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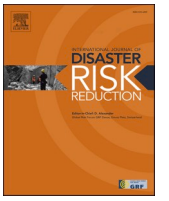

The role of individual preparedness and behavioural training in natural hazards: A scoping review

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ABSTRACT

As the frequency and intensity of natural hazards continue to rise due to climate change and other factors, it becomes imperative to address the human element in disaster risk management. Individual training and education prepare people to react better to face different phases of a disaster. Understanding and improving individual and community preparedness can lead to more effective disaster response, reduced loss of life, mitigated economic damage, increased community resilience, better resource allocation, and improved long-term recovery processes. This study conducts a scoping review on a broad spectrum of publications relevant to individual disaster preparedness and training in natural hazards. It identifies the boundaries of this area of research, encompassing all aspects and approaches to disaster preparedness and all forms of natural hazards. A total of 222 relevant studies are reviewed and categorised. Specific attention is paid to whether the reviewed studies have taken a descriptive or prescriptive approach, concluding that the current literature is dominated by the former, whereas the latter constitutes a knowledge gap. The current literature overall indicates that to measure the level of preparedness, we need valid disaster preparedness scales specifically designed for each natural hazard. In the next step, with the knowledge on areas of weakness in individual preparedness, we can plan for educational methods tailored to the targeted individual/community. Schools, local councils, and community volunteers have the potential to play an essential role in training individuals. This can include integrating disaster preparedness into schools' curricula or planning workshops for community members. Disaster preparedness is not a short-term process of transferring knowledge. Rather, it requires long-term systematic planning for promoting relevant skills and safety culture. This all requires close collaboration and engagement between the stakeholders such as individuals, communities, professional organizations, and governments.

1. Introduction

Natural hazards affect thousands of people's lives every year all over the globe. The increase in the number of devastating natural hazards due to climate change has caused billion dollars of economic loss, in addition to environmental issues, human injuries and death [1,2]. In 2020 alone, 416 natural catastrophic events occurred around the globe, which resulted in USD 268 billion of direct economic losses and damage [3]. As the potential consequences of the natural hazards are predicted to become more prevalent and sever, numerous global efforts have been undertaken in recent years to address these interconnected challenges. Particularly,

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2015–2030 Sendai Framework for Disaster Risk Reduction has emphasised the significance of individual preparedness and education in addressing these issues [4].

Disaster mitigation research has contributed to recognising critical ways of reducing the detrimental effects of these catastrophic events. However, disaster research and practice mostly concentrate on planning and policies for the government and emergency services to manage and combat natural hazard damages. Primarily, the disaster risk management approaches have centred on reactive rather than proactive behaviour [5–8]. Despite its significant role in disaster mitigation, educating and preparing individuals for disastrous events has been a relatively underexplored area [9–11].

Individual disaster preparedness can prevent severe damages, injuries, and death during and after the disaster occurrence [12–17]. Individual training and education prepare people to react better and make decisions to face different phases of a natural hazard, from responding to disaster warnings to the evacuation process. Enhancing the knowledge of each community member about natural hazard emergencies facilitates and promotes the whole community experience, ultimately boosting societal resilience.

Community disaster preparedness refers to the proactive measures and strategies implemented by individuals or family units to ensure safety and survival, reduce the impact of disasters, and enhance their ability to respond effectively to emergencies and recover more quickly. It serves as an additional layer of protection, complementing the role of rescue and emergency services by focusing on the community members' ability to minimise harm during disasters. This preparedness encompasses several dimensions, including knowledge and awareness, physical and mental preparedness, risk assessment and planning, action-readiness, and supplies and equipment and beyond. These aspects of preparedness can be acquired through formal training, community-level education, behavioural campaigns, school education, and other avenues. This form of preparedness is ultimately meant to generate community resilience, which according to the definition of United Nations' 2009 (UNISDR) report, refers to "the degree to which the community has the necessary resources and is capable of organising itself both prior to and during times of need" [18].

An emerging body of literature on disaster preparedness and education has been revealed in the area of natural hazard research during the last two decades [19,20]. This newly emerging area of research investigates different aspects of an individual's preparedness, including a wide range of methods applicable to measuring and improving community response to natural hazards.

This study aims to conduct a scoping review on a broad spectrum of papers relevant to individual disaster preparedness and training to identify this research area's boundaries. It encompasses all aspects and approaches to disaster preparedness. Our research questions are.

1. Which natural hazards have been discussed specifically within the scope of individual disaster preparedness?
2. To what extent do disaster preparedness studies employ observational research to describe individuals' behaviour, and which studies use interventional approaches to improve the response of communities to natural hazards?
3. Which themes can be identified in observational/interventional studies investigating individual disaster preparedness?

A review and classification of 222 relevant papers were conducted to investigate the research questions, and commonalities and contradictory findings were identified. A range of knowledge gaps that can advance the state of research in this area were also highlighted in light of the reviewed literature. We believe that the findings would be of interest to a broad cohort of natural hazard researchers by providing a broader overview of the role that preparedness and education can play in various contexts of disaster research and the overall picture that current research has provided about the efficacy of various educational methods to prepare people in response to natural hazards.

The rest of the paper is structured as follows; section 2 introduces the review method, sections 3 (flood), 4 (bushfire/wildfire), 5 (volcano), 6 (landslide), 7 (tsunami), 8 (cyclone and the like), 9 (earthquake), and 10 (natural hazards in general) are structured in a consistent manner. Each of these sections consist of two subsections: descriptive (observational) studies and prescriptive (interventional) studies. In these subsections, the relevant papers were reviewed within the identified themes. In section 11, a statistical summary of the studied papers is presented. Section 12 centres on the discussion, and section 13 on the conclusion. Following this, the characteristics of the 222 papers studied in this research are outlined in an appendix table.

2. Review method

To address the research questions, we first compiled a database of studies investigating individual preparedness and behavioural training in natural hazards. Subsequently, we conducted meticulous content analysis to explore the studies' scope, identifying commonalities, contradictories, and varying viewpoints in their investigations at different stages (both before and after the occurrence) of a disaster. Every element and dimension relevant to preparedness is of interest and the diversity of studies in this area would be reflected in this paper.

2.1. Identification of relevant studies

The relevant studies can be found in a diverse range of journals and other sources, containing key terms in their title, abstract, and keywords. Therefore, developing a search strategy based on terms seemed most appropriate method to capture the scope of the literature. The selection of keywords for our systematic search is grounded in a deliberate strategy to encapsulate the diverse dimensions of disaster preparedness, including physical and non-physical preparedness for individual, household, and community. To formulate an inclusive query, we began with an initial set of terminology related to disaster preparedness, including terms such as "disaster planning," "emergency preparedness," and "individual preparation." This initial set was expanded through an iterative process, incorporating relevant terminology identified in an initial search. The aim was to create a comprehensive and nuanced query covering various aspects of individual preparedness, from psychological and mental preparedness to community engagement, and

behavioural intervention and training. Terms like "behavioural change," "mental awareness," and "preparation scale,[1]" were included to capture the multidimensional nature of our research focus.

After thorough consideration, the following term combination was identified as the most suitable. This search query was input into the Advanced Search section of Web of Science (WoS) Core Collection database, with the topic specified as the search domain, encompassing title, abstract, author keywords, and keywords plus. The search parameters were set to include only journal articles published in English. The search was performed with no restrictions on the time of publication: TS[2]=(((“disaster preparedness” OR “disaster preparation” OR “emergency preparedness” OR “emergency preparation” OR “disaster planning” OR “emergency planning”) AND (“behavioural* change” OR “behaviour* change” OR “behaviour* intervention” OR “behavioural* intervention” OR “behaviour* modification” OR “behavioural* modification” OR “individual preparedness” OR “household preparedness” OR “individual preparation” OR “household preparation” OR “community preparedness” OR “community engagement” OR “mental preparedness” OR “mental awareness” OR “individual awareness” OR “psychological preparedness” OR “behavioural* training” OR “preparation scale”)) OR (“disaster training” OR “disaster education”)). A total number of 655 papers were identified through the systematic search. Following that, a more freestyle supplementary search in Google Scholar was conducted to cover relevant studies indexed by other journal databases, including the defined keywords. The search was updated in March 2022 for the last time.

These papers were screened and filtered individually by authors using inclusion and exclusion criteria to systematically narrow down the initial pool. The inclusion criteria were established to ensure relevance to our research focus on individual preparedness and behavioural training in the context of natural hazards. Papers were included if they addressed aspects such as disaster planning, emergency preparedness, individual or community engagement, and behavioural interventions. Additionally, studies focusing on psychological and mental preparedness were considered pertinent. In contrast, exclusion criteria were applied to filter out studies that did not align with our primary research objectives, excluding papers unrelated to natural hazards or those concentrating solely on health emergencies. The systematic application of these criteria enabled us to curate a subset of 222 papers, providing a comprehensive and targeted exploration of the subject matter for final analysis and review.

2.2. Content analysis

After finding relevant papers in the previous step, a content analysis of the identified studies was conducted to investigate the research questions. In this phase, each of the 222 references was summarised in a table (Appendix Table) based on characteristics, including the year of publication, descriptive/prescriptive approaches, country of case study, target group, data, method, and highlighted findings. In the process of coding and classification of the studies, each paper was meticulously assigned to specific natural hazards[3] and identified as either descriptive or prescriptive. The classification task was straightforward, with the first author initially categorizing the studies and the second author providing a comprehensive review. To address any ambiguities or uncertainties, collaborative discussions involving all authors were conducted, ensuring a consensus-based approach.

Descriptive studies aimed to observe and describe the individuals’ disaster preparedness behaviour and the influencing factors. In contrast, prescriptive studies applied active methods and interventions to assess their effectiveness on disaster education and training. Although both types of studies are crucial in advancing knowledge and improving practices in individual disaster preparedness, the significance of this classification lies in highlighting the distinct contributions of these approaches. Previous studies in this area had not classified and analysed the research based on this approach, making it valuable to discover the contribution of descriptive and prescriptive approaches in enhancing individual disaster preparedness.

The distribution of studies across various natural hazards is as follows: bushfire (10), cyclone and similar events (30), earthquake (49), flood (22), generic disaster (114), landslide (5), tsunami (17), and volcano (4). Each study exploring more than one natural hazard was carefully allocated to the relevant categories. Additionally, studies were further classified based on their nature as descriptive or prescriptive. The breakdown is as follows: bushfire descriptive (7), bushfire prescriptive (3), cyclone and similar events descriptive (23), cyclone and similar events prescriptive (7), earthquake descriptive (30), earthquake prescriptive (19), flood descriptive (14), flood prescriptive (8), generic disaster descriptive (68), generic disaster prescriptive (46), landslide descriptive (3), landslide prescriptive (2), tsunami descriptive (4), tsunami prescriptive (13), volcano descriptive (3), and volcano prescriptive (1).

With this initial categorization, we were able to define and explore themes within each natural hazard and study type, facilitating a nuanced understanding of the landscape of individual preparedness and behavioural training across diverse disaster contexts. We elicited major themes within observational and interventional studies, and developed narratives through emergent themes to provide greater detail.

The method of this study is predominantly qualitative; however, following the qualitative analysis of content, we generated relevant graphs under the “Summary Statistics” section, considering the characteristics of each study in our database such as publication year, disaster type, descriptive/prescriptive approaches, country of case study, international collaboration/domestic authors, keywords list, and identified themes.

[1] In this paper, ‘scale’ refers to standard self-reported questionnaires commonly employed in the social sciences and adopted for research in various areas.
[2] TS = Topic (title, abstract, author keywords, and keywords plus).
[3] Some studies might have explored more than one natural hazard.

3. Flood

3.1. Descriptive studies in flood

Several studies (n = 22) have employed observational approaches to investigate individuals' flood preparedness. Three main categories have been identified in these studies: Measuring individuals' flood preparedness, social communities' role in individuals' flood preparedness, and social media impact on individuals' flood preparedness.

Measuring individuals' flood preparedness—Some studies (n = 5) have used questionnaire survey/interviews to measure flood preparedness. For example, using a questionnaire survey, Coulston and Deeny [21] measured the preparedness of individuals living in two high flood risk towns, Monmouth and Tewkesbury, in the United Kingdom. Individuals who were aware of living in a flood risk-area were found more likely to be prepared and knowledgeable. Moreover, individuals' awareness and preparedness increased for 18 months after exposure to major flooding, and beyond the initial 18 months will help mitigate the devastating health, financial, and social effects. Mishra and Suar [22] have examined the effect of anxiety on flood preparedness of 300 people living in a flood-prone area in Orissa, India; and found that "disaster education and resources are partial mediators between anxiety and flood preparedness" (p. 1). Guo et al. [23] have conducted a cross-sectional structured questionnaire survey to measure the readiness of rural residents in three flood-prone villages with different landforms (plains, loess plateau, and mountains). People living in the plains were more prepared than those inhabiting in mountains or plateau. Titko et al. [8] have explored the influence of various aspects on the preparedness and preventive proactive behaviour of a sample of citizens living in the Slovak Republic. The majority of the population was inactive and poorly prepared. However, the younger respondents were more inclined to adopt protective behaviour. Another aspect that impacts proactive behaviour is a relatively serious past negative experience.

Social communities' role in individuals' flood preparedness—Several studies (n = 7) have investigated the role of different communities and associations in enhancing public awareness and preparation for flood disasters. For example, in their interviews with public health emergency management professionals, Andrulis et al. [24] identified individual-level barriers to preparing diverse communities including socioeconomic status, trust, culture, and language, as well as institutional-level barriers such as inadequate support for culturally/linguistically appropriate initiatives. In addition, they recommended four intervention priorities for California and across the United States, including involving diverse communities in emergency planning, implementation, and evaluation; reducing stigma and fear; improving organisational cultural competence; facilitating information sharing and enhancing resource coordination. As outlined by Pascapurnama et al. [25], integrated health education in schools as well as community-based disaster risk reduction (DRR) plans, including information dissemination, are crucial for building resilient communities in Indonesia following natural hazards. Interviewers administered a flood disaster preparedness questionnaire to business owners and managers of Small and Medium Enterprise (SMEs) in a study by Hashim et al. [26]. Preparedness actions were most consistently influenced by risk perception. Flood disaster preparedness engagement was also high due to previous flood experience, the retail sector, and male ownership.

Social media impact on individuals' flood preparedness—The role of social media in enhancing flood preparedness has been studied in two studies. During the Uttarakhand disaster of June 2013, Khan et al. [27] examined the disaster mitigation information systems and proposed that better information and communication mediums be used along with some indigenous methods to deal with disasters that may arise in the future with the support of public and private partnership. Geng et al. [28] have explored how new media users perceive and comment on the storm flood in several provinces of China. The comments of users were classified into four categories: attention, cognition, response, and trust, and an index system was developed. Despite their low-risk awareness, new media users are able to understand the severity of disasters clearly. In disaster-affected areas, users have higher cognition and response levels than in non-affected areas.

3.2. Prescriptive studies in flood

The impact of education and intervention on individuals' flood preparedness has been investigated through three main categories in prescriptive studies: School-based disaster training, Community-based disaster training, and Game-based and VR[4]-based training system.

School-based flood training—Three studies have explored the impact of school-based flood training on individuals' preparedness. Muzenda-Mudavanhu et al. [29] interviewed 40 school-going children in Zimbabwe and found that preparedness does not depend on worry and awareness of being at risk, but rather on resources, political commitment, and social support. In a study of school safety and disaster education in South America and the Caribbean, Munoz et al. [30] developed a model of Comprehensive School Safety based on three pillars: 1. A safe learning environment and facilities, 2. Disaster management in schools, and 3. Education for risk reduction and resilience. Zhong et al. [31] surveyed the risk perceptions of children in 45 primary schools in China before and after the educational intervention. Children's perception of flood risk was significantly influenced by classroom education, propaganda posters, and professional guidance. Based on their findings, it is also important to consider risk-related parent-child interaction in disaster education.

Community-based flood training—The impact of community-based flood preparedness training has been examined in two studies. Karanci et al. [32] investigated the impact of a disaster awareness training program on preparedness behaviours and cognitions of community participants. It was found that disaster-related cognitions of participants are related to gender, education, anxiety, attendance at the training program, and locus of control. In another study by Asharose et al. [33], 42 members of the community were evaluated for their general awareness level. Following the workshop, participants showed a positive improvement in their level of understanding and awareness. In addition, the study results emphasise that enhancing the individual's preparedness requires more

[4] VR= Virtual Reality.

long-term educational projects and programs.

Game-based and VR-based training systems—In three studies, games and virtual reality-based training methods have been developed to assess the impact of education on flood preparedness. Clerveaux et al. [34] used the disaster awareness game (DAG) to educate children in multicultural societies and conducted pre- and post-test stage surveys to identify the changes in children's preparedness levels in the Caribbean. A study in the Philippines by Caballero and Niguidula [35] developed an immersive virtual reality tool using gamification techniques and validated it through focus groups, observations, interviews, and controlled experiments. Also, a learning package called Battle of Flooding Protection was developed and validated using a 67-student class by Tsai et al. [36] to raise willingness and interest in learning disaster-related actions and inspire students' self-awareness in Taiwan.

4. Bushfire/wildfire

4.1. Descriptive studies in bushfire

Three main types of study design are used to identify individuals' preparedness in a bushfire: measuring individuals'/households' bushfire preparedness, bushfire preparedness scale development, and community and campaign programs' impact on bushfire preparedness.

Measuring individuals'/households' bushfire preparedness—Three studies measured household and individual preparedness in a bushfire, conducting interviews/surveys to identify different aspects of Australian residents' bushfire preparedness. Ingham and Redshaw [37] investigated the vulnerable residents' preparedness, while McNeill and Ronan [38] and Thompson et al. [39] identified households with children, and horse owners' actions and preparedness during a bushfire, respectively.

Bushfire preparedness scale development—One study has contributed to bushfire preparedness knowledge by developing a psychological preparedness scale specifically for a bushfire. Boylan and Lawrence [40] proposed a 33-item self-report scale to measure bushfire psychological preparedness by evaluating an individual's knowledge and psychological coping capacity in a bushfire. The BPPS (bushfire psychological preparedness scale) was developed by surveying a sample of 661 Australian bushfire-prone area residents.

