https://casp-uk.net/casp-tools-checklists/qualitative-studies-checklist/> (Accessed: 29/07/2025).
- Dixon-Woods, M., Bonas, S., Booth, A., Jones, D. R., Miller, T., Sutton, A. J., Shaw, R. L., Smith, J. A. and Young, B. (2006) 'How can systematic reviews incorporate qualitative research? A critical perspective', *Qualitative research*, 6(1), pp. 27-44.
- 635 Donovan, A. (2017) 'Geopower: Reflections on the critical geography of disasters', *Progress in Human Geography*, 41(1), pp. 44-67.
- Donovan, A., Morin, J. and Walshe, R. (2023) 'Interdisciplinary research in hazards and disaster risk', *Progress in Environmental Geography*, 2(3), pp. 202-222.
- Edmonds, A. S. and Cutter, S. L. (2008) 'Planning for pet evacuations during disasters', *Journal of Homeland Security and*
- 640 *Emergency Management*, 5(1), pp. 20.
- Eiser, J. R., Bostrom, A., Burton, I., Johnston, D. M., McClure, J., Paton, D., Pligt, J. v. d. and White, M. P. (2012) 'Risk interpretation and action: A conceptual framework for responses to natural hazards', *International Journal of Disaster Risk Reduction*, 1.
- Ekenga, C. C. and Lan, Z. Y. (2019) 'Gender and Public Health Emergency Preparedness Among United States Adults',
- 645 *Journal of Community Health*, 44(4), pp. 656-660.
- Federico, J. L. and Banks, R. E. (2020) 'PET PODs: A Tool to Assist with Good Welfare Provisions during Emergent Conditions', *Journal of Applied Animal Welfare Science*, 23(3), pp. 253-264.
- Gaisie, E., Han, S. S. and Kim, H. M. (2021) 'Complexity of resilience capacities: Household capitals and resilience outcomes on the disaster cycle in informal settlements', *International Journal of Disaster Risk Reduction*, 60, pp. 12.
- 650 Gargano, L. M., Caramanica, K., Sisco, S., Brackbill, R. M. and Stellman, S. D. (2015) 'Exposure to the World Trade Center Disaster and 9/11-Related Post-Traumatic Stress Disorder and Household Disaster Preparedness', *Disaster Medicine and Public Health Preparedness*, 9(6), pp. 625-633.
- Gill, J. C. and Malamud, B. D. (2014) 'Reviewing and visualizing the interactions of natural hazards', *Reviews of Geophysics*, 52(4), pp. 680-722.
- 655 Gill, J. C. D., M., de Ruiter, M., Tiggeloven, T., Ward, P. J., Smale, L., & Ciurean, R. (2025) *Concept note: The multi-hazard context and its relevance to the UN Office for Disaster Risk Reduction / International Science Council's Hazard Information Profiles (HIPs)*. Available at: <https://zenodo.org/records/15574444>.
- Grant, M. J. and Booth, A. (2009) 'A typology of reviews: an analysis of 14 review types and associated methodologies', *Health information & libraries journal*, 26(2), pp. 91-108.
- 660 Halim, N., Jiang, F., Khan, M., Meng, S. S. and Mozumder, P. (2021) 'Household Evacuation Planning and Preparation for Future Hurricanes: Role of Utility Service Disruptions', *Transportation Research Record*, 2675(10), pp. 1000-1011.
- Han, Z., Lu, X., Hörhager, E. I. and Yan, J. (2017a) 'The effects of trust in government on earthquake survivors' risk perception and preparedness in China', *Natural Hazards*, 86, pp. 437-452.
- Han, Z., Wang, H., Du, Q. and Zeng, Y. (2017b) 'Natural hazards preparedness in Taiwan: A comparison between
- 665 households with and without disabled members', *Health security*, 15(6), pp. 575-581.
- Hansen, A., Bi, P., Saniotis, A., Nitschke, M., Benson, J., Tan, Y., Smyth, V., Wilson, L. and Han, G.-S. (2013) *Extreme heat and climate change: adaptation in culturally and linguistically diverse (CALD) communities*. National Climate Change Adaptation Research Facility Gold Coast.
