



Speaking of the devil: a systematic literature review on community preparedness for earthquakes

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Abstract

Community preparedness in facing natural hazards such as earthquakes is extremely important. Although there are numerous studies on community preparedness for earthquakes, the effort to systematically review this particular research topic has been challenging since it fails to incorporate the review procedures, presenting a considerable challenge for scholars to replicate or interpret. Therefore, this study aims to conduct a systematic literature review concerning community preparedness for earthquakes. The review processes included five key methodological steps, namely guided by review protocol, formulation of research questions, systematic searching strategies based on identification, screening, and eligibility on several established databases such as Scopus, Web of Science, Science Direct, Emerald, Taylor Francis, Springer Link, and Sage Journals, followed by quality appraisal, and data extraction and analysis. Seven main themes were also discovered based on the thematic analysis: (1) infrastructure-related; (2) information seeking and sharing, and experience sharing; (3) related programmes, training and campaign; (4) strong social relationships; (5) survival kits and supplies; (6) involvement, planning, training in evacuation or emergency drills; and (7) life-saving techniques and life protection. These seven themes were divided into 18 sub-themes.

Keywords Earthquake preparedness · Earthquake · Natural hazards · Community preparedness

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1 Introduction

Earthquakes are considered one of the most terrifying natural hazards. A total of 1791 earthquakes with the Richter magnitude scale ranging from 5.0 to 6.9 were recorded in 2018 (US Geological Survey 2019), while the largest earthquake ever recorded occurred in Chile in 1960. This catastrophe, which struck at a magnitude of 9.5, is also known ‘Great Chilean Earthquake’ and the ‘1960 Valdivia Earthquake’ (Geology.com 2019).

The effects of an earthquake on physical facilities, the environment, and humanity are disastrous. The seismic impacts result in a devastating number of deaths. For instance, the 2004 Indian Ocean earthquake and tsunami resulted in approximately 227,898 casualties across 14 countries, including India, Nepal, Thailand, the Maldives, Somalia, and Myanmar, with Banda Aceh in Indonesia recording the highest number of mortalities (130,376). The earthquake also caused irreparable damage to mangroves areas, coastal areas, farms, livestock, coral reefs, forests, animal and plant biodiversity, and groundwater. While the most affected communities, such as farmers and the tourism workforce, were obstructed from conducting their socio-economic routines, other victims suffered from widespread psychological trauma.

Since predicting the occurrence of future seismic events is almost impossible, further efforts must be directed towards strengthening community preparedness so that the common mindset of ‘if an earthquake strikes’ can be shifted to ‘when an earthquake strikes’ (Bronfman et al. 2020). The principal aim of earthquake preparedness is to reduce the impact of these natural hazards on vulnerable populations, to prepare an organisation for an influx of activity, and to formulate strategies that utilise resources, time, and efforts effectively when tragedy strikes. Organised preparedness can save lives, reduce property damage during a disaster, and expedite the process of returning to normality.

It should also be emphasised that there is no comprehensive review of earthquake preparation or preparedness research undertaken at this juncture. SLR refers to a formal technique that comprehensively locates and synthesises pertinent research, in addition to practising organised, transparent, and replicable procedures at each step in the process (Higgins et al. 2011). The SLR proposed in this study relies explicitly on integrative review analysis where quantitative, qualitative, and mixed methods are combined. The issue of community preparedness for catastrophic events such as earthquakes has gained considerable interest among scholars worldwide. While Azim and Islam (2016), Guo and Li (2016), and Onuma (2017) examined the subject of community preparedness for earthquakes in Saudi Arabia and Japan, Ismail et al. (2016), Paton et al. (2015), and Kenney and Phibbs (2015) focused their research on the same issue in the context of Indonesia and New Zealand.

Although there is a vast body of literature on earthquake preparedness at present, the effort to systematically review these studies, identify patterns, and develop potential themes on the subject remains limited. Notably, the review procedures, including identification, screening, and eligibility, have not been adequately addressed. The practices of traditional literature reviews have several issues related to transparency and bias. Many authors would typically simply choose articles that favour their research (Shaffril et al. 2020). Indeed, such a system would consequently pose a substantial challenge to future scholars to replicate the study, validate the interpretations, or examine the study’s comprehensiveness.