Community and campaign programs' impact on bushfire preparedness—A few studies (n = 3) have examined how communities and campaigns impact individuals' preparedness. For example, a study by Gibbs et al. [41] estimated the costs and benefits of the Community Fireguard Program (CFG) over ten years, assuming each region faces a 10-year bushfire risk and the CFG group learnings would continue for a decade. In 100 years, $217,116 per group would be saved, even if a significant bushfire occurrence risk in a region is once in a century. Also, these programs have psychosocial impacts whose value was not calculated, due to the lack of quantitative data. Perez-Fuentes et al. [42] examined the content and design of three major earthquake and fire preparedness campaigns in North America. These campaigns rely mainly on simply delivering information to the public rather than focusing on training sufficient skills. In addition, due to the lack of evaluation systems on their performance, the success of these campaigns is not proven.

4.2. Prescriptive studies in bushfire

Three interventional studies have employed the VR disaster training system to examine bushfire preparedness. Caballero and Niguidula [35] designed a simulated training application by applying various methods and techniques such as observations, interviews, controlled experiments, and gamification techniques, including storyboard techniques and object prototyping. A VR training system has been developed by Ooi et al. [43] in three modes: evacuation drills, firefighting training, and comprehensive training. The proposed training system was compared to an existing teaching method experimenting with two groups of participants to determine how it improved upon current teaching materials. A study by Wetterberg et al. [44] conducted a VR experiment with 46 participants to determine the correlation between driving speed and smoke density (road visibility). In the case of a bushfire event, the traffic evacuation modelling tool was used to estimate evacuation times more accurately.

5. Volcano

5.1. Descriptive studies in volcano

Some studies (n = 4) have used observational methods to investigate individuals' preparedness in response to volcanic eruptions. There are two main categories identified in these studies: the evaluation of individual/household preparedness and the contribution of schools and social communities to individual preparedness.

Measuring individuals'/households' preparedness in response to volcanic eruptions—Two studies have conducted surveys to assess peoples' preparedness in response to volcanic eruptions. Barberi et al. [45] distributed a 45-item risk perception questionnaire among 3600 students, parents and the general public in the Vesuvius area of Italy. The findings indicate that people are willing to participate in emergency planning discussions/activities with scientists and civil protection officials. Although they are generally aware of volcano risk and its serious consequences, they need to increase their self-efficacy and confidence, as well as their knowledge of emergency plans. Similarly, another study by Wei and Lindell [46] surveyed 1050 Washington households to determine how they responded to the threat of volcanic mudflows from Mount Rainier. Using factor analysis and OLS[5] regression, they found that variables such as hazard intrusiveness, affective response, and risk perception are affected by demographic, locational, and past information search variables. According to their study, there are three distinct aspects of community hazard adjustment that need further study:

[5] OLS= Ordinary Least Square.

household preparedness for emergencies, perceived preparedness of the community, and perceived emergency preparedness adequacy.

Schools and social communities' contribution to individuals' preparedness—According to a study on disease outbreaks in the aftermath of natural hazards, Pascapurnama et al. [25] argued that school and community-based disaster risk reduction (DRR) programs can prepare people for health and disease issues following a disaster. They can be invaluable by conducting drills, delivering short courses, developing modules, and providing printed or visual materials to increase people's awareness of health risks.

5.2. Prescriptive studies in volcano

Game-based training systems—In an interventional study conducted on children in Caribbean multicultural societies, Clerveaux et al. [34] designed a disaster awareness game (DAG) to promote children's knowledge and preparedness. The children's level of awareness before and after participating in the game, as well as the effectiveness of their exposure to the game, were evaluated in pre- and post-test stages. It was validated as an effective and interesting tool for educating children.

6. Landslide

6.1. Descriptive studies in landslide

In a few studies (n = 5), an observational approach has been used to determine individual preparedness in response to a landslide. There are two main types of study designs: one category of studies measured individuals' landslide preparedness, and the second category examined how social communities affected individuals' preparedness.

Measuring individuals/households' landslide preparedness—Two studies have examined the level of public preparedness in countering a landslide. Luo et al. [47] surveyed the risk perception of households living in debris-flow affected communities in Taiwan, using a structured survey based on the Preparedness, Awareness, Action, and Affect (PAAA) model. The results demonstrated that the most prepared and knowledgeable households were those who had received disaster education, followed by those who had experienced disasters. Nevertheless, of the majority of households (86.2 percent) that failed to receive formal early warnings, 73% lacked disaster education or experience. Another study by Xu et al. [48] investigated the disaster awareness of a sample of 348 households who live in landslide-prone farming areas in southwestern China. It was found that 67% of farming households were unprepared for disasters, and their behaviours were based on experiences and self-learning. In addition, the sense of place and risk perception positively impact people's landslide preparedness.

Social communities' role in individuals' landslide preparedness—A study by Pascapurnama et al. [25] reviewed natural hazards that led to infectious disease outbreaks in Indonesia. Using modules, short courses, drills, and printed and visual materials, they recommended and emphasised incorporating health education into school or community-based disaster risk reduction plans.

6.2. Prescriptive studies in landslide

An interventional approach has been employed to promote individual preparedness in some studies. These studies have discussed school-based landslide education.

School-based landslide education—The role of school-based landslide education on disaster preparedness has been investigated in two studies. A study by de Mendonca and Valois [49] implemented educational disaster preparedness activities in a public school in Brazil. Using a variety of pedagogical tools and the theory of meaningful learning, the landslide disaster issue was addressed in the "Sciences" subject of the sixth grade of elementary school, for a total of 16 hours. Participants in the course engaged in interactive and participatory learning and gained an understanding of the real issue encountered and an emotional attachment to the issue. A recent study by Munoz et al. [30] reviewed disaster education examples and practices in South America and the Caribbean. Student reflections on Hurricane Maria from Puerto Rico's primary schools and universities provide innovative examples. High school curriculum skills and research competencies are being developed in Brazilian schools. Instead of reproducing centrally disseminated information, the Brazilian scheme emphasises knowledge production by schools. Safe learning facilities, disaster management at schools, and education about resilience and risk reduction are the main components of comprehensive school safety management in the study.

7. Tsunami

7.1. Descriptive studies in tsunami

A few studies (n = 4) have employed an observational approach to examine community preparedness in response to a tsunami. They have investigated school, workplace, and social communities' role in individuals' tsunami preparedness.

School, workplace, and social communities' role in individuals' tsunami preparedness—Two studies have explored the role of social communities in peoples' preparedness in response to a tsunami. A study by Pascapurnama et al. [25] reviewed eight natural hazards that caused infectious disease outbreaks in Indonesia. In the face of these challenges, schools and community centres can help address the issue by serving as agents of health promotion information dissemination. This will make people aware of health risks and engage them in effective practices. It was recommended that DRR[6] programs curriculum include health education and promotion as printed or visual materials, modules, short courses, and drills. In another study by Castaneda et al. [50], 1504 adults from the Chilean coastal

[6] DRR = Disaster Risk Reduction.

cities of Iquique and Concepcion were interviewed to examine the influences of experience and sociodemographic variables on disaster preparedness. A three-domain approach to preparedness was employed: household, community, and work. Experiencing earthquakes and tsunamis in the past and being exposed to them more frequently was associated with a higher level of preparedness. Moreover, findings indicated that different sociodemographic characteristics affect preparedness levels in different domains. It is also important to study and implement preparedness activities in other contexts, including the workplace and community settings. Furthermore, it was recommended that strategies should target groups that are less prepared for natural hazards.

7.2. Prescriptive studies in tsunami

Several interventional studies (n = 13) have been conducted to investigate individual/community preparedness in response to a tsunami through three types of study design: School-based tsunami education, Community-based tsunami education, Game-based and VR-based training systems, and the relationship between education and individual/community tsunami preparedness.

School-based tsunami education—A number of studies (n = 6) examined school-based education to prepare people for a tsunami disaster. For example, in a study by Dicky et al. [51], children in Indonesian schools near geological hazard prone areas were examined for their disaster awareness and response. They emphasised the importance of introducing earth science to school communities by exploring three areas: disaster education, disaster response, and earth science knowledge. Johnson et al. [52] have argued on the development of program theory models, and the advantages and disadvantages of the theory-based approaches, to evaluate disaster education programs for children. They provide empirical examples for program theory development based on the program theory matrix, and the stage step model frameworks. Using a program theory matrix, they evaluated "ShakeOut", an earthquake and tsunami drill in two Washington State school districts, and a stage step model was used to assess "What's the Plan Stan?", a voluntary teaching resource distributed to all New Zealand primary schools. To improve the awareness of children about tsunamis, a study by Yasuda et al. [53] in Japan conducted game-like group activities for elementary school students in three prefectures affected by the 2011 Great East Japan earthquake. In a recent study by Sakurai et al. [54], a school-based disaster education program was examined in a city affected by the 2011 Great East Japan tsunami disaster. They investigated the students' responses before and after the program implementation in the years 2013 and 2014, and 2018. The program experience positively affected the students and motivated them to contribute to the community and keep records of reconstruction, however their disaster preparedness behaviour was not impacted significantly.

Community-based tsunami education—A few studies (n = 4) have discussed community-based tsunami disaster education to enhance people's preparedness in a tsunami. For example, in Indonesia, Sugimoto et al. [55] investigated the "tsunami height poles" and their influence on the disaster awareness memory of public people. The local people have very low awareness of tsunamis based on the result of questionnaires. It was significant that the 85 "tsunami height poles", constructed by local NGOs, served as unique evocative devices to assist people in recalling the tsunami disaster impacts while awareness is likely to fade away as time passes. Another study by Goto et al. [56] in Banda Aceh, Indonesia, executed an exercise of town watching and a visual animation depicting the tsunami inundation and evacuation. The participants rated these methods as simple to use and highly effective. Based on the study findings, the bottleneck in the process of popularising disaster education is the lack of calibre education materials.

Game-based and VR-based training systems—Two studies have examined the training systems established based on virtual reality and games. Leelawat et al. [57] introduced a mobile application to enhance the traditional tsunami evacuation drill, which informs the participants about the inundation depth and the safety of their chosen evacuation route and destination respectively. The results indicated an improvement in participants' behaviour and decision-making. A study by Caballero and Niguidula [35] in the Philippines has designed a training application using gamification techniques as well as immersive virtual reality. Throughout the tsunami virtual training module, which provided outdoor scenarios during a tsunami, participants learned about different safety measures they can take to ensure their survival in the event of a tsunami. Actual flood and typhoon simulations were demonstrated in this case-driven scenario.

The relationship between education and individual/community tsunami preparedness—Two studies have investigated the tsunami preparedness of an individual/community and its association with their education. A study by Siripong [58] has emphasised the significance of "lifelong education for everyone" as a disaster risk reduction investment for individuals and society in Thailand. Their findings indicated that if the community gains an understanding of the characteristics of the disasters from a scientific viewpoint, this knowledge will allow them to escape from natural hazards in a timely manner and mitigate their effects, even without highly sophisticated and costly early warning systems. Also, Muttarak and Pothisiri [59] surveyed 557 households in the areas at risk of tsunami in Thailand to investigate the individual characteristics that influence disaster preparedness and found that receiving a "formal education" is highly associated with being prepared for a tsunami at different levels of individual, household, and community. Based on their results, disaster preparedness is more likely in communities with a high proportion of educated women -at least receiving a secondary education.

8. Cyclone and the like

Some studies (n = 30) have examined individual preparedness for cyclones, hurricanes, storms, tornados, and typhoons. In this study, we combined them in a "Cyclone and the like" group. These studies have taken place in various countries and adopted two different identifiable approaches: descriptive and prescriptive.

8.1. Descriptive studies in "cyclone and the like"

A number of studies (n = 23) have investigated individual preparedness for cyclones from an observational point of view. These studies predominantly measured people's preparedness. Also, a proportion of them explored the role of social communities in cyclone

preparedness. Some descriptive studies examined the impact of individual trust in government on community cooperation with emergency preparedness in response to cyclones and the like.

Measuring individuals/households' disaster preparedness in response to cyclones and the like—Some studies (n = 13) have used surveys/interviews to measure individual's preparedness. For example, Baker [60] evaluated preparedness levels among 1200 Florida households during hurricane seasons 2004 and 2005, using telephone interviews. The score of preparedness was calculated based on eight items for spring 2006 and ten items for hurricane preparedness in 2004 and 2005. Chaney et al. [61] surveyed 124 households for tornado hazard preparedness. The majority of the participants had participated in a tornado drill and had a plan for seeking shelter in the event of a tornado. According to research by Hossain [62], who surveyed two coastal villages at high risk of cyclone in Bangladesh, socioeconomic and physical factors play an integral role in determining the household's vulnerability. Low-income and less-educated households and those with a vulnerable physical condition are less likely to have access to weather forecasts, disaster training and resilience to cope with future hazards. Using a fuzzy cognitive mapping approach, Singh and Chudasama [63] assessed the community perceptions and preparedness as well as the economic, ecological, and social impacts of cyclones to help policymakers and planners make better plans to enhance disaster preparedness. Martins et al. [64] measured the disaster preparedness of households before Hurricane Sandy in New York City, using a random telephone (RDD) survey data of 2001 residents across all five boroughs. They concluded that the strongest predictors of household preparedness were trust in local government and social network support. Following the 2018 Typhoon Mangkhut, Chan et al. [65] conducted a cross-sectional random digit-dialling telephone survey among Hong Kong adults. 93.9% of the respondents reported having a plan for emergency preparedness, while 74.3% reported having a plan for a "typhoon-specific preparedness measure (TSPM)" against Mangkhut. TSPM was more likely to be undertaken by respondents who, during typhoons, perceived higher levels of risk at home and also during non-emergency periods and practised routine emergency preparedness measures. Reviewing academic and grey literature, Ryan and King [66] have collected activities to provide emergency agencies and individuals with a storm inventory to measure individual preparedness. They argued that a smartphone application on storm preparedness could help collect data to identify where the community engagement programs should focus on the targeted community based on their needs. A study by Dasgupta et al. [67] examined the thematic dimensions and perceptual variables associated with disaster preparedness among foreign residents during Typhoon Hagibis. They developed a self-evaluation framework to assess the individual preparedness of 133 foreign residents based on the 72-hours golden rule of disaster survival.

Social communities' contribution to individuals' disaster preparedness in response to cyclone and the like—A few studies (n = 6) have investigated the social communities' role in people's preparedness in cyclone and the like disasters. For instance, after 1999 Hurricane Floyd in the United States, Moore et al. [68] conducted qualitative research to examine how social capital, social cohesion, and collective efficacy affect community preparedness, responsiveness, and recovery. Koch et al. [69] concluded that the one-size-fits-all approach for disaster plans is ineffective, and community assets should be incorporated as much as possible. Still, it is restricted by the operational limitations of Community-Based Organizations (CBOs). Socially marginalised communities must engage in sustainable, mutually beneficial partnerships to build resilience, which is often overlooked in disaster planning. Guo et al. [70] argued that community-based programs should consider that providing residents with more information-seeking channels could help improve perceived community resilience. A critical part of enhancing urban resilience and community-based disaster management in coastal areas is to synergise new information channels with top-down and bottom-up information about typhoons, physical and socioeconomic conditions. Kranke et al. [71] addressed a research gap by conceptualising emotional preparedness. They conducted a thematic analysis, and the results revealed that social workers' emotional preparedness involves: 1) emotional anticipation; 2) emotional presence on the job; 3) self-efficacy to handle the disaster; and 4) concerns about having to provide additional services beyond their expertise.

The impact of individual trust in government/authorities on their cooperation with emergency preparedness in response to cyclone and the like—Three studies have explored how people's trust in government/authorities contributes to their willingness to participate in disaster training. As explanations for perceived and actual preparedness levels, Basolo et al. [72] examined individuals' confidence in local government and their exposure to disaster preparedness information. Choi and Wehde [73] found a nuanced relationship between trust in emergency management authorities and individual emergency preparedness for tornadoes. In other words, trust in authorities may affect people's cooperation with the recommendations regarding emergency preparedness. According to Wehde and Nowlin [74], the general public assigns limited responsibility to governments for hurricane preparation. Rather, respondents, particularly conservatives and those with low trust in government, view individual preparedness as being the responsibility of individuals themselves.

8.2. Prescriptive studies in "cyclone and the like"

A proportion of the studies (n = 7) have employed an interventional approach to investigate community preparedness in response to cyclones and the like disasters. Some of these studies have discussed community and school-based education, and some have argued that game-based and VR-based training systems address people's preparedness for cyclones disasters.

Community and school-based "cyclone and the like" education—Some studies (n = 5) have investigated community and school-based education methods in response to cyclone and the like disasters. For example, following Hurricane Hugo, Faupel and Styles [75] compared a group of adults who had participated in an educational workshop and a general public sample to examine the impact of disaster education and household preparedness activities on stress responses among adults in the Charleston, South Carolina area. A study by Munoz et al. [30] discussed an innovative example of memories of Hurricane Maria reflected by primary students and university undergraduates in Puerto Rico. Lee [76] investigated the influence of voluntary associations' membership and previous disaster damage experiences on Taiwanese individuals' preparedness behaviour. They found that voluntary association members were more prepared for natural hazards than non-members; both damage experience and perception of risk positively affected preparedness

behaviours.

Game-based and VR-based training systems—Two studies have utilised game-based and VR-based training systems to enhance community preparedness in response to cyclones disasters. Clerveaux et al. [34] discussed the effectiveness of the "Disaster Awareness Game (DAG)" among children in multicultural societies. Based on the results, the tool was found to be engaging enough to keep children's attention and effectively measure children's disaster preparedness levels and educate them. Caballero and Niguidula [35] developed a simulated training application using prototyping and gamification techniques. Through immersive virtual reality, they explored the architecture and design features of the virtual training program for disaster risk management and emergency preparedness.