- Heagele, T. N., McNeill, C. C., Adams, L. M. and Alfred, D. M. (2022) 'Household Emergency Preparedness Instrument Development: A Delphi Study', *Disaster Medicine and Public Health Preparedness*, 16(2), pp. 570-582.
- 670



- Heidenstrom, N. (2020) 'Informal household preparedness: methodological approaches to everyday practices', *Journal of Risk Research*, 23(3), pp. 379-397.
- Heidenstrom, N. and Hansen, A. R. (2020) 'Embodied competences in preparedness for blackouts: Mixed methods insights from rural and urban Norwegian households', *Energy Research & Social Science*, 66, pp. 11.
- 675 Heinkel, S.-B., Thiebes, B., Than, Z. M., Aung, T., Kyi, T. T., Mar, W. L., Oo, S. S., Miller, C., Willkomm, M. and Maung, W. (2022) 'Disaster preparedness and resilience at household level in Yangon, Myanmar', *Natural hazards*, 112(2), pp. 1273-1294.
- Hémond, Y. and Robert, B. (2012) 'Preparedness: the state of the art and future prospects', *Disaster Prevention and Management: An International Journal*, 21(4), pp. 404-417.
- 680 Hung, L.-S. (2018) 'Gender, intra-household dynamics, and household hurricane preparedness: an exploratory study employing a dyadic interview approach', *International Journal of Disaster Risk Science*, 9, pp. 16-27.
- Hung, L. S. (2019) 'Comparing spousal agreement on perceived responsibility for household natural hazard preparedness to actual behavior', *Plos One*, 14(8), pp. 19.
- Huntsman, D., Wu, H.-C. and Greer, A. (2021) 'What matters? Exploring drivers of basic and complex adjustments to tornadoes among college students', *Weather, Climate, and Society*, 13(3), pp. 665-676.
- 685 Jamshidi, E., Majdzadeh, R., Namin, M. S., Ardalan, A., Majdzadeh, B. and Seydali, E. (2016) 'Effectiveness of Community Participation in Earthquake Preparedness: A Community-Based Participatory Intervention Study of Tehran', *Disaster Medicine and Public Health Preparedness*, 10(2), pp. 211-218.
- Jasanoff, S. (2004) 'Ordering knowledge, ordering society', *States of knowledge*: Routledge, pp. 13-45.
- 690 Jensen, J. 2014. Emergency Management (EMGT) 761: Preparedness theory and practice: Individual and household preparedness notes.
- Joffe, H., Potts, H. W., Rossetto, T., Doğulu, C., Gul, E. and Perez-Fuentes, G. (2019) 'The Fix-it face-to-face intervention increases multihazard household preparedness cross-culturally', *Nature human behaviour*, 3(5), pp. 453-461.
- Johnson, A. L., Oven, K., Rosser, N., Basnet, D., Bhotia, N. D., Dong, T. B., Puri, A., Tamang, S., Kincey, M. and Kincey, M. (2025) 'Integrating ethnographic and physical science methods in interdisciplinary research projects: Reflections on pedagogy and practice for 'deep interdisciplinary' engagement within the Sajag-Nepal Project', *Critical Physical Geography: Interdisciplinary Approaches to Nature, Power and Politics*.
- 695 Kappes, M., Keiler, M. and Glade, T. 'From single-to multi-hazard risk analyses: a concept addressing emerging challenges'. *Proceedings of the International Conference Mountain Risks: Bringing Science to Society*, Firenze, 24-26 November 2010: Unknown publisher, 351-356.
- 700 Kappes, M. S., Keiler, M., von Elverfeldt, K. and Glade, T. (2012) 'Challenges of analyzing multi-hazard risk: a review', *Natural hazards*, 64(2), pp. 1925-1958.
- Kelman, I. (2020a) *Disaster by Choice: How our actions turn natural hazards into catastrophes*. Oxford, United Kingdom: Oxford University Press.
- 705 Kelman, I. (2020b) 'Islands of vulnerability and resilience: Manufactured stereotypes?', *Area*, 52(1), pp. 6-13.
- Kirschenbaum, A. (2002) 'Disaster preparedness: A conceptual and empirical reevaluation', *International Journal of Mass Emergencies & Disasters*, 20(1), pp. 5-28.