Given this gap found in the literature, the current study aims to conduct an SLR that focuses explicitly on community preparedness in facing earthquakes. Through this

approach, the authors' empirical evidence can be justified to identify the gaps and guide the direction for future research in this field. In progressing the review, the authors were guided by the main research question; 'How do the community worldwide prepare for the threat of an earthquake?'. Moreover, the main focus of this paper lies in the preparation strategies employed by communities since it is important to mitigate against the hazards and risks to reduce the number of casualties and damage to properties.

2 Methodology

2.1 Review protocol—ROSES

The SLR is guided by ROSES (Reporting Standards for Systematic Evidence Syntheses). ROSES was developed by Haddaway et al. (2018), aiming to strengthen and maintain a sound methodology for developing an SLR via increased transparency and to ensure and control the quality of the review. Although this review is more centred towards disaster management and given the fact that ROSES was explicitly developed for environment management, this review protocol suits the current review as it is developed to suit the nuances and heterogeneity across diverse situations and research regarding the synthesis method (Haddaway et al. 2018). Guided by ROSES, the SLR process began with formulating the research questions applying the PICO method; 'P' for Problem or Population, 'I' for Interest and 'Co' for Context. Next, the strategy for document searching was planned and was conducted according to three systematic phases: identification, screening, and eligibility. A quality appraisal process was then conducted based on the adapted criteria outlined by Hong et al. (2018). Here, the quality of each selected article was determined before incorporated into the review. Lastly, the selected articles were processed through several stages, data extraction and data analysis. The data extraction process was guided by the primary research question, while the qualitative data synthesis (thematic synthesis) was performed in analysing the extracted data. Where suitable, the authors followed the suggestions put forward in the review by considering alternatives to ensure the review protocol met the aim of the review.

2.2 Formulation of the research question

In formulating the research question, two sources were utilised; first, ideas from previous studies such as by Joffe et al. (2019), Bronfman et al. (2019) and Pacheco et al. (2020). All the articles were related to how and why do communities prepare against earthquakes. Second, using the mnemonic of PICO, which signifies 'P' (Population or Problem), 'I' (interest) and 'Co' (Context) (Lockwood et al. 2015). Based on these concepts, the authors included three main aspects as part of the review, the global community (Population), earthquake threats (Interest) and preparation against earthquake threats (context). This enabled the authors to formulate the main research question of this study; "How do communities globally prepare for the threat of earthquakes?".

2.3 Systematic searching strategies

Three systematic processes of identification, screening, and eligibility proposed by Shaffril et al. (2018) were employed to retrieve the relevant articles. Implementing these processes

allowed the authors to comprehensively locate and synthesise the studies in conducting a well-organised and transparent SLR.

2.3.1 Identification

Based on the formulated research questions, three main keywords were identified: community, prepare, and earthquake. To enrich these keywords, the authors sought its synonyms, related terms and variations by using an online thesaurus, such as thesaurus.com, referring to the keywords used by past studies, referring to the keywords suggested by Scopus and by asking the opinion of experts. Based on this process, several keywords similar to earthquake preparedness, including *earthquake*, *community*, *prepare*, *plan*, *readiness*, *awareness*, *alert*, *precaution*, *strategy*, *safeguard* and *safety measure*, were checked. The combinations of these keywords were processed using search functions, such as field code functions, phrase searching, wildcards, truncation, and Boolean operators in two databases: Scopus and Web of Science (see Table 1).

Additionally, the searching process was based on a manual searching technique. Here ‘handpicking’ was used in databases like Science Direct, Emerald, Taylor Francis, Springer Link and Sage Journals. Although a tsunami earthquake can trigger a tsunami, different natural hazards may result in different impacts, which require a different set of preparation strategies. Accordingly, it is worth noting that the present study only addresses community preparedness for earthquakes. Based on the searching efforts, a total of 4773 potential articles were identified from the selected databases.