9. Earthquake

9.1. Descriptive studies in earthquake

Some studies (n = 30) have employed a descriptive approach to investigate the individual's preparedness in response to an earthquake disaster. Four categories have been identified among these studies: measuring individuals/households' disaster preparedness in response to earthquakes, earthquake preparedness scale development, School and social communities' role in individuals' earthquake preparedness, and the impact of individual trust in government/authorities on their cooperation with emergency preparedness in response to the earthquake.

Measuring individuals/households' disaster preparedness in response to earthquake—A number of studies (n = 17) have measured the preparedness of individuals/households in an earthquake disaster. For example, Sadeghi and Ahmadi [77] investigated the mental health preparedness of people in response to the 2003 Bam earthquake in Iran. They concluded that psychological preparedness should be considered one of the essential parts of education for natural hazards and is no less important than physical and economic preparedness, and we have to take it seriously to improve training programs. Wei et al. [78] conducted a questionnaire survey to investigate the factors affecting the public response level to an earthquake disaster. They found that low education levels and an undeveloped economy are the most significant factors influencing public response capacity. Yildiz et al. [79] have employed a mixed method approach, including a questionnaire survey, interview, and the "pictorial representation of illness and self-measure (PRISM)" technique to examine the risk perception and preparedness level of children. Although the children were primarily aware of the earthquake risk in their home area, they rarely participated in disaster education programs. Using a survey of 327 farmers in rural areas affected by Wenchuan and Lushan counties major earthquakes, Yong et al. [80] aimed to compare the general public and professionals' preparedness behaviour. The results showed that there is a significant difference in knowledge and skill skewed to the professionals, though their preparedness regarding physical disaster-prevention was not significantly varied. Kwazu and Chang-Richards [81] surveyed residents affected by the Kaikoura earthquake and identified 11 critical factors that impacts livelihood preparedness. Using a principal component analysis, they classified the factors into four categories: resource accessibility, livelihood diversity, disaster risk reduction effectiveness, and individual adaptive capacity. Conducting a survey of households in the Wenchuan and Lushan earthquakes hardest-hit areas, Qing et al. [82] have explored the association between farmers' quality of life and their disaster preparedness and, moreover, tested the disaster risk perception as a mediating factor. They concluded that the quality of life factors among farmers, including life satisfaction, happiness and general health, are significantly related to their disaster preparedness behaviour. Sim et al. [83] have surveyed residents from three different villages with high risk but no occurrence of earthquake for years placed in northwest China. The final results indicated that plain area and mountainous area villagers had higher resilience scores rather than individuals who inhabited in the loess plateau.

Earthquake preparedness scale development—Three studies have developed an earthquake preparedness scale to measure an individual's readiness and response regarding an earthquake disaster. For example, Tanaka [84] has developed an index of earthquake preparedness to measure and compare different countries' preparedness in response to an earthquake. The result of a cross-country comparison between Fukui, Japan and the San Francisco Bay Area, California, showed that the level of readiness of respondents from Japan regards educational sources and social activities was slightly higher than their American counterparts who lived in seismic areas. Also, the American respondents were relatively well-prepared regarding the required goods for an earthquake disaster. Miller et al. [85] have developed a new scale based on the "vested interest theory (VI)" and the "extended parallel process model of fear appeals (EPPM)" to measure people's awareness and vestedness related to earthquake and tornado disasters.

School and social communities' role in individuals' earthquake preparedness—A few studies (n = 9) have investigated the school and social communities' contribution in preparing individuals in response to an earthquake disaster. For example, Andrulis et al. [24] have identified barriers to racially and ethnically diverse communities' disaster preparedness at individual and institutional levels. Moreover, they suggested specific remedies for these communities, such as providing language assistance services, strengthening cross-sector collaborations, increasing flexibility in funding allocation, and enhancing organisational capacity for diversity initiatives. Naseri and Kang [86] surveyed 324 students from 10 high schools in the 13th district of Kabul, Afghanistan. They found that although the majority of students had experienced earthquakes before, they were not educated and prepared to take the right actions during an earthquake disaster. Pascapurnama et al. [25] have emphasised the role of community centres and schools in preparing individuals to face common water and air-borne health issues after a disaster.

The impact of individual trust in government/authorities on their cooperation with emergency preparedness in response to earthquake—Two studies have examined how the people's trust in government can influence their earthquake disaster preparedness and response. Basolo et al. [72] have found a significant association between the people's trust in government and their level of perceived preparedness using data from a sample of households who lived in Los Angeles County, USA. Han et al. [87] have identified a positive relationship between survivors of the 2008 Wenchuan earthquake's preparedness actions and their confidence in the government.

9.2. Prescriptive studies in earthquake

Some studies (n = 19) have explored interventional methods to educate people to be prepared for earthquake disasters. These study themes can be classified into three categories: community-based earthquake education, school-based earthquake education, and game-based and VR-based training systems.

Community-based earthquake education—Some studies (n = 7) have examined community-based earthquake education. For example, Bartolucci and Magni [88] have discussed the rarely studied phase of education immediately after a disaster, using a decision flow chart to develop educational programs to enhance the adapting capacity of survivors. They surveyed 45 individuals to assess and validate the effectiveness of this program. Joffe et al. [89] have argued the fix-it intervention, a cross-cultural, longitudinal method for earthquake disaster preparedness. The intervention was implemented in two target coastal cities, Seattle, USA and Izmir, Turkey. Cretney [90] has studied the impact of a grassroots organisation (named Project Lyttelton) in shaping local community-led preparedness and response initiatives in New Zealand. Cui et al. [91] have found a significant correlation between perceived community post-disaster resilience and their participation in disaster education training in Yingxiu Town, a rural community in China. Lian et al. [92] have explored the impact of disaster prevention and mitigation training on farmers' earthquake preparedness behaviour as inhabitants of high-risk earthquake areas. The results indicated that education led farmers to adopt a greater extent of preparedness behaviour.

School-based earthquake education—A number of studies (n = 10) have discussed school-based earthquake education. For example, Fuhrmann et al. [93] and Aksa et al. [94] have investigated the integration of disaster preparedness lesson plans in geographic education for elementary, middle, and high schools in the United States and university students in Indonesia, respectively. Dicky et al. [51] have highlighted the need for integration of the subjects of geology including disaster education, disaster response, and earth science knowledge into the curriculum of Indonesian primary and secondary level schools. MacDonald et al. [95] have proposed a museum-based education to enhance the awareness and preparedness of students, teachers, and parents. Providing students with some bridging objects such as a fill-in disaster plan and critical instructions for students to practice preparedness behaviours with their families, was found to have a positive impact on children's self-efficacy beliefs and skills for disaster preparedness. Yeon et al. [96] provided an earthquake disaster education program following the Pohang earthquake in 2017 and analysed the student's cognitive and emotional responses. They found that emotional responses are more important than cognitive responses for developing a disaster preparation education program. Shoji et al. [97] have examined the influence of an innovative dance-based program on students' earthquake response and found it an easily understandable and cost-effective way of education suitable to engage students with poor educational backgrounds living in disaster-prone areas in developing countries. Sakurai et al. [54] have investigated the impact of the "Reconstruction Mapping Program", a disaster education program based on a town watching and map-making approach, on elementary school children. School children can be considered "agents of change" to develop a disaster-resilient community. Nakano et al. [98] have recommended researchers employ a long-term action-oriented rather than a short-term knowledge transfer approach to evaluate the disaster education methods. They evaluated the learner's proactive attitudes in building an earthquake-resilient community in Nepal which was continued for more than ten years and included three phases: educational, participatory, and independent action.

Game-based and VR-based training systems—Two studies have investigated game-based and VR-based training systems. Clerveaux et al. [34] have designed a "disaster awareness game (DAG)" to educate and promote the level of children's preparedness and response to disasters in multicultural societies. Caballero and Niguidula [35] employed a qualitative approach with gamification techniques to design a simulated training application for disaster preparedness education programs.

10. Generic disaster (natural hazards in general)

10.1. Descriptive studies in generic disaster

Many studies (n = 68) have employed an observational approach to investigate individuals' generic disaster preparedness. Five main categories have been identified in these studies: Measuring individuals' generic disaster preparedness, planning for medically vulnerable/disabled people, scale development, school and social communities' role in individuals' generic disaster preparedness, and public education and disaster preparedness management.

Measuring individuals/households' disaster preparedness in response to generic disaster—A number of studies (n = 32) have examined the level of public preparedness in countering generic disaster. For example, a study by Xu et al. [99] in Heilongjiang, China, identified poor attitude and awareness about emergency preparedness among residents. They suggested emergency awareness campaigns provide more focused education considering the needs of the intended audience and their common source of knowledge in relation to emergencies. Lam et al. [100] assessed the Hong Kong residents' disaster preparedness levels and examined the relationship between having an evacuation tool kit and adequate first-aid knowledge and disaster preparation. They concluded community programs should target different cohorts of the population to enhance the community disaster education. Chen et al. [101] assessed the disaster preparedness of a sample of 3541 households in China by designing a questionnaire with a range of 14 indicators such as emergency necessities, coverage of accident insurance, and evacuation plan. The results showed low levels of individual preparedness. Every et al. [102] examined the psychological preparedness of 1253 Australian households. They identified two subscales of psychological preparedness (Knowledge and management, Anticipation and awareness) that are correlated with material preparedness. Teo et al. [103] discussed the influence of an individual's ethnicity and English language proficiency on disaster preparedness in Logan City, Australia. They suggested that education programs should be designed to cater to different language abilities as well as various ethnic groups. McNeill et al. [104] have highlighted the importance of identifying challenges faced by vulnerable population in disaster preparedness

to reach social justice and planning for disaster management. Ghazi Baker [105] measured disaster preparedness levels among nurses in Medina, Saudi Arabia, and found a significant difference between individuals who received disaster education and those who did not participate in education programs. Green et al. [106] have explored household preparedness among Japan's foreign residents. They identified that cultural background and exposure to local hazards information are determinants of foreign residents' preparedness rather than their Japanese language skills. E. M. McCourt et al. [107] have conducted a 70-question survey to assess disaster preparedness among Australian pharmacists and factors affecting their preparedness. Zhang et al. [108] evaluated disaster literacy among college students in China and highlighted their need for disaster education. Carswell et al. [1] have examined the disaster preparedness behaviours of households who have been impacted by disasters previously compared to those who were unaffected by prior disasters.

Planning for medically *vulnerable/disabled people*—Four studies have investigated the planning for medically vulnerable/disabled people. Bethel et al. [109] measured disaster preparedness among medically vulnerable communities (those with poor health and disabilities) using "Behavioural Risk Factor Surveillance System (BRFSS)" survey respondents. Results showed that vulnerable groups tend to have more medication supplies and less household preparedness items than their healthier counterparts. Kruger et al. [12] investigated the disaster preparedness and specific needs of disabled people and recommended tools, training, and online webinars, as well as planning for national guidelines on disability inclusion in emergency preparedness. Adams et al. [110] highlighted the individual and community factors, such as self-efficacy and community advantage, which impacts the preparation of people with disabilities. McLennan et al. [111] investigated the disaster preparedness for natural hazards among Australian individuals with activity-limiting disabilities. They found small differences in material and knowledge preparedness between disabled individuals and other individuals in a sample of 1253 Australian residents, however the emotional readiness differed considerably between the two groups.

Generic disaster preparedness scale development—Six studies have developed a disaster preparedness scale to measure an individual's readiness and response regarding a generic disaster. McLennan et al. [112] have replicated and confirmed the "Psychological Preparedness for Disaster Threat Scale (PPDTS)", using a confirmatory factor analysis of a survey of 1253 Australian residents. They concluded that the PPDTS scale can measure disaster psychological preparedness in an English-speaking context. Mizrak and Aslan [113] developed a scale to measure the disaster preparedness of university students, surveying 617 Gumushane University students in Turkey. Han and Chun [114] developed and validated a "Disaster Preparedness Evaluation Tool for nurses in South Korea (DPET-K)". The 28-item scale is categorised into five factors: disaster education, disaster knowledge, bioterrorism and emergency response, disaster response, and disaster evaluation. Shi et al. [115] adopted the Chinese version of "Hospital Nursing Department Disaster Preparedness Scale (HNDDPS)", a 72-item scale comprising five dimensions. Widowati et al. [116] examined the "Disaster Preparedness and Safety School (SSSB)" program as an assessment tool for the child safety education system in schools. Ryan et al. [15] developed a Preparedness Competency Index by mapping Australian emergency agencies' understanding of the competencies people and communities need to effectively prepare for a disaster.

School and social communities' contribution to individuals' generic disaster preparedness—Some studies (n = 13) have investigated the school and social communities' contribution in preparing individuals to respond to a generic disaster. For example, Codreanu et al. [117] have found that school-based disaster reduction education in collaboration with family and charity organizations had the highest predictive value to increase disaster preparedness. It has been identified by Tan et al. [118] that universities should have a systematic disaster training course focusing on rescue skills, and the government and universities should support the establishment of a simulated disaster rescue centre. According to Bandecchi et al. [119], school-based emergency management efforts should focus on developing a community-wide resilience culture. In Southwest Nigeria, Ilo et al. [120] examined disaster training challenges in federal and state university libraries. As part of his research on disaster risk management and post-disaster activities in Nepal, Pandey [121] examined the role of communities in disaster risk management as well as their recognition of disaster-related policies. Shmueli et al. [122] emphasised the importance of collaborative planning principles and involving communities in decisions prior to, during and after catastrophic events occur.

Public education and disaster preparedness management—Several studies (n = 13) have examined the relationship between public education and disaster preparedness management in preparing individuals against generic disasters. For example, Ingrassia et al. [123] conducted a qualitative analysis of the preferences and characteristics of disaster management "Educational and Training Initiatives (ETIs)" at a postgraduate level, and identified the need for developing a standardised competency-based educational and training program across all European countries. Thayaparan et al. [124] discussed the role of "Higher Education Institutions (HEIs)" in disaster management education, the challenges that come along with it, and how higher education industry collaboration can help address the challenges. Describing how disaster education has changed and continued in post-war Japan, Kitagawa [125] provides insight into the complexity of the field of 'disaster education', emphasising its two-dimensional aspects: 'the science of disasters' and 'life skills for disasters'. Tatebe and Mutch [126] reviewed international reports and academic journal articles covering a variety of fields and a range of intergovernmental organizations, international aid and NGOs to examine various aspects of DRR education-related activities. An education project supported by the cabinet office, the government of Japan, titled "Disaster Management Education Challenge Plan", was analysed by Tomoyasu et al. [127]. The development of a lifelong and life-wide preparedness model was suggested by Kitagawa [128] in Japan to take a social approach to lifelong learning. He argued that the four forms of aid including –public aid, self-help, and mutual aid-operate as an effective balance act, and that mutual aid is powerful in legitimacy in hybrid politics. Kitagawa [129] has shed light on the relationship between the 'public pedagogy' and 'disaster preparedness' fields.

10.2. Prescriptive studies in generic disaster

Several interventional studies (n = 46) have been conducted to examine individual/community preparedness in response to a generic disaster through three types of study design: school-based disaster education, community-based disaster education, and game-

based and VR-based training systems.

Community-based generic disaster education—Some studies (n = 16) have explored community-based generic disaster education. For example, Schafer et al. [130] have examined emergency management from the perspective of the local community and provided a case study to illustrate five dimensions of community preparedness including collaborative efforts, details of the local area, local culture, geographical information, and emergency planning. To apply community engagement to disaster planning, Wells et al. [131] developed a vision and design for the Los Angeles County Community Disaster Resilience initiative by creating a community resilience toolkit and comparing it with individual preparedness. Pfefferbaum et al. [132] compared six community resilience interventions to address their foundations, methodologies, and implementations.

School-based generic disaster education—A number of studies (n = 17) have discussed school-based generic disaster training. For example, through the dissemination of "What's the Plan, Stan?" program, a voluntary, curriculum-based teaching resource, Johnson et al. [7] assessed national disaster preparedness education implementation in New Zealand primary schools. Shiwaku [133] has compared teacher training programs in Armenia and Japan with the purpose of mainstreaming school disaster management through teacher training. In two rural semi-arid communities in Ghana, Apronti et al. [6] have explored the presence and nature of DRR within the school system syllabi. Nouchi et al. [14] have introduced a new package of disaster education for elementary school students and assessed its effects on protective and prevention actions related to disasters. A conceptual model of school-community collaboration was developed by Oktari et al. [134] with the aim to build resilience in coastal communities in Indonesia. Kawasaki et al. [135] have clarified the importance of parents and teachers collaboration in preparing for a disaster and responding following a disaster. Gokmenoglu et al. [136] evaluated the school-based disaster training program conducted by "The Turkish Republic of Ministry of National Education", consisted of three components: distance training, local teacher training, and face-to-face teacher trainer program. M. S. Y. Hung et al. [137] conducted a single group pre- and post-intervention comparison to identify how disaster management training improves Hong Kong nursing students' knowledge, willingness, and perception of disasters. According to Seddighi et al. [138], school disaster education programs often experience equipment shortages, financial barriers, policy gaps, and teachers inexperience. Handaka et al. [139] assessed psychosocial disaster preparedness training for Indonesian guidance and counselling high school teachers.

Children and teenagers' disaster preparedness—Five studies have examined disaster preparedness among children and teenagers. A study by Johnson et al. [140] explored how scholars and practitioners measure and assess the effectiveness of children disaster education programs. Codreanu et al. [141] investigated whether the methods of disaster training for teens enhance their disaster knowledge and skills, and also examined if there is a behavioural change that would enhance their survival chances after disasters. Edmonds [142] highlighted the lack of research focusing on psychological effects of disasters on children with disabilities, specifically neurodevelopmental disabilities like autism, and considered the need for intervention for children with autism, a group that has been virtually neglected in the field of emergency preparedness education, and reports on the first phase of an initiative aimed to develop resources for this group. Another research gap has been highlighted by Midtbust et al. [13] about whether changes in awareness and attitudes have led to changes in children's actual behaviour or whether disaster education and risk communication affect how children behave and cope during and after natural hazards. According to Wisner et al. [143], increasing urbanisation has resulted in children having fewer contacts with nature and relying on techno-social systems more often. Hence, natural hazards are often misunderstood by young people, and schools and conscious parenting can play an important role in helping them gain a better understanding and psychological resilience.