- Kurkjian, K. M., Winz, M., Yang, J., Corvese, K., Colón, A., Levine, S. J., Mullen, J., Ruth, D., Anson-Dwamena, R., Bayleyegn, T. and Chang, D. S. (2016) 'Assessing Emergency Preparedness and Response Capacity Using Community Assessment for Public Health Emergency Response Methodology: Portsmouth, Virginia, 2013', *Disaster Medicine and Public Health Preparedness*, 10(2), pp. 193-198.
- 710 Kusumastuti, R. D., Nurmala, N., Arviansyah, A. and Wibowo, S. S. (2022) 'Indicators of community preparedness for fast-onset disasters: a systematic literature review and case study', *Natural Hazards*, 110(1), pp. 787-821.
- Lindell, M. K. and Hwang, S. N. (2008) 'Households' perceived personal risk and responses in a multihazard environment', *Risk Analysis: An International Journal*, 28(2), pp. 539-556.
- 715 Lindell, M. K. and Perry, R. W. (1992) *Behavioral foundations of community emergency planning*. Hemisphere Publishing Corp.
- Mabuku, M., Senzanje, A., Mudhara, M., Jewitt, G. and Mulwafu, W. (2018) 'Rural households' flood preparedness and social determinants in Mwandi district of Zambia and Eastern Zambezi Region of Namibia', *INTERNATIONAL JOURNAL OF DISASTER RISK REDUCTION*, 28, pp. 284-297.
- 720



- Marlowe, J. and Bogen, R. (2015) 'Young people from refugee backgrounds as a resource for disaster risk reduction', *International journal of disaster risk reduction*, 14, pp. 125-131.
- Martins, V. N., Louis-Charles, H. M., Nigg, J., Kendra, J. and Sisco, S. (2018) 'Household disaster preparedness in New York City before Superstorm Sandy: findings and recommendations', *Journal of homeland security and emergency management*, 15(4), pp. 20170002.
- 725 Martins, V. N., Nigg, J., Louis-Charles, H. M. and Kendra, J. M. (2019) 'Household preparedness in an imminent disaster threat scenario: The case of superstorm sandy in New York City', *International Journal of Disaster Risk Reduction*, 34, pp. 316-325.
- McGowran, P., Mathews, M. A., Johns, H., Harasym, M. C., Raju, E. and Ayeb-Karlsson, S. (2024) 'Investigating the conditions of vulnerability experienced by migrant workers during the COVID-19 pandemic in Kerala, India', *Disasters*, 48(2), pp. e12614.
- 730 McNeill, I. M. and Ronan, K. R. (2017) 'Children in disasters: the role of household preparedness', *Natural Hazards*, 89(3), pp. 1239-1254.
- Najafi, M., Khankeh, H., Soltani, A. and Atighechian, G. (2020) 'Reliability and Validity of Household Disaster Preparedness Index (HDPI)', *Iranian Red Crescent Medical Journal*, 22(12), pp. 9.
- 735 Ng, S. L. (2022) 'Effects of Risk Perception on Disaster Preparedness Toward Typhoons: An Application of the Extended Theory of Planned Behavior', *International Journal of Disaster Risk Science*, 13(1), pp. 100-113.
- Nojang, E. N. and Jensen, J. (2020) 'Conceptualizing Individual and Household Disaster Preparedness: The Perspective from Cameroon', *International Journal of Disaster Risk Science*, 11(3), pp. 333-346.
- 740 Nurse-Clarke, N. and Heagele, T. (2023) 'Key Factors Related to Household Emergency Preparedness Among Parents of Newborn Infants', *Advances in Neonatal Care*, 23(3), pp. 229-236.
- Osman, M. and Altıntaş, K. H. (2023) 'Domains and psychometric properties of scales measuring disaster preparedness among general population: a systematic literature review', *Prehospital and Disaster Medicine*, pp. 1-9.
- Paton, D. (2003) 'Disaster preparedness: a social-cognitive perspective', *Disaster Prevention and Management: An International Journal*, 12(3).
- 745 Paton, D., Bajek, R., Okada, N., McIvor, D., Paton, D., Bajek, R., Okada, N. and McIvor, D. (2010) 'Predicting community earthquake preparedness: a cross-cultural comparison of Japan and New Zealand', *Natural Hazards* 2010 54:3, 54(3).