2.3.2 Screening

Screening was the second procedure carried out where articles were either included or excluded (with the assistance of the database or manually screened by the authors) from the study based on a specific set of criteria (see Table 2). Considering the concept of ‘research field maturity’ emphasised by Kraus et al. (2020), this review limited the screening process to only include the articles published between 2015 and 2020. This timeline was chosen given that the number of published studies was sufficient to perform a representative review. The authors decided to review empirical research papers since they offer primary data. Notably, to avoid confusion, only those written in English were considered. Since the SLR objective related to community preparation, choosing social science research studies

Table 1 Search string used in the selected database

Database	String
Scopus	TITLE-ABS-KEY ((earthquake*) AND (communit*) AND (prepare* OR plan* OR read* OR aware* OR alert* OR precaution OR strateg* OR safeguard OR “safety measure”))
Web of Science	TS=((earthquake*) AND (communit*) AND (prepare* OR plan* OR read* OR aware* OR alert* OR precaution OR strateg* OR safeguard OR “safety measure”))

Table 2 Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Timeline	2015–2020	2014 and earlier
Document type	Articles (with empirical data)	Review article, chapter in a book, book, conference proceeding, etc
Language	English	Non-English
Subject area	Social Science	Medical, public health, environmental science, engineering, geography, other non-social science studies

as one of the criteria was believed to increase the possibility of acquiring more articles related to community preparedness. A total of 4541 articles were excluded from the review during this stage since they were not in line with the inclusion requirement. This resulted in 232 remaining articles for evaluation in the subsequent stage.

2.3.3 Eligibility

The authors manually checked the remaining papers to identify (either by reading the title, abstract or the entire paper) whether the papers matched the established inclusion criteria. One hundred twenty-two articles were excluded during the title screening state, and during the abstract screening stage, 68 articles were removed. Another six articles were excluded after the authors read the content of the selected articles. In total, 196 articles were removed in this stage since they did not focus on preparedness at the community level, did not focus on earthquakes, were in the form of a review paper, and were science-based (referring to studies that are non-social science-based such as engineering or environmental science, etc.). The final number of articles for the quality appraisal stage was 28 (see Fig. 1).

2.4 Quality appraisal

The quality appraisal stage was performed to ensure that the methodology and analysis of the selected studies were completed satisfactorily. For this purpose, the Mixed-Method Appraisal Tool (MMAT) by Hong et al. (2018) was used. MMAT enables researchers to appraise a systematic mixed studies review and covers the appraisal of five kinds of studies: qualitative research, randomised controlled trials, non-randomised studies, quantitative descriptive studies, and mixed methods studies (Hong et al. 2018). For each selected study, two screening processes were conducted before proceeding to the quality assessment. The selected articles were assessed based on their quality using five main criteria established in the research design. To ensure the selected qualitative sources had a sound methodology and underwent rigorous analysis, MMAT helped emphasise the criteria such as the appropriateness of the research questions to provide adequate data, the adequacy of qualitative data collection to address the research questions, the coherence between qualitative data sources, data collection, analysis and interpretation.

For quantitative research design, the authors relied on the assessment criteria such as the relevance of the sampling strategy towards the research questions, the sample's representativeness to its population, the appropriateness of the measurement and the suitability of the