Game-based and VR-based training systems—Four studies have investigated training systems designed based on virtual reality and gamification. Farra et al. [144] examined the effects of "virtual reality simulation (VRS)" on disaster training learning outcomes and retention. The VRS method has been found to reinforce and improve learning. With the aim of improving visual reality in the "game-based evacuation drill (GBED)" system, Kawai et al. [145] developed a new GBED system that presents augmented reality (AR) materials on tablet computers. They found that the modified new system is suitable for disaster education since it enhances visual reality. Caballero and Niguidula [35] focused on developing simulated disaster risk management and emergency preparedness training to facilitate disaster awareness training, capacity building activities and real-life disaster response. To propagate disaster preparedness and risk management training, they explored the architectural and design aspects of immersive virtual reality. Kankanamge et al. [146] have investigated how gamification can be integrated into disaster emergency planning and motivate community engagement.

11. Summary statistics

Following the qualitative content analysis of studies, relevant tables and graphs have been generated to summarise the classification and statistics of the papers in this study which depict an overview of all studies' characteristics. All studies have been classified in Appendix Table based on various characteristics including the year of publication and descriptive/prescriptive approaches; and in Table 1 based on identified themes. Also, several statistical graphs have been extracted from the 222 studied papers, based on various characteristics including the year/decade of publication, natural hazards which have been studied, descriptive/prescriptive approaches, the country of the case study, and the identified themes in the studies (Fig. 1, Fig. 2(a–f), and Fig. 3). Moreover, the keyword sets of the 222 studied papers were compiled and analysed for the frequency and co-occurrence of terms (Fig. 4).

Table 1 illustrates the summary classification of all studies in categories and themes based on the content analysis of descriptive and prescriptive studies in each natural hazard. The identified themes for descriptive studies are measuring disaster preparedness, school programs' impact on disaster preparedness, campaign and social community programs' impact on disaster preparedness, scale development, social media impact on disaster preparedness, impact of trust in government/authorities on people's cooperation with emergency preparedness, planning for medically vulnerable/disabled people, and disaster education planning. Also, prescriptive studies' themes include school-based training, community-based training, game-based and VR-based training, relationship between

Table 1
Summary classification of studies in categories and themes.

Category	Descriptive (Observational)								Prescriptive (Interventional)				
Theme/Disaster Type	Measuring disaster preparedness	School programs' impact on disaster preparedness	Campaign and social community programs' impact on disaster preparedness	Scale development	Social media impact on disaster preparedness	Impact of trust in government/ authorities on people's cooperation with emergency preparedness	Planning for medically vulnerable/ disabled people	Disaster education planning	School-based training	Community-based training	Game-based and VR-based training	Relationship between formal education and disaster preparedness	Children and teenagers' disaster preparedness
Bushfire	Ingham and Redshaw [37], McNeill and Ronan [38], Thompson et al. [39]		Andrulis et al. [24], Gibbs et al. [41], Perez-Fuentes et al. [42]	Boylan and Lawrence [40]							Caballero and Niguidula [35], Ooi et al. [43], Wetterberg et al. [44]		
Cyclone and the like	Baker [60], Chaney et al. [61], Hossain [62], Singh and Chudasama [63], Martins et al. [64], Chan et al. [65], Ryan and King [66], Dasgupta et al. [67], Kyne et al. [147], Clay et al. [148], C. Ma et al. [149], Nikkanen et al. [150], Joshipura et al. [151]		Moore et al. [68], Kapucu [152], Koch et al. [69], Guo et al. [70], Kranke et al. [71], Phuong et al. [153]	Miller et al. [85]		Basolo et al. [72], Choi and Wehde [73], Wehde and Nowlin [74]			Munoz et al. [30]	Faupel and Styles [75], Levin et al. [154], Asharose et al. [33], Lee [76]	Clerveaux et al. [34], Caballero and Niguidula [35]		
Earthquake	Sadeghi and Ahmadi [77], Muttarak and Pothisiri [59], Wei et al. [78], Gerdan and Cakin [155], Wu et al. [156], Xu et al. [157], Castaneda et al. [50], Khodadadizadeh et al. [158], Wei et al. [159], Yildiz et al. [79], Yong et al. [80],	Shiwaku et al. [163], Naseri and Kang [86], Pascapurnama et al. [25]	Andrulis et al. [24], Ainuddin and Routray [5], Perez-Fuentes et al. [42], Pascapurnama et al. [25], Kusumastuti et al. [164], Chai et al. [165]	Tanaka [84], Spittal et al. [166], Miller et al. [85]		Basolo et al. [72], Han et al. [87]			Fuhrmann et al. [93], Dicky et al. [51], Johnson et al. [52], MacDonald et al. [95], Yeon et al. [96], Shoji et al. [97], Sakurai et al. [54], Nakano et al. [98], Munoz et al.	Shaw et al. [167], Bartolucci and Magni [88], Joffe et al. [89], Cretney [90], Cui et al. [91], Lian et al. [92], Lee [76]	Clerveaux et al. [34], Caballero and Niguidula [35]		

(*continued on next page*)

Table 1 (*continued*)

Category	Descriptive (Observational)								Prescriptive (Interventional)				
Theme/Disaster Type	Measuring disaster preparedness	School programs' impact on disaster preparedness	Campaign and social community programs' impact on disaster preparedness	Scale development	Social media impact on disaster preparedness	Impact of trust in government/ authorities on people's cooperation with emergency preparedness	Planning for medically vulnerable/ disabled people	Disaster education planning	School-based training	Community-based training	Game-based and VR-based training	Relationship between formal education and disaster preparedness	Children and teenagers' disaster preparedness
	Ao et al. [160], Kwazu and Chang-Richards [81], Z. Ma et al. [161], Qing et al. [82], Sim et al. [83], Wei et al. [162]								[30], Aksa et al. [94]				
Flood	Coulston and Deeny [21], Mishra and Suar [22], Jagnoor et al. [168], Guo et al. [23], Titko et al. [8]		Buckland and Rahman [169], Andrulis et al. [24], Koch et al. [69], Pascapurnama et al. [25], Shah et al. [170], Hashim et al. [26], Monteil et al. [171]		Khan et al. [27], Geng et al. [28]				Muzenda-Mudavanhu et al. [29], Munoz et al. [30], Zhong et al. [31]	Karanci et al. [32], Asharose et al. [33]	Clerveaux et al. [34], Caballero and Niguidula [35], Tsai et al. [36]		
Generic Disaster	Foster et al. [172], Levac et al. [173], Ko et al. [174], Muller et al. [175], Xu et al. [99], DeBastiani et al. [176], Shannon [9], Xu et al. [99], Kurkjian et al. [177], Farajzadeh et al. [178], Lam et al. [100], Roudini et al. [179], Stewart et al. [17], Tam et al. [180], Appleby-Arnold et al. [181], Chen et al. [101],	Codreanu et al. [117], Tan et al. [118], Zhu and Zhang [188], Uhm and Oh [189], Bandecchi et al. [119], Ilo et al. [120], Lahiri et al. [190]	Zukowski [191], Schoch-Spana et al. [192], Dunlop et al. [193], Pandey [121], Shmueli et al. [122], Xiang et al. [194]	McLennan et al. [112], Mizrak and Aslan [113], Han and Chun [114], Shi et al. [115], Widowati et al. [116], Ryan et al. [15]	Anson et al. [195], Wukich [196]	Born et al. [197], Ibem [198], Baker and Ludwig [199], Wei et al. [200]	Bethel et al. [109], Kruger et al. [12], Adams et al. [110], McLennan et al. [111]	Perry and Lindell [201], Paton [202], Kohn et al. [203], Ingrassia et al. [123], Thayaparan et al. [124], Kitagawa [125], Chadderton [204], Khorram-Manesh et al. [205], Tatebe and Mutch [126], Tomoyasu et al. [127], Kitagawa [128], Sakurai and Sato [16], Kitagawa [129]	Johnson et al. [7], Shiwaku [133], Apronti et al. [6], Codreanu et al. [206], Nouchi et al. [14], Matsuura and Shaw [207], Oktari et al. [134], Lin et al. [208], Salita et al. [209], Park [210], Kawasaki et al. [135], Gokmenoglu et al. [136], K. K. C. Hung	Carter [213], Schafer et al. [130], Yasunari et al. [214], Wells et al. [131], Eisenman et al. [215], Glik et al. [216], Pfefferbaum et al. [132], McNeill et al. [217], Feng et al. [19], Thomas et al. [218], Zurita et al. [219], Shannon [220],	Farra et al. [144], Kawai et al. [145], Caballero and Niguidula [35], Kankanamge et al. [146]	Torani et al. [10], Kitagawa [20]	Johnson et al. [140], Codreanu et al. [141], Edmonds [142], Midtbust et al. [13], Wisner et al. [143]

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Table 1 (*continued*)

Category	Descriptive (Observational)								Prescriptive (Interventional)				
Theme/Disaster Type	Measuring disaster preparedness	School programs' impact on disaster preparedness	Campaign and social community programs' impact on disaster preparedness	Scale development	Social media impact on disaster preparedness	Impact of trust in government/ authorities on people's cooperation with emergency preparedness	Planning for medically vulnerable/ disabled people	Disaster education planning	School-based training	Community-based training	Game-based and VR-based training	Relationship between formal education and disaster preparedness	Children and teenagers' disaster preparedness
	Every et al. [102], Hamidazada et al. [182], Teo et al. [103], Ekenga and Lan [183], McNeill et al. [104], Ghazi Baker [105], Green et al. [106], E. M. McCourt et al. [107], E. M. McCourt et al. [107], Ning et al. [184], Sugisawa et al. [185], Wang et al. [186], Y. Ma et al. [149], Zhang et al. [108], Chegini et al. [187], Carswell et al. [1]								et al. [211], Seddighi et al. [138], Uchida et al. [212], White-Lewis et al. [11], Handaka et al. [139]	Oktari et al. [221], Ramanathan and Crawley [2], K. K. C. Hung et al. [211], Nagamatsu et al. [222]			
Landslide	Luo et al. [47], Xu et al. [48], Pascapurnama et al. [25]								de Mendonca and Valois [49], Munoz et al. [30]				
Tsunami	Muttarak and Pothisiri [59]	Pascapurnama et al. [25]	Lindell and Prater [223], Pascapurnama et al. [25], Castaneda et al. [50]						Dicky et al. [51], Johnson et al. [52], Katada and Kanai [224], Sakurai et al. [225], Yasuda et al. [53], Sakurai et al. [54]	Sugimoto et al. [55], Goto et al. [56], Said et al. [226], Asharose et al. [33]	Leelawat et al. [57], Caballero and Niguidula [35]	Siripong [58], Muttarak and Pothisiri [59]	
Volcano	Barberi et al. [45], Wei and Lindell [46]	Pascapurnama et al. [25]	Pascapurnama et al. [25]								Clerveaux et al. [34]		

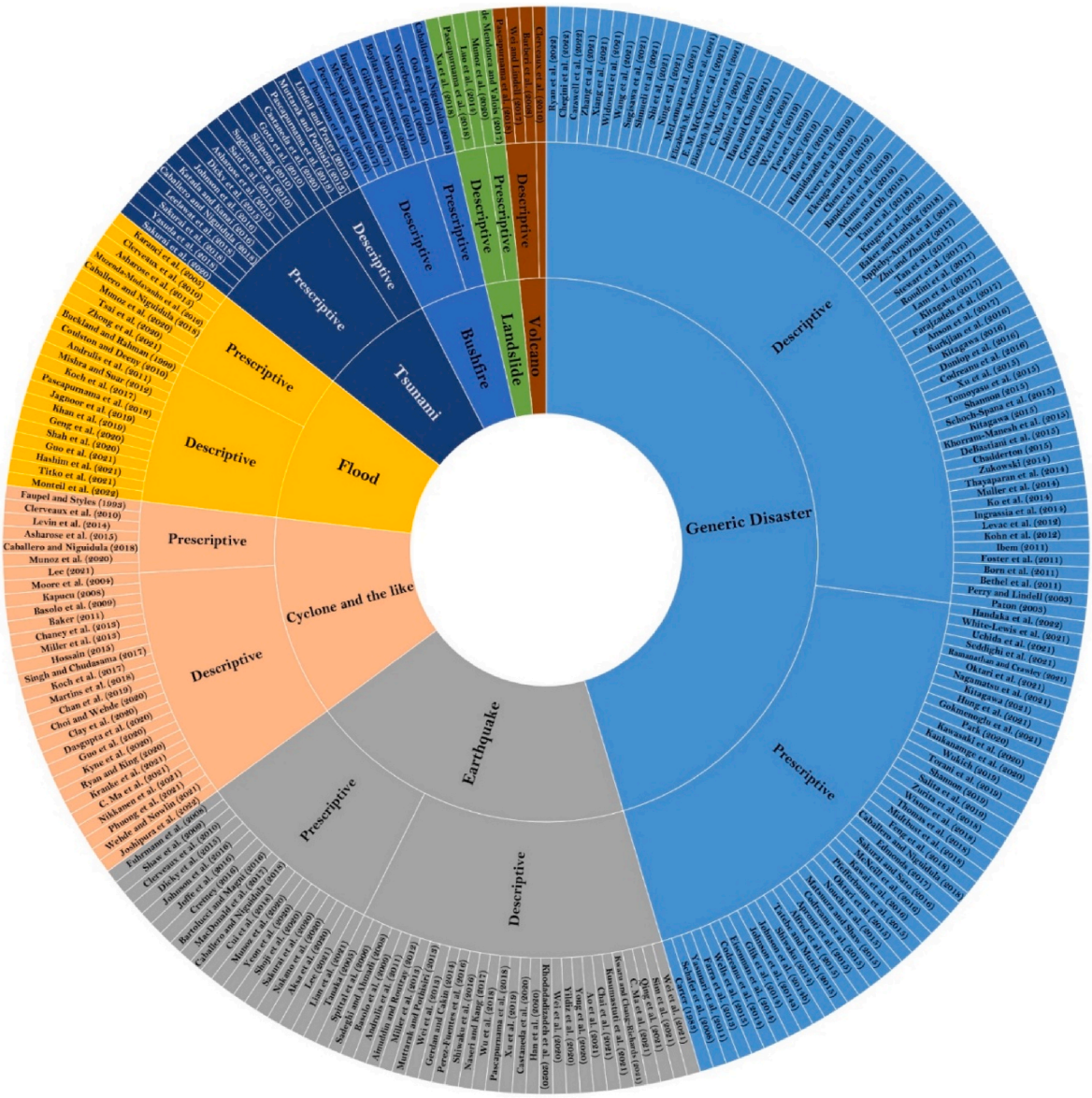

Fig. 1. Studies of disaster preparedness for all natural hazards in descriptive and prescriptive approaches.

formal education and disaster preparedness, and children and teenagers' disaster preparedness. There are various themes that are common across different natural hazards. However, certain themes within each natural hazard category have been less explored or remain uncharted, as evident from the empty cells in Table 1.

Fig. 1 classifies papers on disaster preparedness into eight categories of natural hazards, including flood, bushfire, tsunami, earthquake, cyclone and the like (including cyclone, typhoon, storm, tornado, hurricane), volcano, landslide, and generic disaster (natural hazards in general). Some papers that have investigated several specific disasters are included in multiple sections. There are descriptive and prescriptive studies for each natural hazard. According to Fig. 1, the majority of papers on disaster preparedness are generic and have not investigated individual's preparedness or tested the effectiveness of behavioural interventions or preparedness programs in relation to specific disasters. And the number of papers which specifically investigated earthquake and cyclone, and the like (typhoon, storm, tornado, hurricane) are further than other natural hazards. Despite the significant role of education and preparedness in facing natural hazards like tsunamis, volcanoes, landslides, floods, and bushfires, they are less discussed in scientific papers (Fig. 2 (a)). Papers focusing on generic disasters, earthquakes, cyclones and the like disasters, which constituted the majority of publications in the 2010s decade (middle era), continue to dominate the research in this area between 2020 and 2022 in present era (Fig. 2 (b)). It is noteworthy to refer to different eras of disaster research as the early era (1980s–2000s), the middle era (2010s), and the present era (2020s).