- Pelling, M., Adams, H., Adamson, G., Barcena, A., Blackburn, S., Borie, M., Donovan, A., Ogra, A., Taylor, F. and Yi, L. (2022) 'Building back better from COVID-19: Knowledge, emergence and social contracts', *Progress in Human Geography*, 46(1), pp. 121-138.
- 750 Penta, S., Kendra, J., Marlowe, V. and Gill, K. (2021) 'Risk, Hazards & Crisis in Public Policy | PSO Journal | Wiley Online Library', *Risk, Hazards & Crisis in Public Policy*, 12(3).
- Penta, S., Marlowe, V. G., Gill, K. and Kendra, J. (2017) 'Risk, Hazards & Crisis in Public Policy | PSO Journal | Wiley Online Library', *Risk, Hazards & Crisis in Public Policy*, 8(1).
- 755 Perry, M. (2021) 'Pluriversal literacies: Affect and relationality in vulnerable times', *Reading Research Quarterly*, 56(2), pp. 293-309.
- Quarantelli, E. L. (1994) 'Disaster studies: The consequences of the historical use of a sociological approach in the development of research', *International Journal of Mass Emergencies & Disasters*, 12(1), pp. 25-49.
- 760 Rego, I. E., Pereira, S. M., Morro, J. and Pacheco, M. P. (2018) 'Perceptions of seismic and volcanic risk and preparedness at Sao Miguel Island (Azores, Portugal)', *International Journal of Disaster Risk Reduction*, 31, pp. 498-503.
- Reininger, B. M., Rahbar, M. H., Lee, M., Chen, Z. X., Alam, S. R., Pope, J. and Adams, B. (2013) 'Social capital and disaster preparedness among low income Mexican Americans in a disaster prone area', *Social Science & Medicine*, 83, pp. 50-60.
- Robson, E. B., Dahal, B. K. and Toll, D. G. (2025) 'A participatory approach to determine the use of road cut slope design guidelines in Nepal to lessen landslides', *Natural Hazards and Earth System Sciences*, 25(3), pp. 949-973.
- 765 Shah, A. A., Gong, Z. W., Ali, M., Sun, R. L., Naqvi, S. A. A. and Arif, M. (2020) 'Looking through the Lens of schools: Children perception, knowledge, and preparedness of flood disaster risk management in Pakistan', *International Journal of Disaster Risk Reduction*, 50, pp. 13.
- Siddiqi, A. and Canuday, J. J. P. (2018) 'Stories from the frontlines: decolonising social contracts for disasters', *Disasters*, 42, pp. S215-S238.
- 770



- Sullivan-Wiley, K. A. and Gianotti, A. G. S. (2017) 'Risk perception in a multi-hazard environment', *World Development*, 97, pp. 138-152.
- Sutton, J. and Tierney, K. (2006) 'Disaster preparedness: Concepts, guidance, and research', *Colorado: University of Colorado*, 3(1), pp. 3-12.
- 775 Taylor, F. E., Millington, J. D., Jacob, E., Malamud, B. D. and Pelling, M. (2020) 'Messy maps: Qualitative GIS representations of resilience', *Landscape and Urban Planning*, 198, pp. 103771.
- Teo, M., Goonetilleke, A., Deilami, K., Ahankoob, A. and Lawie, M. (2019) 'Engaging residents from different ethnic and language backgrounds in disaster preparedness', *International Journal of Disaster Risk Reduction*, 39, pp. 101245.
- 780 Than, Z. M., Oo, H. M., Aung, T., Kyi, T. T., Oo, S. S., Mar, W. L., Willkomm, M., Miller, C., Martini, S. and Myint, Z. N. (2023) 'DISASTER RISK PERCEPTION AND PREPAREDNESS OF HOUSEHOLDS IN YANGON, MYANMAR', *Erdkunde*, (H. 4), pp. 303-322.