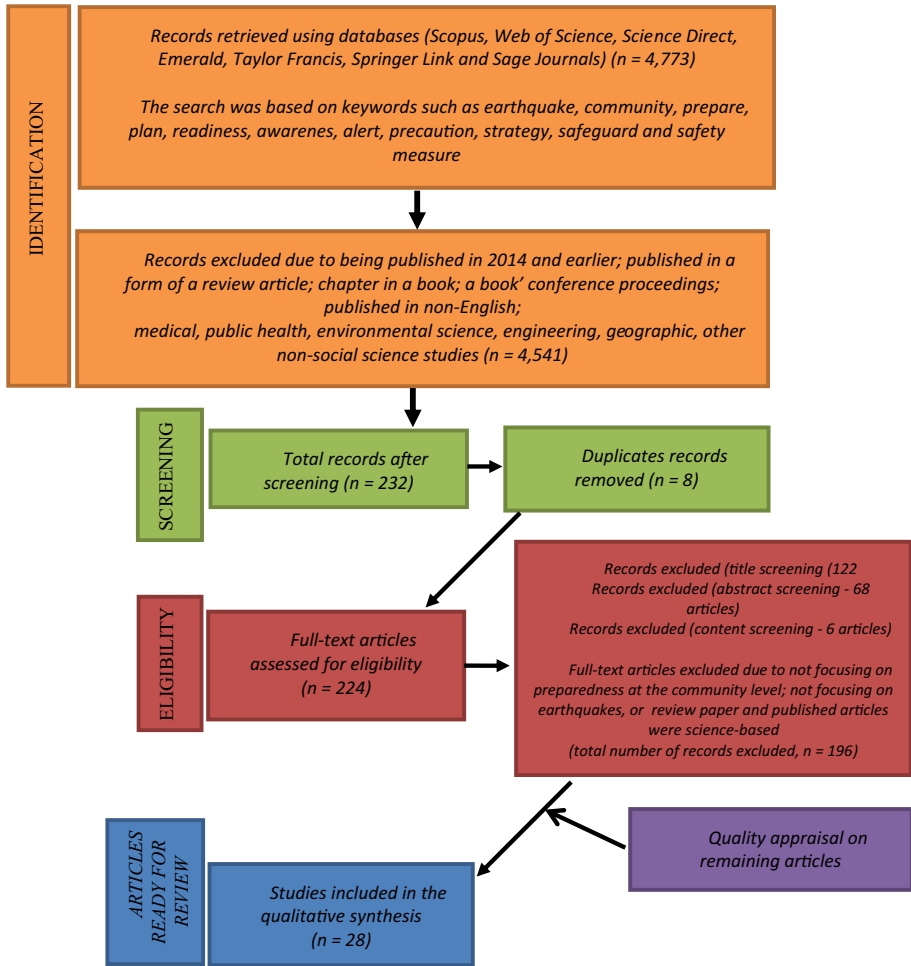


Fig. 1 Flow diagram of the searching process

analysis performed. Meanwhile, for mixed-method research designs, to control the quality from the methodological and analysis perspective, MMAT helped in providing guidance concerning the rationale for using the mixed-method to address the research questions, the effectiveness of the different research design to answer the research questions, the integration of qualitative and quantitative and the ability to address the divergence and the differences between research designs.

With the assistance of two co-authors, the corresponding author then assessed each article’s methodological and analytical rigour. Each article was carefully read with a focus on its methodology section and the analysis undertaken. Guided by MMAT, the authors scrutinised the articles, for example, searching the consistency of the sampling performed and analysis undertaken (e.g. random sampling vs inferential analysis) (Table 3). Each article was assessed based on five criteria with three options provided in presenting their answers: “yes”, “no”, and “don’t know/can’t tell”. The articles were included in the review if they passed at least three criteria. All decisions on the assessment were based on mutual

agreement, and any disagreement was quickly settled via discussion among the authors. Based on this process, all authors agreed that all selected articles passed the minimum quality requirement regarding the methodology and analysis. In total, 15 articles fulfilled all criteria, seven articles fulfilled at least four criteria, and a further six articles managed to fulfil at least three criteria (Table 4).

2.5 Data extraction and analyses

The articles were thematically analysed, given that the review relied on diverse research designs, presenting the best ways to integrate the differences by performing qualitative synthesis (Whittemore and Knafl 2005). While several qualitative syntheses could be applied, the present review relied on the approach suggested by Flemming et al. (2019), who stressed the suitability of thematic synthesis on synthesising data from diverse research designs due to its flexible mode. Thematic analysis is a form of analysis that attempts to identify and notify the pattern of existing studies by detecting any similarities or relationships that could exist in available data (Braun and Clarke 2019). In this review, the thematic synthesis was based on the steps suggested by Kiger and Varpio (2020). First, the

Table 3 The criteria used to determine the rigour of the methodology and analysis used in the selected articles