Individual disaster preparedness for natural hazards emerged as a relatively new area of research, with less than 20 papers

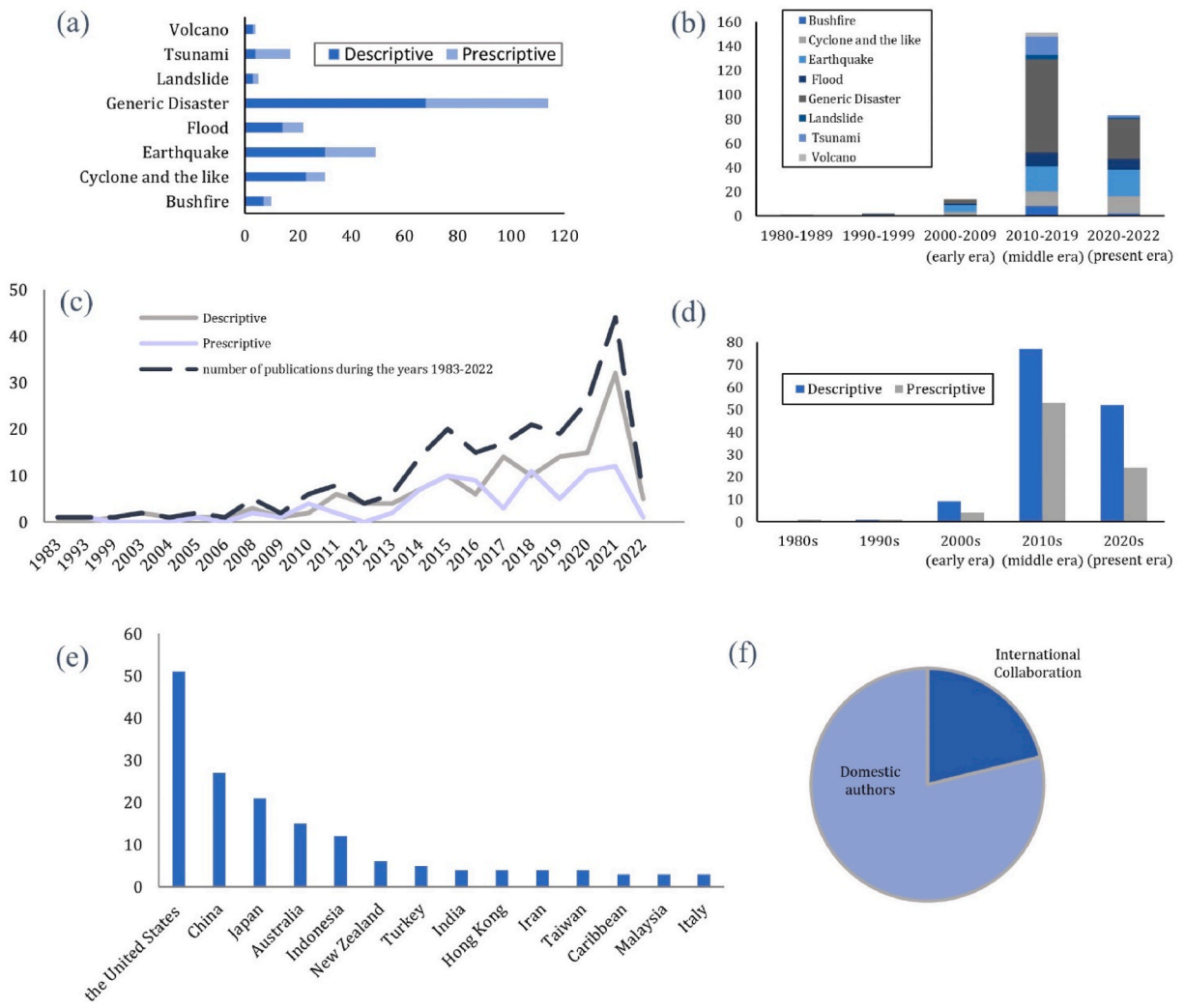

Fig. 2. Summary statistics based on the 222 studies of individual disaster preparedness. (a) the number of descriptive and prescriptive studies in each natural hazard, (b) the number of papers in each natural hazard in decades, (c) the number of descriptive, prescriptive and total studies in the 1983–2022 period, (d) the number of descriptive and prescriptive studies in decades, (e) the country of case study of papers (limited to countries with 3 or more publications), and (f) the portion of international collaboration vs domestic authors.

published before 2010.[7] However, during the 2010–2019 decade (middle era), there was a notable increase in publications. Since 2020 (present era), this field has experienced rapid growth, with the number of papers published between 2020 and 2022 exceeding half of the papers published in the entire 2010s decade (Fig. 2 (b)). Research on individual and community preparedness has been mostly descriptive, and prescriptive research has not received as much attention (Fig. 2 (d)). Prescriptive studies surpass descriptive studies only in the case of tsunamis, for all other disasters, the majority of papers are descriptive in nature (Fig. 2 (a)). Since 1983, both descriptive and prescriptive studies have experienced fluctuations in growth, with an overall upward trend (Fig. 2 (c)). The papers include case studies from 39 countries across the globe, with 5 studies conducted in Africa, 59 in America, 100 in Asia, 13 in Europe, and 21 in Oceania. Among them, the United States (51 studies), China (27 studies), Japan (21 studies), Australia (15 studies), and Indonesia (12 studies) have been the most frequent countries as case studies in the publications (Fig. 2 (e)). Only 21% of papers had international collaborations among the authors, while the remaining 79% consisted of domestic authors (Fig. 2 (f)).

Common themes were identified through the content analysis process of descriptive and prescriptive studies in individual disaster preparedness (Table 1). According to Fig. 3, the most investigated theme among all studies is measuring disaster preparedness, which shows the dominant role of descriptive studies in this research area, after that school-based training in prescriptive studies is the second most explored theme with about half of the studies in the first theme (measuring disaster preparedness theme). It is notable that all the identified themes were found to be underexplored in some natural hazards, for example measuring tsunami disaster preparedness is

[7] Obviously, there are some papers, published before 2000s, both in grey literature and academic papers that are not commonly found on the internet.

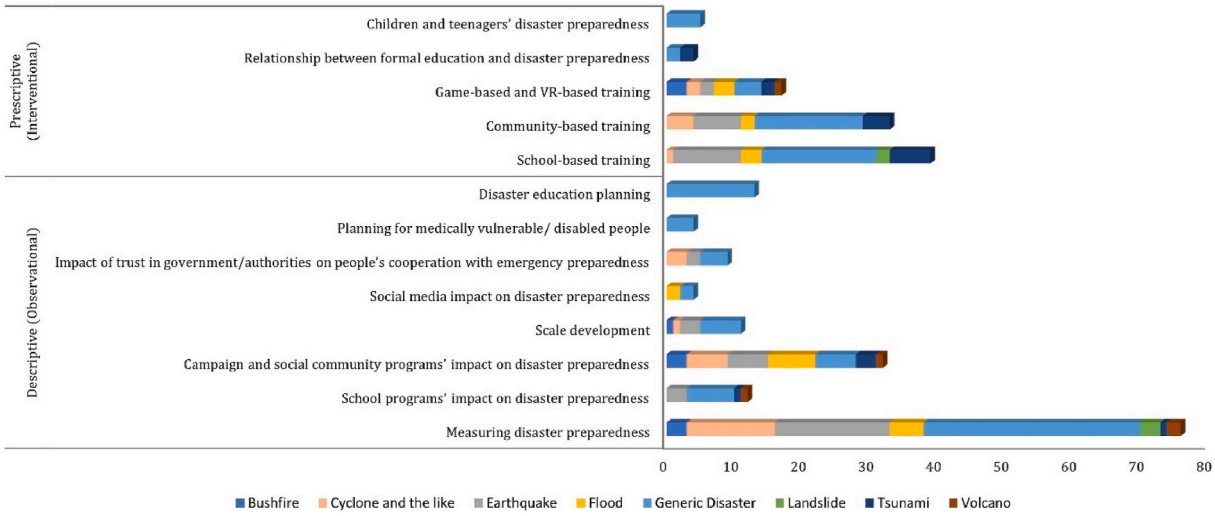

Fig. 3. The number of studies in identified categories and themes.

less discussed comparing to other natural hazards or scale development is not investigated in flood, landslide, tsunami, and volcano. Also, three themes of planning for medically vulnerable/disabled people, disaster education planning, and children and teenagers' disaster preparedness are only explored in generic disaster (not in any specific natural hazard). The absence of studies on specific natural hazards within various themes highlights knowledge gaps and underscores the need for further research in those areas.

To identify the main research themes and examine changes over time, the keywords of the 222 studied papers (as listed under the abstract section in every paper) were analysed for their frequency and co-occurrence of terms. The frequency of identified keywords represents the total number of appearances of each keyword across the keywords list of all papers, which helps determine the prominent terms in disaster preparedness literature (Fig. 4). The analysis of frequency of occurrence of keywords across all studies revealed a set of dominant terms prevalent within the disaster preparedness literature, which encompass "disaster preparedness", "disaster", "disaster education", "earthquake", "resilience", "emergency preparedness", "risk perception", "China", and "disaster risk

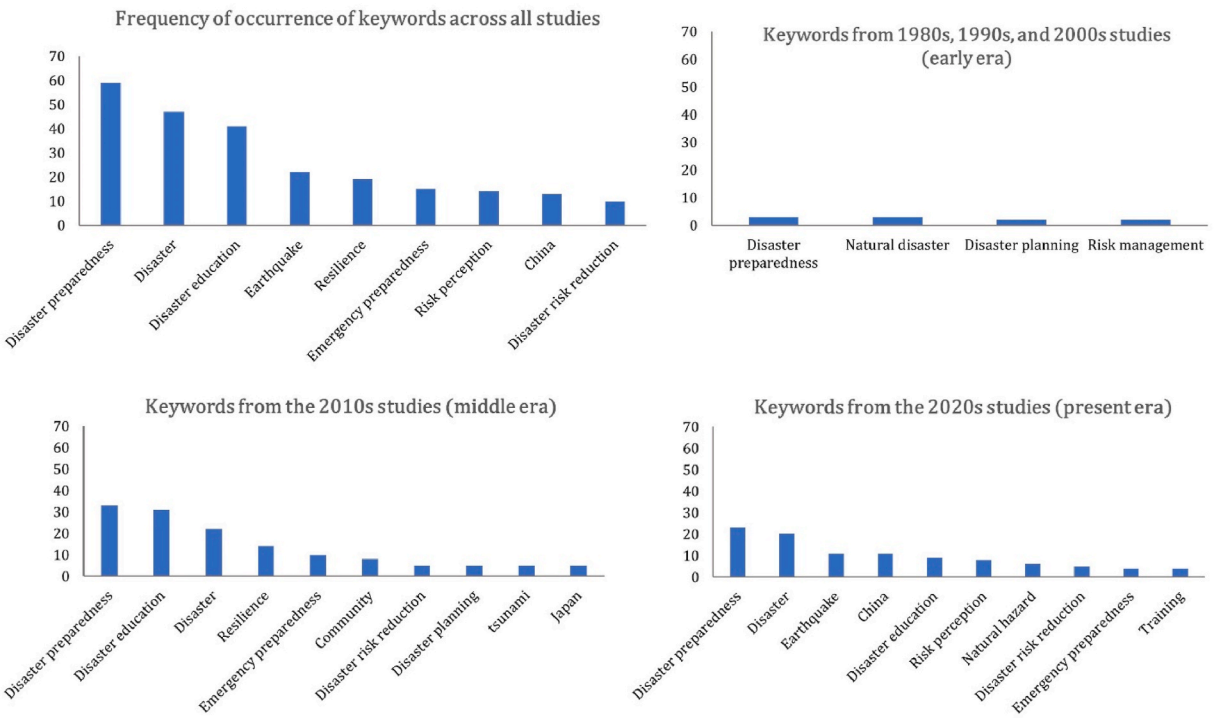

Fig. 4. Frequency of occurrence of top keywords in disaster preparedness research.

reduction". Top keywords in studies from the early era (1980s, 1990s, and 2000s) indicate a focus on disaster planning and risk management. During the middle era (2010s), themes of resilience and community emerged as recurrent, while in the present era (2020s) recurring keywords include risk perception and training (Fig. 4). This highlights the evolution of research themes over time. In addition, the keyword lists in all papers were analysed to measure how often certain terms appear together in the keywords of research papers. This indicates a connection between these terms, showing they are frequently coappear and discussed together in the context of disaster preparedness research. For instance, the terms "disaster" and "disaster preparedness" demonstrated a frequent co-occurrence. Similar co-occurrence patterns were observed between other keyword pairs, such as "disaster preparedness" and "disaster education", "disaster education" and "disaster risk reduction", "disaster preparedness" and "natural hazard", as well as "disaster preparedness" and "community resilience". This pattern of co-occurrence highlights the interconnection and close relationship between these keywords and suggests that they are often discussed in tandem within the context of disaster preparedness research.

12. Discussion

Individual disaster training has a critical role in enhancing people's preparedness for various stages before, during, and aftermath of a disaster occurrence. Individual preparedness involves equipping individuals with the knowledge, skills, and resources necessary to protect themselves and their families during disasters. It encompasses a wide range of measures, such as creating emergency plans, assembling disaster supply kits, and knowing evacuation routes. Community preparedness, on the other hand, focuses on fostering collective resilience within a community by encouraging coordination, communication, and cooperation among its members. Community and individual awareness and knowledge are essential in raising early warning awareness and understanding risk factors specific to their region. If individuals become ready, then everybody is ready in response to natural hazards. By recognising potential hazards and taking proactive measures, communities can reduce vulnerability and enhance their capacity to respond effectively.

This scoping review has explored a number of research papers relevant to individual disaster preparedness and education, which investigated different aspects of an individual's preparedness, including physical and material preparedness [101], mental health and psychological preparedness [40,139,179], and emotional preparedness [71], using a wide range of methods applicable for measuring and improving community response to natural hazards.

Descriptive studies mostly used survey to measure individuals' disaster preparedness, develop disaster preparedness scale, and investigate the factors impact preparedness such as socioeconomic factors, social communities' role, social media impact on individuals' disaster preparedness. On the other hand, prescriptive studies used interventional methods such as virtual reality (VR) and gamification, school-based disaster education, and workshop for public to improve the level of preparedness.

The first step for all educational methods would be measuring the current level of individual preparedness with the assistance of disaster preparedness scales, which provides a clear view of a particular individual/community needs as a baseline knowledge that can be used to tailor a plan in regards of enhancing the preparedness of a specific cohort of the population [99,100,180,203]. The more the scales are specialised and accurate the better they can recognise the needs and requirements of a plan for community/household/individual in response to a specific disaster. Despite the importance of scales in providing baseline data for planning educational interventions, there is a lack of comprehensive scales for evaluating people's readiness considering different circumstances through each natural hazard specifically. Also, it is necessary to incorporate additional practical aspects, such as driving conditions during evacuations, to enhance the tangibility of scales.

Followed by measuring preparedness, the second step is improving sufficient knowledge and skills for various phases, such as being prepared to analyse the situation, decision-making, and driving to evacuate during a disaster. For this purpose, we need comprehensive, accessible, user-friendly, and motivating educational methods, considering a variety of practised educational techniques for various learning styles to raise the willingness of people of all ages, languages, ethnicity, and health limitations to improve their level of preparedness. It is essential to identify the wide range of possible solutions that previous studies have employed to educate people and build a culture of disaster preparedness in various communities. A variation in culture (such as a museum-based hazard education program studied by MacDonald et al. [95]), environment (such as the impact of different geographical places like plain, mountain, and plateau on individual disaster preparedness by Guo et al. [23]), design (such as tsunami height poles studied by Sugimoto et al. [55]), community, economy, or government can led a disaster preparedness approach. For instance, the museum-based disaster preparedness demonstrates an example of how cultural events can impact individual preparedness, also the influence of geographical and environmental factors is evident in different needs of people based on their location, and the tsunami height poles illustrate how design can enhance the level of individual disaster preparedness. Each individual/community has unique needs and characteristics that must be considered when selecting effective educational methods to achieve higher levels of disaster preparedness.

Currently, the bulk of research in this domain has concentrated on the impact of individual/household education and training for single-type disasters. However, there is a significant need for further investigation into how community-level preparedness can address scenarios where multiple natural disasters strike in close temporal succession, such as a flood followed by a landslide, or an earthquake followed by a tsunami. Addressing the challenge of preparing communities for such compound multi-event natural disasters reveals intricate research gaps that require attention.

The complex and holistic nature of educating individuals in this area, should be considered in any planning for disaster risk reduction at local, national, regional, and global levels. Aligned with the goals of this research, the Sendai framework for disaster risk reduction has emphasised on a people-centred approach in promoting the disaster risk knowledge, disaster preparedness and education and mentioned different aspects of it [4]. However, it lacks formulating an integral and clear mechanism for education, monitoring and evaluation, that works for all levels and scales while being flexible in considering various needs of different communities, also it overlooked the difference between different natural hazards and the need for specific measures and plans for each of

them. An all-inclusive mechanism for disaster risk reduction will need to be able to measure the characteristics of a community and its potentials to improve the level of disaster preparedness in response to a specific natural hazard. Also, a holistic knowledge about the implementation organizations and regular reassessment are necessary to ensure the plans will be executed smoothly and effectively. The plans should be monitored regularly and be always open to a change.

Schools, universities and local communities have the potential to play an essential role in training individuals by introducing good resources and practices to increase individuals' knowledge and skills in response to a natural hazard. Disaster preparedness teaching materials can be integrated into various school's courses curricula, such as science, geographic education, geology and earth science, and health education [25,51,86,93,94,210]. Students are able to convey the preparedness lessons to their family members and the whole community [159]. Considering this underlying potential, as Sakurai et al. [54] mentions children can be regarded as "agents of change" to make a disaster-resilient community. On the other hand, organising local campaigns and workshops with different methods could help train individuals, especially adults and vulnerable members of neighbourhoods [10,12,104,110], including individuals with limited English abilities [176], ethnic groups [103], gender differences [182,183,221], individuals with activity-limiting disabilities [111], individuals with health diseases [109], rural population [217], and low-income people [149,216]. Implementation of more local projects and activities could lead to upgrading the whole community disaster preparedness level. Furthermore, schools and the community should contribute to raising the level of individual preparedness. The relationship between community, family, and school should be strengthened by combining theoretical and practical activities to promote disaster awareness and skills [141,163,170].

Furthermore, enhancing the role of volunteers in local communities, leveraging their unique knowledge of their areas, along with their proximity to facilitate easy communication and influence on local people, can be a game-changer in disaster preparedness and education, leading to sustainable and resilient communities. This represents a critical roadmap with significant advantages to elevate the level of preparedness among communities in a feasible and short timeframe. However, their role in disaster preparedness and education have not received the attention it deserves, highlighting a significant need to bridge this knowledge gap. While existing studies, such as Lee [76], have explored the positive relationship between being a member of a voluntary association and higher levels of individual preparedness, there remains a lack of research specifically addressing volunteers' contributions in facilitating disaster preparedness education and training.

Community volunteers, armed with their commitment and local insight, can serve as instrumental agents in different stages of disaster preparedness, including disseminating the latest knowledge and education, hosting community awareness workshops, and conducting training sessions to educate people for various stages before, during and after a disaster. Their unique position makes them the most knowledgeable consultants for planning integrated and effective interventions tailored to local contexts. Beyond amplifying educational efforts, volunteers enhance people's motivation and provoke proactive behaviour among individuals and communities. This proactive engagement translates into a smooth bottom-up approach in disaster planning and education, increasing individual preparedness, and contributing to community self-resilience in disaster preparedness and education. As schools, universities, and local communities contribute to training individuals through various methods and initiatives, the involvement of community volunteers becomes imperative to fast-track achieving the not easily reachable goal of disaster preparedness among communities.