- Than, Z. M., Oo, H. M., Aung, T., Kyi, T. T., Oo, S. S., Mar, W. L., Willkomm, M., Miller, C., Martini, S., Myint, Z. N., Soe, K. K., Maung, W., Heinkel, S.-B., Thiebes, B., Spohner, R. and Kraas, F. (2023/12/28) 'Disaster risk perception and preparedness of households in Yangon, Myanmar: Disaster experiences, socio-demographic factors and spatial variation', *ERDKUNDE*, 77(4).
- 785 Thompson, H. E., Gill, J. C., Šakić Trogrlić, R., Taylor, F. E. and Malamud, B. D. (2024) 'A methodology to compile multi-hazard interrelationships in a data-scarce setting: an application to Kathmandu Valley, Nepal', *Natural Hazards and Earth System Sciences Discussions*, 2024, pp. 1-43.
- Thompson, K. (2018) 'Facing disasters together: how keeping animals safe benefits humans before, during and after natural disasters', *Revue Scientifique Et Technique-Office International Des Epizooties*, 37(1), pp. 223-230.
- 790 Thompson, K., Trigg, J. and Smith, B. (2017) 'Animal Ownership Among Vulnerable Populations in Regional South Australia: Implications for Natural Disaster Preparedness and Resilience', *Journal of Public Health Management and Practice*, 23(1), pp. 59-63.
- Tohan, M. M., Kabir, A., Hoque, M. Z. and Roy, T. (2024) 'Demographic predictors of disaster preparedness behaviour: Sylhet and Sunamganj, Bangladesh', *Environmental Hazards*, 23(2), pp. 167-185.
- 795 Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D., Horsley, T. and Weeks, L. (2018) 'PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation', *Annals of internal medicine*, 169(7), pp. 467-473.
- UNDRR (2015) *The Sendai Framework for Disaster Risk Reduction 2015-2030*, New York: United Nations Office for
- 800 Disaster Risk Reduction (UNISDR).
- UNDRR (2023) *The Report of the Midterm Review of the Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030*, Geneva. Available at: <https://sendaiframework-mtr.undrr.org/publication/report-midterm-review-implementation-sendai-framework-disaster-risk-reduction-2015-2030#downloads>.
- Vrselja, I., Pandzic, M. and Glavas, D. (2023) 'Predicting earthquake preparedness intention among Croatian residents: Application of the theory of planned behaviour', *International Journal of Psychology*, 58(2), pp. 124-133.
- 805 Wachinger, G., Renn, O., Begg, C. and Kuhlicke, C. (2013) 'The risk perception paradox—implications for governance and communication of natural hazards', *Risk analysis*, 33(6), pp. 1049-1065.
- Walch, C. (2018) 'Evacuation ahead of natural disasters: Evidence from cyclone Phailin in India and typhoon Haiyan in the Philippines', *Geo: Geography and Environment*, 5(1), pp. e00051.
- 810 Walch, C. (2019) 'Adaptive governance in the developing world: disaster risk reduction in the State of Odisha, India', *Climate and Development*, 11(3).
- Wang, L., Jiang, Y., Pan, L., Ji, J. and Xu, A. (2023) 'Research on household emergency supplies storage from the theory of planned behavior and intention-behavior gap in the context of COVID-19', *Frontiers in Psychology*, 13, pp. 1069843.
- Wisner, B., Blaikie, P. M., Cannon, T. and Davis, I. (2003) *At Risk II : Natural Hazards, People's Vulnerability and*
- 815 *Disasters*. Florence, UNITED STATES: Routledge.
- Yadav, P., Lassa, J., Marchezini, V. and Van Niekerk, D. (2022) 'Guest editorial: Introduction to calling for change in disaster studies—rethinking disaster studies', *Disaster Prevention and Management: An International Journal*, 31(3), pp. 177-181.
- Yilmaz, E. and Yildirim, A. (2023) 'Too little, Too late: Addressing the Roles of A School Safety Programme in Earthquake
- 820 Preparedness of Elementary Students in Turkey', *Asia Pacific Journal of Education*, 43(4), pp. 1049-1070.



Zaremohzzabieh, Z., Abu Samah, A., Roslan, S., Shaffril, H. A. M., D'Silva, J. L., Kamarudin, S. and Ahrari, S. (2021) 'Household preparedness for future earthquake disaster risk using an extended theory of planned behavior', *International Journal of Disaster Risk Reduction*, 65, pp. 8.