Also, social media and trust in government have impacts on individuals' willingness to participate in training programs. Social media can disseminate useful information and encourage volunteers to contribute to programs and apply the preparedness measures to respond to a disaster. In regards to trust in government, and organisational identification [227], individuals with a high degree of confidence in authorities show more willingness to participate in preparedness activities and follow the rules that announced by authority [200]. However, this influence on individuals' behaviour and useful strategies and practices is less investigated.

Disaster preparedness is not a short-term process of transferring knowledge, it requires long-term systematic planning for promoting relevant skills by designing refresher courses and regular knowledge-based and action-oriented individual assessments. Long-term disaster preparedness assessment is essential in contrast to the dominant paradigm of short-term knowledge-transfer, using pre-post-test survey methods in the literature, to evaluate if the interventions are effective and helps to enhance people's proactive behaviour in the long run [89,98]. As the majority of studies tend to investigate short-term educational interventions and their impact on increasing the knowledge and preparedness behaviour of participants, the potential of each program/educational method in enhancing long-term preparedness is unknown and overlooked. Longitudinal studies could provide insights into the long-term effects of training and awareness programs, shedding light on the sustainability of preparedness efforts over time. Disaster training should be considered a long-term process to ingrain disaster preparedness into the culture and life of people. By empowering individuals and communities to take proactive measures and fostering a culture of preparedness, we can collectively work towards reducing the devastating impacts of natural hazards and building more resilient societies. Further investigation is also needed to identify the most effective methods for promoting individual and community preparedness, understanding the psychological factors influencing the uptake, and developing tailored training programs. Moreover, research should further explore the role of technology and social media in disseminating information and mobilising communities prior to and during emergencies.

13. Conclusion

In this study, disaster preparedness in response to natural hazards have been examined through two categories of studies: descriptive and prescriptive. A total of 222 papers on disaster preparedness were reviewed and classified into two categories, each exploring various themes. Descriptive studies primarily centre on measuring individual preparedness, facing a significant challenge due to the lack of specific disaster preparedness scales for different natural hazards. Conversely, prescriptive studies aim to enhance preparedness and encounter the challenge of developing tailored educational methods and plans based on identified needs and

weaknesses. Notably, prescriptive studies are less prevalent than descriptive ones, highlighting a pressing need for increased focus on improving disaster preparedness. While various themes have been identified within both descriptive and prescriptive studies across different natural hazards, numerous areas remain underexplored. Addressing these knowledge gaps through research in neglected areas is essential for the development of disaster preparedness as an emerging and vital field. The diversity of themes and methodologies applied in various natural hazards serves as a valuable source of ideas to cross-fertilise insights from one natural hazard to build new methods or research themes in another.

Formulating an integral and clear mechanism for long-term education, monitoring, and assessment of disaster preparedness is recommended for sustained progress. Additionally, an essential avenue for exploration involves investigating the role of voluntourism in building resilient communities. Focused attention on how communities can autonomously foster resilience through education initiatives would substantially advance our understanding of holistic disaster preparedness strategies. This underscores the need for more in-depth investigations into community-based volunteerism, particularly in the context of education for disaster preparedness.

Future review papers are recommended to assess the overall effectiveness of specific areas such as school-based disaster preparedness, community-based disaster preparedness, scale development, and disaster preparedness of specific groups such as children and teenagers' disaster preparedness, medically vulnerable/disabled people disaster preparedness, and conduct meta-analysis on different educational methods.

CRediT authorship contribution statement

Sara Fazeli: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Milad Haghani:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Mohammad Mojtahedi:** Writing – review & editing, Supervision, Project administration, Investigation. **Taha H. Rashidi:** Writing – review & editing, Supervision, Resources, Project administration, Investigation, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix Table. Comprehensive details of papers and key findings in chronological order from 1983 to 2022

No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
1	Carter [213]	generic disaster		*					-emphasises on the importance of compatibility between the resources within a given country and appropriate training programmes
2	Faupel and Styles [75]	cyclone combine		*	the United States	adults in South Carolina	telephone interview		As disaster education increases cognitive awareness of potential dangers and raises expectations for disaster response, - both physiological and psychological stress levels were higher in the trained group than in the general sample. Possible reasons for these unexpected

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									findings are discussed.
3	Buckland and Rahman [169]	flood	*		Canada	rural communities in Manitoba			-flood disaster response was more effective in communities with higher degrees of physical, human and social capital.
4	Paton [202]	generic disaster	*						-proposes a social cognitive disaster preparation model
5	Perry and Lindell [201]	generic disaster	*		the United States			reviews community preparedness guidelines	-provides ten guidelines for planning against environmental threats based on preparedness literature for natural and technological disasters
6	Moore et al. [68]	cyclone combine	*		the United States			qualitative participatory research	-presents a qualitative evaluation of "Health Works After the Flood" and connects them to conceptualizations of social capital.
7	Tanaka [84]	earthquake	*		the United States -Japan				-developed an index of individual's readiness in response to earthquakes
8	Karanci et al. [32]	flood		*	Turkey		survey	Regression analysis	- the training program increased participant's disaster expectation, worry, loss estimation, and preparedness behaviours.
9	Spittal et al. [166]	earthquake	*		New Zealand	residents of Wellington	survey		-develops and validates an earthquake readiness measure
10	Kapucu [152]	cyclone combine	*		the United States	Central Florida residents	mail survey		-nobody is ready if individuals are not prepared, then. -despite considerable experience with disasters, households are prone to complacency.
11	Sadeghi and Ahmadi [77]	earthquake	*		Iran				-training programs should include psychosocial interventions to prepare first responders mentally for emergencies
12	Fuhrmann et al. [93]	earthquake		*	the United States				-explains how disaster preparedness can be incorporated into school geography lessons based on the National Geography Standards

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
13	Schafer et al. [130]	generic disaster		*					-community preparedness includes collaborative efforts, local details, local culture, geographical information, and emergency plans
14	Barberi et al. [45]	volcano	*		Italy	population residing near Vesuvius	questionnaire survey		-individuals are interested to engage in the public discussion of emergency planning and preparedness with scientists and civil protection officials
15	Basolo et al. [72]	Earthquake/ cyclone combine	*		the United States	Los Angeles and New Orleans households	survey	Regression analysis	-the perception of preparedness was positively correlated with trust in local government's ability to deal with disasters and exposure to preparedness information
16	Shaw et al. [167]	earthquake		*	Japan				-a proactive co-learning approach is the key to disaster education's success. It links schools and formal education with community.
17	Clerveaux et al. [34]	cyclone combine/ earthquake/ flood/ volcano		*	Caribbean	children in multicultural societies			-validates the "Disaster Awareness Game (DAG)", a tool for promoting disaster awareness among children in multicultural societies.
18	Coulston and Deeny [21]	flood	*		the United Kingdom	residents at risk of flooding in two towns	questionnaire survey		-as a result of recent exposure, individuals are better prepared for major flooding 18 months after the event.
19	Lindell and Prater [223]	tsunami	*		the United States	key informants in six coastal communities	interview		-proposes research recommendations on perception and risk communication
20	Goto et al. [56]	tsunami		*	Indonesia	teachers, volunteers, and students in Banda Aceh	questionnaire survey		-analyses two original disaster education methods from Japan for their applicability. -the lack of quality education materials is the biggest obstacle in the popularisation of disaster education.
21	Siripong [58]	tsunami		*	Thailand				-by understanding the scientific characteristics of natural hazards,

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									people can defend themselves from them and mitigate their impacts.
22	Sugimoto et al. [55]	tsunami		*	Indonesia		questionnaire survey and field observation		−85 tsunami height poles have been brought from the outside to Banda Aceh city to help people remember the tsunami over a longer period of time.
23	Andrulis et al. [24]	Bushfire/ earthquake/ flood	*		the United States	racially/ ethnically diverse communities in California	key informant interviews		- socioeconomic status, trust, culture, and language are barriers faced by individuals preparing diverse communities, and inadequate support for culturally/ linguistically appropriate initiatives is a barrier faced by organizations.
24	Baker [60]	cyclone combine	*		the United States	Florida households	telephone interviews		-most households report being prepared to survive on their own for at least three days after a disaster.
25	Bethel et al. [109]	generic disaster	*		the United States	Medically vulnerable population	"Behavioural Risk Factor Surveillance System (BRFSS)" data	descriptive statistics	-it was generally more likely for vulnerable population to possess medication supplies than household preparedness items.
26	Born et al. [197]	generic disaster	*						-A more robust disaster education program for civilian responders would promote disaster preparedness.
27	Foster et al. [172]	generic disaster	*		the United States	adults at six regional dialysis centres	survey questionnaire	chi-squared test	-due to a lack of dialysis-specific disaster preparedness, dialysis patients were not adequately prepared to shelter in place or evacuate when a disaster struck.
28	Ibem [198]	generic disaster	*		Nigeria	academics and practitioners	questionnaire survey		-presents experts' and key stakeholders' perceptions on disaster vulnerability reduction, which can be used as a guide to address the challenges

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
29	Yasunari et al. [214]	generic disaster		*	Japan	pregnant women	questionnaire survey	comparing the intervention group vs control group	-for primiparous women without disaster experience, the education effect was statistically significant, so the program should be tailored to this group of women.
30	Said et al. [226]	tsunami		*	Malaysia		focus group discussion/ survey	tsunami education through lectures and workshops	-a tsunami evacuation plan was tested with a drill.
31	Ainuddin and Routray [5]	earthquake	*		Pakistan		interviews and group discussions		-local communities should be strongly prepared for disasters by the implementation of disaster management authorities' projects and activities.
32	Mishra and Suar [22]	flood	*		India	areas with high risks of floods and heatwaves	questionnaire survey		-disaster education plays the role of a partial mediator between anxiety and flood preparedness and also a full mediator between anxiety and heat-wave preparedness.
33	Kohn et al. [203]	generic disaster	*					systematic literature review	-disaster preparedness requirements and vulnerabilities differ among various populations, households, and individuals.
34	Levac et al. [173]	generic disaster	*		Canada			literature review on household preparedness	-preparation for disasters is a complex process involving many factors such as health, self-efficacy, community support, and disaster characteristics
35	Chaney et al. [61]	cyclone combine	*		the United States		questionnaire survey		-hazard adjustment adoption was not significantly influenced by locus of control or past experience.
36	Miller et al. [85]	cyclone combine/ earthquake	*		the United States		survey		-develops a set of metrics based on Vested Interest theory (VI) and the "extended parallel process model of fear appeals (EPPM)" to evaluate individual disaster preparedness
37	Muttarak and Pothisiri [59]	Earthquake/ tsunami	*	*	Thailand	Andaman coast residents	survey and interviews	partial proportional odds model	- a community with a higher percentage of women with at least a secondary

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									education is more likely to be prepared for disasters.
38	Wei et al. [78]	earthquake	*		China		questionnaire survey		-low educational levels and economic development limit public response capabilities
39	Farra et al. [144]	generic disaster		*	the United States	nursing students	questionnaire survey	generalized linear model, independent and paired t-tests	-using "virtual reality simulation (VRS)", disaster training learning outcomes and retention reinforced and improved.
40	Wells et al. [131]	generic disaster		*	the United States				-knowledge sharing through community-partnered participatory research was an effective framework for planning a "community resilience (CR)" initiative.
41	Levin et al. [154]	cyclone combine		*	the United States			collaborative learning, a function-based assessment tool	-"Community Human Service Organizations' (CHSO's)" staff have expertise and knowledge in providing assistance with their clients' personal preparedness planning.
42	Gerdan and Cakin [155]	earthquake	*		Turkey	personnel & students of Kocaeli University	online questionnaire		-highlights the role of formal education in promoting students' awareness levels
43	Ingrassia et al. [123]	generic disaster	*		the European Union		existing disaster management training programs		-the development of a standardized competency-based training program suitable to be used across all European countries is needed.
44	Ko et al. [174]	generic disaster	*		the United States		"Behavioural Risk Factor Surveillance System (BRFSS)" data	Chi-square statistics	-generally, people with diabetes, cardiovascular disease, and asthma were not better prepared for natural hazards than those without
45	Muller et al. [175]	generic disaster	*		the United States	Faith-based organizations (FBOs)	survey and semi-structured interviews	thematic analysis	-faith-based organizations require interventions to enhance disaster preparedness and resilience.
46	Thayaparan et al. [124]	generic disaster	*			higher education institutions (HEIs)			-disaster management education is limited by the bureaucracy of higher education institutions.

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
47	Zukowski [191]	generic disaster	*		the United States		quantitative survey	multiple, hierarchical, and robust regression	-response and recovery performance outcomes can be estimated by factors including planning prior to the event, engaging the community, conducting full-scale exercises, and utilising national frameworks.
48	Codreanu et al. [141]	generic disaster		*		teenage population		systematic literature review	-school, family, community, and self-education programs should combine theoretical and practical activities to achieve the best disaster education results.
49	Eisenman et al. [215]	generic disaster		*	the United States		survey	Pre-test post-test method with control group design	-evaluates the "Los Angeles County Community Disaster Resilience (LACCDR)" Project, which is a public health initiative designed to increase community resilience to disasters.
50	Glik et al. [216]	generic disaster		*	the United States		survey	household education intervention	-the use of media-based communication motivates disadvantaged households to get disaster supplies
51	Johnson et al. [140]	generic disaster		*		children		literature review	-the effect of disaster education on children's self-protective skills and their roles in household preparedness are not well studied through empirical research.
52	Johnson et al. [7]	generic disaster		*	New Zealand	primary schools	a focus group study and survey of schools		-assesses the "What's the Plan, Stan?" framework for curriculum-based teaching. - between the promotion of resources and teachers' awareness of the resources, word of mouth among teachers and proactive lesson planners plays a major role.
53	Shiwaku [133]	generic disaster		*	Armenia and Japan	school teachers		comparison of teacher training programs	-analyses similarities and differences between Japan's and Armenia's school

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									disaster management and teacher training
54	Luo et al. [47]	landslide	*		Taiwan	households in debris-flow-prone areas	structured survey and interviews		-educating communities about hydro-meteorological disasters is a vital part of improving their response behaviour.
55	Gibbs et al. [41]	bushfire	*		Australia		Country Fire Authority data	economic analysis of the "Community Fireguard Program (CFG)"	-estimates a ten-year cost-benefit analysis, assuming the CFG learnings will last ten years, and each region faces a 10-year bushfire risk.
56	Hossain [62]	cyclone combine	*		Bangladesh	cyclone-prone areas of southwestern coastal villages	questionnaire, interviews, and field observation	descriptive and inferential statistics	-households with easy access to cyclone shelter, regular cyclone forecasts, and disaster preparedness measures are significantly less vulnerable to cyclones.
57	Asharose et al. [33]	cyclone combine/ tsunami/ flood		*	India	community members	questionnaire	workshop training	-stresses that awareness generation is a long-term process. -sustainable educational programs and projects are important so that disaster risk reduction becomes ingrained in people's everyday life and culture.
58	Dicky et al. [51]	Earthquake/ tsunami		*	Indonesia	children around geological hazard prone areas	school visit		-highlights the importance of introducing earth science for school communities through three areas: disaster education, disaster response, and earth science knowledge.
59	Chadderton [204]	generic disaster	*		Germany		interview data	analysis of archival materials, websites, and academic literature	-analyses disaster preparedness and education in Germany in response to national emergencies.
60	DeBastiani et al. [176]	generic disaster	*		the United States		"Behavioural Risk Factor Surveillance System (BRFSS)" data		-community-based preparedness education campaigns which targeted at vulnerable population with limited English proficiency helps to enhance household

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									disaster preparedness.
61	Khorram-Manesh et al. [205]	generic disaster	*		The European Union's (EU)				-improving intercultural and interagency disaster management performance requires a standard European course.
62	Kitagawa [125]	generic disaster	*		Japan			historical description of continuity and change	-emphasises the complexities and two-dimensional nature of disaster education, which includes disaster science and disaster life skills.
63	Schoch-Spana et al. [192]	generic disaster	*		the United States		web-based questionnaire	multivariate analysis	-recommends institutions that integrate community engagement into public health emergency preparedness objectives, employ skilled staff, utilise the existing community-based organizations' support, and align budgets with community priorities.
64	Shannon [9]	generic disaster	*		the United States		survey		-it is necessary to educate local citizens about the methods they can use to support their personal disaster preparedness.
65	Tatebe and Mutch [126]	generic disaster		*		schools, children and young people	reports and journal articles	literature review	-identifies common themes and several research gaps about the role of education in DRR and emphasises the complexity of this research area due to the variety of purposes, audiences, and perspectives.
66	Tomoyasu et al. [127]	generic disaster	*		Japan		governmental training programs	cluster analysis	-using cluster analysis, classifies disaster education programs into four categories.
67	Xu et al. [99]	generic disaster	*		China	Heilongjiang province residents	questionnaire survey	multivariate logistic regression model	-exposing to education and awareness-raising programs do not significantly predict emergency preparedness.
68	Alfred et al. [228]	generic disaster		*		nursing schools			-an overview of the tools used by nurse educators to incorporate disaster education into

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									nursing classrooms and clinicals.
69	Apronti et al. [6]	generic disaster		*	Ghana	basic school in rural communities of northern Ghana	interviews and questionnaires	content analysis of syllabus and field observation	-despite the theory outlines innovative methods of teaching and evaluating DRR lessons, there are a number of challenges to use these methods in practice in the classroom.
70	Codreanu et al. [206]	generic disaster		*	Australia	high school students	questionnaire	logistic regression analysis	-disaster related discussions of students with their family and friends can be considered as an indicator of proactive behaviour change in disaster preparedness which is influenced by disaster training, age, gender, and country of residence examines
71	Matsuura and Shaw [207]	generic disaster		*	Japan		survey		-prior to "East Japan Earthquake and Tsunami (EJET)", the school-community linkage played a critical role in residents' ability to respond and react to the disastrous event.
72	Nouchi et al. [14]	generic disaster		*	Japan	primary school students	survey		-develops a disaster education package and assesses its benefits in preventing and mitigating disasters.
73	Oktari et al. [134]	generic disaster		*	Indonesia	schools in Banda Aceh city	questionnaire survey and focus group	qualitative and quantitative methods	-proposes the "School-Community Collaborative Networks (SCCN)" model, which promotes community engagement in disaster education and helps individuals in making correct decisions to save their lives.
74	Pfefferbaum et al. [132]	generic disaster		*					-identifies and compares the foundation, method, and implementation of six interventions to enhance community resilience.
75	Perez-Fuentes et al. [42]	Bushfire/ earthquake	*		the United Kingdom	earthquake and fire disasters preparedness campaigns		content analysis of the preparedness campaigns'	-public education through merely providing some information about

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
								design and theoretical background	risk and safety skills is not enough to influence individual preparedness behaviours. -disaster preparedness campaigns are generally not evaluated and therefore their success cannot be determined.
76	Shiwaku et al. [163]	earthquake	*		Japan	schools in the Kesennuma city	SDRA (school disaster resilience assessment)		-illustrates the importance of strengthening ties between school and community and increasing stakeholder participation through the application of SDRA in 31 schools.
77	Johnson et al. [52]	Earthquake/ tsunami		*	the United States -New Zealand	children		evaluates theory matrix and stage step models.	-describes the benefits of using program theory models to evaluate disaster education programs for children.
78	Joffe et al. [89]	earthquake		*	the United States -Turkey	communities with high seismic risk	survey		-describes the logical basis and method of "fix-it" study, a longitudinal, cross-cultural intervention that aims to improve earthquake and home fire preparedness.
79	Cretney [90]	earthquake		*	New Zealand		in-depth qualitative interviews		-analyses a grassroots organisation to outline how pre-disaster community activity facilitates social support and social learning
80	Bartolucci and Magni [88]	earthquake		*	Italy		questionnaire		-proposes a decision flow chart that is useful to design educational programs aimed at improving survivors' adapting capacity.
81	Muzenda-Mudavanhu et al. [29]	flood		*	Zimbabwe	Children in Muzarabani	interviews and focus group discussions		-being concerned and aware that they are at risk does not guarantee that children are ready to face disasters or will actively involve in risk reduction activities.
82	Codreanu et al. [117]	generic disaster	*		Australia	high school students	questionnaire survey	Regression analysis	-disaster reduction education needs to be delivered in a variety of channels

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									and methods and should include materials which teenagers are more likely to interact with.
83	Dunlop et al. [193]	generic disaster	*		the United States	emergency management agencies	semi structured interview	thematic analysis	-examines how academic institutions and public health and emergency management leaders perceive the barriers and facilitators of effective collaboration for disaster preparation and response.
84	Kitagawa [128]	generic disaster	*		Japan				-discuss a prevalent policy discourse in Japan known as the four forms of aid in disaster preparedness– public aid, self-help, mutual aid.
85	Kurkjian et al. [177]	generic disaster	*		the United States		interview		-most households reported they had a prepared plan for emergency evacuation, a first aid kit and water supply for three days. -In an emergency, 65% of households rely on television as their primary source of information.
86	Kawai et al. [145]	generic disaster		*					-develops a “game-based evacuation drill (GBED)” system using “augmented reality (AR)” materials on a tablet computer.
87	McNeill et al. [217]	generic disaster		*	the United States	rural people in east Texas			-evaluates the self-reported individual preparedness prior to and after being exposed to the Ready Campaign’s and the Texas "Ready or Not?" Campaign’s training materials.
88	Sakurai and Sato [16]	generic disaster		*	Japan				-stresses the importance of a comprehensive approach to school safety, which includes disaster management, disaster risk reduction training, and learning environment safety.
89	Katada and Kanai [224]	tsunami		*	Japan	children in Kamaishi			-explores the disaster prevention

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									education based on "Kamaishi Miracle" story that made the appropriate evacuation of the children possible.
90	Ingham and Redshaw [37]	bushfire	*		Australia	vulnerable residents	interviews and focus groups discussion		-a collaborative plan by local emergency planning committees and community services is needed for vulnerable members of the community that are not able to take an active role in bushfire preparation.
91	McNeill and Ronan [38]	bushfire	*		Australia	residents of wildfire-prone areas	survey		-compares households with young children and households without children regarding their property's preparedness, perceived difficulty and time to prepare, and preparation motivation.
92	Singh and Chudasama [63]	cyclone combine	*		India	residents of Ganjam and Puri districts		simulation-based "fuzzy cognitive mapping (FCM)"	-based on communities' perceptions, captures economic, ecological, and social effects of cyclones to provide policy makers and planners with options to strengthen disaster preparedness.
93	Naseri and Kang [86]	earthquake	*		Afghanistan	high school students in 13th district, Kabul	questionnaire survey		-recommends that school courses include disaster prevention training and information on disasters be shared in parent council meetings.
94	MacDonald et al. [95]	earthquake		*	New Zealand	students, teachers, and parents	questionnaire	pre- and post-test for museum-based program	-a museum-based earthquake education program is an effective way to increase school and household discussions about disaster preparedness and can stimulate preparedness actions that will ultimately result in protecting lives and property.
95	Koch et al. [69]	Flood/ cyclone combine	*		the United States	Community-based organizations (CBOs)	Interview, table-top exercise and focus group meetings		-the use of one-size-fits-all disaster plans is not effective and community assets incorporation is essential but is

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									restricted by community-based organisation's operational limitations.
96	Anson et al. [195]	generic disaster	*			Red Cross Red Crescent and humanitarian actors	semi-structured Skype interviews and online survey		-the reasons for not using social media analysis tools were related to seven categories of barriers affecting the user and the tool: language, culture, value, financial, human resources, data, and technology.
97	Farajzadeh et al. [178]	generic disaster	*		Iran	nurses of two hospitals in Saqqez	a cross-sectional questionnaire survey		-recommends that nurses receive continuous disaster preparedness training in an appropriate and motivating environment.
98	Kitagawa [129]	generic disaster	*		Japan			a conceptual discussion	-conducts a conceptual discussion to find out how and why the two fields of 'disaster preparedness' and 'public pedagogy' are associated
99	Lam et al. [100]	generic disaster	*		Hong Kong	residents aged 18 years and above	survey and interview	multiple logistic regression	-develops a 19-item questionnaire that measures respondents' preparedness knowledge and behaviour.
100	Roudini et al. [179]	generic disaster	*					a systematic review	-recognises that most countries lack community mental health preparedness for natural hazards.
101	Stewart et al. [17]	generic disaster	*		Peru	vulnerable communities in Trujillo	survey	data analysis by the Research Electronic Data Capture database	-emphasises on the preparedness of vulnerable communities in terms of having evacuation plans, and emergency food, water, and medical supply.
102	Tan et al. [118]	generic disaster	*		China	university students in southern China	questionnaires survey		-a systematic disaster course including refresher drills every semester is required to promote the universities' disaster education system.
103	Edmonds [142]	generic disaster		*		autistic children			-reports a project aiming to design emergency preparedness education materials for autistic children

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
104	Zhu and Zhang [188]	generic disaster	*		China	students and teachers	questionnaire survey	descriptive and qualitative	-evaluates the outcome of considering more attention to disaster training in Chinese schools following the Wenchuan major earthquake.
105	de Mendonca and Valois [49]	landslide		*	Brazil	a public school in Niteri, Rio de Janeiro	survey		-develops a disaster education methodology for landslides which promotes interactive and participatory learning.
106	Wei and Lindell [46]	volcano	*		the United States		mail survey		-future research should investigate three distinct dimensions of community hazard adjustment: perceived community preparedness, household emergency preparedness, and perceived adequacy of emergency preparedness.
107	Thompson et al. [39]	bushfire	*		Australia	households threatened by fire events in SA	semi-structured interviews		-provides insights into equestrian cultures, particularly regarding plans, pre-emptive relocations, behavioural changes, and Australia's horse community
108	Caballero and Niguidula [35]	bushfire/ cyclone combine/ tsunami/ earthquake/ flood/ generic disaster		*	Philippines		focus group discussion/ interview/ controlled experiment	storyboard technique and object prototyping	-develops a simulated emergency preparedness and disaster risk management education to facilitate disaster awareness training programs for proper disaster response.
109	Martins et al. [64]	cyclone combine	*		the United States	residents of New York city across all five boroughs	telephone survey	factor analysis	-household preparedness is most strongly predictable by social network support and level of confidence in local government.
110	Wu et al. [156]	earthquake	*		China	all 31 provinces of China	survey	Linear regression and logit regression models	-material and awareness preparedness are consistently predictable by level of concerns for disaster risk reduction and building safety, and contribution in public affairs.

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
111	Pascapurnama et al. [25]	Earthquake/ flood/ landslide/ tsunami/ volcano	*		Indonesia		Indonesia Disaster Data and Information (DIBI) http://dibi.bnpb.go.id/	Comprehensive literature review	-reviews eight major natural hazards occurred in Indonesia and their following infectious disease outbreaks and emphasises the importance of incorporating health training in schools' curriculum and community-based disaster risk reduction plans.
112	Cui et al. [91]	earthquake		*	China	a post-disaster rural community in Yingxiu	Survey	linear regression analysis	-residents' perception of community resilience was positively associated with their volunteering activities for disaster risk reduction, receiving geological disaster training, participating in evacuation drills, and reporting higher levels of income.
113	Appleby-Arnold et al. [181]	generic disaster	*		the island of Malta		survey	quantitative and qualitative	-shared local people values, everyday experiences, local memories in risk communication strategies and behavioural guidelines should be integrated to encourage residents' disaster preparedness.
114	Baker and Ludwig [199]	generic disaster	*		the United States	staff and students at Earthquake University in Southern California	interviews/ observation and archival analysis of related documents	a systematic and comparative approach	-the paradigm of preparedness needs to be re-framed to reflect the reality of public behaviour more accurately during such events.
115	Kruger et al. [12]	generic disaster	*		the United States	people with disabilities			-investigates the United States' guidelines on disability inclusion in emergency preparedness.
116	Tam et al. [180]	generic disaster	*		Hong Kong		telephone survey	multiple logistic regression models	-tailored preparedness training programs should be designed to target specific needs of communities.
117	Uhm and Oh [189]	generic disaster	*		South Korea	childcare and preschool teachers	questionnaire		-field-based disaster preparedness education for teachers can help them regarding disaster response in various types of

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									disasters, times, and locations.
118	Feng et al. [19]	generic disaster		*				discussion and synthesis of literature	-disaster resilience within a community can be developed using informal training through everyday work-related activities, family life, or leisure.
119	Midtbust et al. [13]	generic disaster		*		Children and adolescents			-disaster preparedness related activities and parental support should be considered as a complement to information-based strategies. -Whether awareness and attitudes changes results in changes in actual behaviour needs further investigation.
120	Thomas et al. [218]	generic disaster		*	the United States	CDC staff and public health workers	Ready CDC	McNemar's chi-square test and Wilcoxon analysis	-interventions should be tailored based on the individual stage of preparedness to optimise the potential for desired behavioural changes.
121	Wisner et al. [143]	generic disaster		*		youth and children		reviewing multi-disciplinary literature	-natural hazards may be misunderstood by young people since the environment in which children grow up is becoming increasingly urban, with less exposure to nature and more reliance on tech-related systems
122	Zurita et al. [219]	generic disaster		*	Australia				-explores how social capital including interorganisational and intraorganizational networks creates the operational and strategic culture of disasters.
123	Xu et al. [48]	landslide	*		China	farming households in areas with a high risk of landslide	questionnaire survey	Binary logistic and Tobit regression models	-disaster preparedness behaviour is impacted by socioeconomic characteristics of households and individuals such as loss, distance from hazard sites, education level, information channels.

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
124	Leelawat et al. [57]	tsunami		*	Japan				-develops an educational tool to enhance traditional evacuation drills through designing a mobile application prototype
125	Sakurai et al. [225]	tsunami		*	Indonesia	elementary schools in Banda Aceh city	school visit, interview, and survey	comparing two school groups	-recommends the annual school plans should include a tsunami evacuation drill at least once a year and allocating a budget for disaster preparedness initiatives.
126	Yasuda et al. [53]	tsunami		*	Japan	10–11 years old elementary school students	survey		-changes in children's awareness varies depending on regional characteristics, therefore considering those attributes in developing disaster-prevention training programs is recommended.
127	Ooi et al. [43]	bushfire		*	Japan				-proposes a VR system including comprehensive training, evacuation drills, and firefighting training
128	Chan et al. [65]	cyclone combine	*		Hong Kong		telephone survey		-Health-Emergency and Disaster Risk Management (Health-EDRM) strategies for urban residents is required to cope with extreme disastrous events caused by climate change.
129	Xu et al. [157]	earthquake	*		China	rural households affected by the Wenchuan earthquake	survey	path analysis	-found a significant positive correlation between the willingness to relocate in the event of a disaster and the perception of risks and disaster risk reduction awareness.
130	Jagnoor et al. [168]	flood	*		Bangladesh	communities in all districts across Barisal	survey, interview, and focus group discussion		-disaster response barriers include financial insecurity, livelihood loss and women's privacy cultural concerns.
131	Khan et al. [27]	flood	*		India	people from several districts of Uttarakhand	scheduled interview	descriptive statistics	-utilising information and communication media in conjunction with public-private partnerships (PPP model) and indigenous methods

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									can assist in dealing with future catastrophic events.
132	Adams et al. [110]	generic disaster	*		the United States	people with disabilities	Los Angeles County community survey data	hierarchical linear regression models	-examines both the individual and community-related factors influence people with disabilities' ability to prepare for disasters.
133	Bandecchi et al. [119]	generic disaster	*		Italy	schools in Tuscany	questionnaire survey		-proposes a series of questionnaires to be used as both an educational and assessment tool for students in different ages at school.
134	Chen et al. [101]	generic disaster	*		China		questionnaire survey and interview	logistic regression models	-emergency preparedness among Chinese households was low and found barriers to household preparedness were lack of knowledge and motivation.
135	Ekenga and Lan [183]	generic disaster	*		the United States		"Behavioural risk factors surveillance system (BRFSS)" data	multivariable log-binomial regression	-evaluates self-reported three-day medication supply, emergency evacuation plans, and household preparedness behaviour and explores the relationship between public health emergency preparedness and gender.
136	Every et al. [102]	generic disaster	*		Australia		survey		-reports seven factors that impact both psychological and material preparedness including previous disaster experience, high levels of mindfulness, low levels of stress, and low levels of depression
137	Hamidazada et al. [182]	generic disaster	*		Afghanistan	rural women	focus group discussion, interview	Grounded Theory and Interpretive Structural Modelling	-there is a need for women participation in disaster risk reduction decision-making and planning activities.
138	Ilo et al. [120]	generic disaster	*		Nigeria	federal and state libraries of universities in Southwest Nigeria	questionnaire and interview	descriptive statistics	-found lack of budget, and disaster equipment and facilities as major challenges to disaster training.
139	Pandey [121]	generic disaster	*		Nepal	two earthquake affected areas	interview		-emphasises that "the mantra of community-based disaster risk

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									management (CBDRM) is community engagement".
140	Teo et al. [103]	generic disaster	*		Australia	Logan city	questionnaire survey	hierarchical regression analysis	-policy makers should develop disaster management and communication plans to cater to the needs of people considering ethnic groups and language abilities.
141	Wei et al. [200]	generic disaster	*		Taiwan		social change survey open data	Poisson and logit regression models	-bridges the gap of knowledge on how perceptions of stakeholders' characteristics motivate the public to prepare for emergencies and disasters.
142	Salita et al. [209]	generic disaster		*	Philippines	school teachers in Angeles city	structured questionnaire		-found both the Witte's behavioural model (WBM) questionnaire and the lay responder disaster training (LRDT) package suitable to improve the schoolteachers' disaster risk reduction and management activities.
143	Shannon [220]	generic disaster		*	the United States	nursing students	survey		-found the multi-semester education enhanced students' awareness of disaster nursing, the engagement of nursing program with community partners, and emergency preparedness knowledge and ability of community members.
144	Torani et al. [10]	generic disaster		*		vulnerable people	11 English published relevant references	review paper	-reviews the impact of various educational methods on vulnerable people's disaster risk reduction and preparedness behaviour.
145	Wukich [196]	generic disaster		*	the United States				-although agencies frequent attempts on emergency preparedness guidance dissemination, strategies generally follow traditional one-to-many, government-to-

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									citizen approaches with little or no public participation.
146	Boylan and Lawrence [40]	bushfire	*		Australia	bushfire-prone areas residents	survey	confirmatory and exploratory factor analysis	-develops a 33-item self-report bushfire psychological preparedness scale (BPPS)
147	Wetterberg et al. [44]	bushfire		*	Sweden				-explores the association between speed of driving and smoke density in wildfires which can help in estimating the evacuation time more accurately with the use of traffic evacuation modelling tools.
148	Choi and Wehde [73]	cyclone combine	*		the United States		survey data		-there is a nuanced relationship between confidence in authorities responsible for emergency management and individual preparedness against tornadoes.
149	Clay et al. [148]	cyclone combine	*		the United States	households in New York City	interview	logistic regression models	-found the risk of Superstorm Sandy's adverse outcomes cannot be reduced by merely having a plan, disaster kit, and medication. The lack of preparedness should be considered while disaster managers make decisions regarding educating the public and allocating resources.
150	Dasgupta et al. [67]	cyclone combine	*		Japan	foreign residents	survey	exploratory factor analysis and multiple linear regression model	-recommends disseminating information about local disasters and creating local disaster-related support networks for foreign residents.
151	Guo et al. [70]	cyclone combine	*		Hong Kong		Conjoint Community Resiliency Assessment Measure (CCRAM-10)	Structural Equation Model (SEM)	-providing more information-seeking channels by community-based training programs can help enhancing the community resilience perceptions.
152	Kyne et al. [147]	cyclone combine	*		the United States	individuals living in the Rio Grande Valley	online survey		-analyses and compares the state of subjective and objective disaster preparedness

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
153	Ryan and King [66]	cyclone combine	*		Australia	a storm-prone community in Queensland	semi-structured interview	literature review	-utilising inventory-based smartphone applications is recommended in behavioural change literature to motivate individual disaster preparedness. -with the use of data from a storm disaster preparedness application, finding an appropriate location for targeted communities' engagement programs would be more effective.
154	Munoz et al. [30]	cyclone combine/ earthquake/ flood/ landslide		*	the Caribbean and South America				-proposes school safety comprehensive model with three pillars including safe learning facilities, education about risk reduction and resilience, and disaster management in schools.
155	Castaneda et al. [50]	Earthquake/ tsunami	*		Chile	Iquique and Concepcion coastal cities	interview		-emphasises on the importance of the study and implementation of preparedness activities in the context of community and work, particularly for less prepared individuals who are more vulnerable to the effects of natural hazards.
156	Han et al. [87]	earthquake	*		China	rural survivors of the Wenchuan earthquake	survey	ordinal logistics and logistic regression models	-individual risk perception and preparedness actions adaptation are positively correlated with trust of people in government and outside helpers.
157	Khodadadizadeh et al. [158]	earthquake	*		Iran	Bam and Rafsanjan cities households	a standardised earthquake preparedness questionnaire	T-test and descriptive statistics	-households who experienced earthquake show higher degrees of preparedness. -community-based disaster related exercises, collaboration, and training are essential activities that can help enhancing community disaster preparedness.

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
158	Wei et al. [159]	earthquake	*		China	high school students in areas affected by Lushan earthquake	questionnaire survey		-earthquake response is significantly affected by prior exposure to earthquake, however when time passes this effect would be weaker as memories of experience fades.
159	Yildiz et al. [79]	earthquake	*		Turkey	children in Van and Kocaeli	questionnaire and interviews		-family conversations to share disaster information is important and it would influence children's preparedness and perception of earthquake risk.
160	Yong et al. [80]	earthquake	*		China	rural farmers in Wenchuan and Lushan earthquake-stricken areas	survey	independent-sample *t*-test and chi-square test	-provides policy directions for disaster prevention and reduction, disaster management, and poverty alleviation in the region.
161	Yeon et al. [96]	earthquake		*	South Korea	Pohang city children and teens	survey		-recommends disaster education programs consider the students' emotional response more than their cognitive response.
162	Shoji et al. [97]	earthquake		*	Indonesia	elementary school students	survey	dance-based disaster preparedness program	-employing dance-based disaster training helps students to respond earthquakes and is applicable even for students with poor educational backgrounds.
163	Sakurai et al. [54]	Earthquake/ tsunami		*	Japan	an elementary school students affected by tsunami		mixed qualitative and quantitative methods	-evaluates an educational program for children about the reconstruction phase following a disaster, called the "Reconstruction Mapping Program" which employs town-watching and map-making approaches and concludes that the program fosters children as "agents of change" to develop disaster-resilient communities.
164	Nakano et al. [98]	earthquake		*	Nepal	secondary and high school students	survey	chronological and progressive evaluation	-suggests a change in the common methods of evaluation of disaster risk reduction education considering long-

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									term action-oriented knowledge rather than short-term knowledge transfers.
165	Aksa et al. [94]	earthquake		*	Indonesia	students of geography education at two universities in Aceh	survey	multiple linear regression model	-explores the effects of integrating disaster education into the geography education syllabus and the role of perceptions of risk in earthquake preparedness.
166	Geng et al. [28]	flood	*		China	new media users	comments on Weibo topic "Shouguang Flood"	text analysis	-using the online data about disaster perception on the internet rather than questionnaire surveys, would help in analysing the perceived disaster knowledge of the general public in a timely manner and therefore broadens the research scope in the field of disaster.
167	Shah et al. [170]	flood	*		Pakistan	elementary schools	survey		-a comprehensive plan of action is required to be designed by employing a synergistic approach to disaster education between the public and private educational sectors, disaster managers, school staff, students, and parents.
168	Tsai et al. [36]	flood		*	Taiwan	students	survey		-develops a learning package by integrating Kolb's Experiential Learning Cycle into a game called "Battle of Flooding Protection", to promote students' disaster learning motivation.
169	Kankanamge et al. [146]	generic disaster		*			scholarly articles and disaster-related gamified applications	systematic literature review	-investigates how to incorporate gamification into disaster and emergency planning as a novel technique to motivate community involvement in disaster-related activities.
170	Kawasaki et al. [135]	generic disaster		*	Japan	parents and teachers	questionnaire survey		-clarifies the significance of collaborating parents and teachers, disaster

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									preparedness, and proper disaster response following a disaster.
171	Park [210]	generic disaster		*					-considering examples from recent disasters in East Asian countries, and science and technology studies (STS), suggests science education and disaster education can be cross-pollinated to alleviate the post-disaster hardships and raise responsible citizens.
172	Kranke et al. [71]	cyclone combine	*		the United States	social work leaders, and social workers	survey	qualitative study Thematic analysis	-conceptualises emotional preparedness to address a research gap
173	C. Ma et al. [149]	cyclone combine	*		the United States		Individual Assistance Housing data	nested multi-level logistic regression	-income inequality has impeded adopting homeowners' insurance (HI) for low-income households and facilitated it for high-income households.
174	Nikkanen et al. [150]	cyclone combine	*		Finland		internet survey	chi-square test and logistic regression	-respondents' residential property type rather than their level of education or employment status was related to taking preparedness measures or experiencing harm.
175	Phuong et al. [153]	cyclone combine/ flood	*		the United States	population health researchers	interview	mixed methods of need assessment, and card sorting to rank priority use cases	-examines the information need of researchers by asking them about barriers and facilitators of their field of expertise and research.
176	Wehde and Nowlin [74]	cyclone combine	*		the United States	residents of counties located along the South Atlantic and Gulf Coasts	survey data	innovative compositional data analysis techniques	-residents particularly those who are conservative or have low levels of trust in government believe that individuals themselves rather than governments are responsible for hurricane preparedness.
177	Lee [76]	cyclone combine/ earthquake		*	Taiwan	Taiwanese individuals	2013 Taiwan Social Change survey data		-being a member of voluntary associations, perception of risk

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									and having prior experience of damage have positive association with adopting preparedness behaviours.
178	Ao et al. [160]	earthquake	*		China	rural regions' residents in Wenchuan earthquake-stricken areas	survey	exploratory factor analysis and random effect logistic regression analysis	-residents who have access to earthquake information and those with a high perceived earthquake risk are more likely to be prepared for earthquakes.
179	Chai et al. [165]	earthquake	*		China	areas affected by the Wenchuan earthquake		linear regression model	-socioeconomic factors including social status, education, and income are the main contributors in the difference between urban and rural individuals' disaster preparedness
180	Kusumastuti et al. [164]	earthquake	*		Indonesia	Lombok Island community affected by two major earthquakes		a systematic literature review	-the 2018 Lombok earthquake caused a boost in creating and transferring disaster knowledge among the community and as a result they better responded to 2019 earthquake.
181	Kwazu and Chang-Richards [81]	earthquake	*		New Zealand	residents affected by Kaikoura earthquake, its aftermath and recovery	survey	a principal component analysis	-develops an integrated framework including critical factors to illustrate livelihood preparedness dimensions and help policymakers and practitioners of disaster risk reduction in formulating new or improved strategy/ initiative for better individual disaster preparation.
182	C. Ma et al. [149]	earthquake	*		China	households affected by Wenchuan earthquake	survey data	Tobit regression model	-investigates and emphasises on how residents' disaster preparedness is related to community resilience.
183	Qing et al. [82]	earthquake	*		China	farmers who live in Wenchuan and Lushan earthquakes areas	survey	ordinal multi-class logistic regression	-general health, happiness, and life satisfaction of individuals is significantly influenced by their disaster preparedness behaviour. Changing the behaviours

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									related to individual disaster preparedness should be considered by policymakers to enhance the quality of life of people.
184	Sim et al. [83]	earthquake	*		China	three villages with high-risk of earthquake and different landscapes	survey data	regression analysis	-assessment of residents about their community resilience vary in different places and landscapes. Plain and mountainous areas' villagers perceived higher resilience comparing to those living in the loess plateau.
185	Wei et al. [162]	earthquake	*		China	areas affected by Lushan earthquake area, Sichuan Province	questionnaire survey		-level of education, income, and the number of prior earthquakes experience are the most important factors that impact the overall capability of an individual for earthquake disaster cognition and response (EDCR) significantly.
186	Lian et al. [92]	earthquake		*	China	earthquake-prone rural settlements	survey data	Probit model and Poisson model	-educating farmers about disaster prevention and mitigation can motivate them to adopt disaster-preparedness behaviours in response to earthquakes.
187	Guo et al. [23]	flood	*		China	rural residents in three flood-prone villages	self-report structured questionnaire survey		-using an ecologically based framework, examines the villagers' disaster preparedness determinants including socioeconomic status, sociodemographic factors, adaptation to hazards, place, community, and neighbourhood effects.
188	Hashim et al. [26]	flood	*		Malaysia	medium and small enterprises managers and business owners	an interviewer-assisted survey	regression analysis	-retails sectors, male-owned business, and previous flood experience contribute to high levels of engaging in flood preparedness activities.
189	Titko et al. [8]	flood	*		the Slovak Republic	all the citizens	questionnaire survey	statistical analysis	-investigates the individuals proactive

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									preventive and preparedness behaviour in response to disasters.
190	Zhong et al. [31]	flood		*	China	8–12 years old children in primary schools	survey	Ordinary Least Squares Regression, Structural Equation Model, Propensity Score Matching Method	-considering risk-related parents and children's interactions in disaster education is an effective way to promote children's perception of risk, climate change adaptation, and disaster resilience.
191	Ghazi Baker [105]	generic disaster	*		Kingdom of Saudi Arabia	full-time nurses in five government hospitals in Medina	Emergency Preparedness Information Questionnaire (EPIQ)	independent sample *t*-test and One-way ANOVA	-suggests considering EPIQ dimensions in nurses' education to raise their preparedness levels.
192	Green et al. [106]	generic disaster	*		Japan	foreign residents	2015 foreign residents of Nagoya city survey		-identifies disaster training experience, disaster information exposure, and nationality of the responder rather than Japanese language proficiency as the most important factors affect foreign residents' preparedness.
193	Han and Chun [114]	generic disaster	*		Korea	nurses in Seoul, Gyeonggi, Gangwon, and Chungcheong provinces	survey	exploratory and confirmatory factor analysis	-verifies the validity and reliability of the disaster preparedness evaluation tool-Korean version (DPET-K) for nurses to use it in South Korean hospitals and community healthcare centres
194	Lahiri et al. [190]	generic disaster	*		the United States	an East Coast university natural hazards research initiative	semi-structured interviews		-identifies that multidisciplinary research collaborations and preparedness and response efforts for natural hazards share common themes, such as the need for greater human and financial resources.
195	C. Ma et al. [149]	generic disaster	*		China	registered disaster volunteers in Beijing	questionnaire	linear regression	-examines the willingness to disaster volunteering participation and factors related to social background, organization, and attitude affecting it, with the purpose of finding a way to attract more

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									volunteer's participation.
196	Elizabeth M. McCourt et al. [229]	generic disaster	*			pharmacy students and pharmacists		systematic review	-finds demographic factors, disaster related competency, and disaster related interventions as the potential factors affecting the disaster preparedness among pharmacy students and pharmacists
197	E. M. McCourt et al. [107]	generic disaster	*		Australia	pharmacists	online questionnaire survey	multiple linear regression	-reports the factors that explained 86.0% of the variation in preparedness were experience in disasters, previous preparedness behaviours, colleague preparedness, trust of external information sources, the perception of knowledge, skills, self-efficacy, and potential disaster severity
198	Elizabeth M. McCourt et al. [229]	generic disaster	*		Australia	pharmacists	semi-structured interviews	open and axial coding methods	-identifies participants' preparedness overarching themes consist of individual factors including experience, soft skills, knowledge and training, and external factors including existing resources, administrative and multisectoral support
199	McLennan et al. [111]	generic disaster	*		Australia	residents	survey		-found a significant association between severe levels of disability and less disaster preparation, particularly regarding emotional preparedness. When it came to disaster knowledge and material preparedness, the difference between residents with and without disability was small.
200	Ning et al. [184]	generic disaster	*		China	Heilongjiang, Guangdong and Sichuan residents	questionnaire survey and face-to-face interviews	structural equation model	-the respondents' attitude about emergency preparedness has the strongest effects on their emergency preparedness

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									behaviour -it is important to provide public education to improve attitudes and ability to emergency preparedness.
201	Shi et al. [115]	generic disaster	*		China	hospital nurses	survey	exploratory and confirmatory factor analysis	-adapts the Chinese version of "Hospital Nursing Department Disaster Preparedness Scale (HNDDPS)" and evaluates the hospital nurses' psychometric characteristics
202	Shmueli et al. [122]	generic disaster	*						-highlights the importance of collaborative planning and community involvement in decisions before, during and after disasters.
203	Sugisawa et al. [185]	generic disaster	*		Japan	dialysis facilities' key personnel	mail survey		-focuses on cognitive factors affect disaster preparedness and suggests that boosting self-efficacy and receiving support from the surrounding environment may contribute to the development of various disaster preparedness domains.
204	Wang et al. [186]	generic disaster	*		China		2018 General Social Survey in Shandong	multiple linear regression and Sobel Goodman test	-identifies material, awareness, and behavioural preparedness as three clusters in disaster preparedness behaviour and investigates the role of self-efficacy in mediating the relationship between place attachment and disaster readiness
205	Widowati et al. [116]	generic disaster	*		Indonesia	elementary school's principals in Yogyakarta Province	survey	confirmatory factor analysis (CFA)	-examines the suitability of measures, indicators, and constructs of the disaster preparedness and safety school (SSSB) program to be used in assessing a multi-hazard-based child safety school educational system.

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
206	Xiang et al. [194]	generic disaster	*		the United States	190 US counties		content analysis of the county-level documents of EOP and HPG	-investigates how household emergency preparedness guides (HPGs) and emergency operations plans (EOPs) address language accessibility.
207	Zhang et al. [108]	generic disaster	*		China	college students	questionnaire	Multiple linear regression	-evaluates disaster literacy and factors affecting it among college students. Educating college students in disaster literacy should be considered an urgent priority by families, colleges, communities, and the government.
208	Gokmenoglu et al. [136]	generic disaster		*	Turkey	school teachers	survey	"Stufflebeam's context, input, process, and product (CIPP)" evaluation model	-evaluates the school-based disaster training program offered by the Turkish Ministry of National Education
209	M. S. Y. Hung et al. (2021)	generic disaster		*	Hong Kong	nursing students	questionnaire, focus group interview	pre- and post-intervention comparison	-evaluates the effects of a training course on disaster management in promoting knowledge of disasters, willingness to participate, and perceived capability.
210	Kitagawa [20]	generic disaster		*					-conceptualises 'disaster education' in the field of education through linking the educational concepts with a synthesise of existing disaster education literature
211	Nagamatsu et al. [222]	generic disaster		*				literature survey	-establishes the concept of Disaster Storytelling as a tool in creating a disaster-resilient society, and discusses the contribution of disaster storytelling trends, including disaster tourism
212	Oktari et al. [221]	generic disaster		*	Indonesia	Kajhu village and Payatieng village in Aceh Province	survey		-assesses the implementation of the Disaster Resilient Village Program (DESTANA) in terms of gender mainstreaming and indicates that DESTANA does not ensure the public

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									preparedness, particularly for women.
213	Ramanathan and Crawley [2]	generic disaster		*			10 major journals in social work	literature review	-develops a disaster preparedness conceptual model for effective research and intervention. Despite differences in individual, community, and cultural needs, there are common universal aspects to disaster preparedness.
214	Seddighi et al. [138]	generic disaster		*		children		systematic literature review	-school disaster education is effective but inadequate in many countries, and common problems in training programs are lack of equipment, financial resources, policy gaps, and insufficient knowledge of teachers.
215	Uchida et al. [212]	generic disaster		*	Japan	high school students in Kanagawa	town watching, questionnaire survey, and group discussion	disaster information tweeting system (DITS) and disaster information mapping system (DIMS)	-establishes a disaster prevention and mitigation ICT-based program to enhance awareness of young people.
216	White-Lewis et al. [11]	generic disaster		*	the United States	high school students in the Kansas City area	pre- and post-intervention survey		-reports a significant post-intervention improvement in the knowledge of disaster topics among the experimental group an effective and cost-efficient disaster preparedness education should be included in school curriculum.
217	Joshipura et al. [151]	cyclone combine	*		Caribbean		interview	logistic regression	-hurricanes had a higher detrimental impact on overall health and marginally significant impact on non-communicable disease (NCD) when individual preparedness was lower.
218	Monteil et al. [171]	flood	*		France	a flash flood-prone neighbourhood in Nîmes	questionnaire and interview	quantitative (questionnaire) and qualitative analysis (interviews)	-explores the key barriers to individual willingness to prepare and identifies multiple forms of marginalization that

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No.	Reference	Disaster type	Approach		Country of case study	Target group	Data	Method	Highlighted findings
			Des.	Pres.					
									hinder individual's willingness despite the recent disasters and the neighbourhood's well-known vulnerability.
219	Carswell et al. [1]	generic disaster	*		the United States		uses the 2017 American Housing Survey (AHS)	multinomial logistic regression	-investigates households that have been previously impacted by disaster to observe their subsequent disaster preparedness behaviours as compared to those who unaffected by prior disaster.
220	Chegini et al. [187]	generic disaster	*		Iran	nurses working in the emergency departments of Qazvin city hospitals	a cross-sectional survey	independent *t*-test, analysis of variance (ANOVA) test, and multiple linear regression	-by providing formal disaster preparedness education and conducting routine sessions of disaster scenarios, nursing managers must support nurses in improving their disaster core competencies.
221	Ryan et al. [15]	generic disaster	*		Australia	staff from emergency agencies, local councils, and non-profit organizations	in-depth semi-structured interviews	descriptive	-maps Australian emergency agencies' perception of what competencies individuals and communities need for effective preparation and develops a Preparedness Competency Index that provides agencies with a benchmark for community preparedness.
222	Handaka et al. [139]	generic disaster		*	Indonesia	Junior high School teachers in Yogyakarta city	in-depth interview, observation, and documentation		-psychosocial preparedness can be implemented during pre-disaster, emergency response, and post-disaster with the collaboration of various parties and school residents.

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