Research design	Assessment criteria
Qualitative	QA1—Is the qualitative approach appropriate to answer the research question? QA2—Are the qualitative data collection methods adequate to address the research question? QA3- Are the findings adequately derived from the data? QA4- Is the interpretation of results sufficiently substantiated by data? QA5—Is there coherence between qualitative data sources, collection, analysis and interpretation?
Quantitative (descriptive)	QA1—Is the sampling strategy relevant to address the research question? QA2- Is the sample representative of the target population? QA3- Are the measurements appropriate? QA4- Is the risk of nonresponse bias low? QA5- Is the statistical analysis appropriate to answer the research question?
Quantitative (non-randomised)	QA1- Are the participants representative of the target population? QA2- Are measurements appropriate regarding both the outcome and intervention (or exposure)? QA3- Are there complete outcome data? QA4- Are the confounders accounted for in the design and analysis? QA5- During the study period, is the intervention administered (or exposure occurred) as intended?
Mixed methods	QA1- Is there an adequate rationale for using a mixed methods design to address the research question? QA2- Are the different components of the study effectively integrated to answer the research question? QA3- Are the outputs of the integration of qualitative and quantitative components adequately interpreted? QA4- Are divergences and inconsistencies between quantitative and qualitative results adequately addressed? QA5- Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

Source: Hong et al. (2018)

Table 4 Results of the quality assessment

Study	Research Design	QA1	QA2	QA3	QA4	QA5	Number of criteria fulfilled	Inclusion in the review
Chou et al. (2015)	MX	✓	✓	X	✓	✓	4/5	✓
Paton et al. (2015)	QN (DC)	✓	C	✓	X	✓	3/5	✓
Kenney and Phibbs (2015)	QL	✓	✓	✓	✓	✓	5/5	✓
Azim and Islam (2016)	QN (DC)	X	✓	✓	✓	✓	4/5	✓
Guo and Li (2016)	QN (DC)	✓	✓	✓	✓	✓	5/5	✓
Ismail et al. (2016)	QN (DC)	✓	✓	✓	✓	✓	5/5	✓
Jang et al. (2016)	QN (DC)	C	C	✓	✓	✓	3/5	✓
Kirschenbaum et al. (2017)	QN (DC)	X	✓	✓	✓	✓	4/5	✓
McClure et al. (2016)	QN (DC)	X	✓	✓	C	✓	3/5	✓
McGeehan and Baker (2017)	QL	✓	✓	✓	✓	✓	5/5	✓
Tipler et al. (2016)	QN (DC)	C	✓	✓	X	✓	3/5	✓
Onuma et al. (2017)	QN (DC)	✓	✓	✓	✓	✓	5/5	✓
Aryankhesal et al. (2017)	QL	✓	✓	✓	✓	✓	5/5	✓
Becker et al. (2017)	QL	✓	✓	✓	✓	✓	5/5	✓
Han et al. (2017)	QN (DC)	✓	✓	✓	X	✓	4/5	✓
Ray (2017)	QN (DC)	✓	X	C	✓	✓	3/5	✓
Chan et al. (2018)	QN (DC)	X	X	✓	✓	✓	3/5	✓
Cerchiello et al. (2018)	QN (DC)	C	✓	✓	✓	✓	4/5	✓
Shapira et al. (2018)	QN (DC)	✓	✓	✓	✓	✓	5/5	✓
Doyle et al. (2018)	QN (DC)	✓	✓	✓	X	✓	4/5	✓
Cui and Han (2018)	QN (DC)	✓	C	✓	✓	✓	4/5	✓
Bronfman et al. (2019)	QN (DC)	✓	✓	✓	✓	✓	5/5	✓
Cvetkovic et al. (2019)	QN (DC)	✓	✓	✓	✓	✓	5/5	✓
Joffe et al. (2019)	QN (NR)	✓	✓	✓	✓	✓	5/5	✓
Songlar et al. (2019)	QN (DC)	✓	✓	✓	✓	✓	5/5	✓
Rostami-Moez et al. (2020)	QN (DC)	✓	✓	✓	✓	✓	5/5	✓
Pacheco et al. (2020)	QL	✓	✓	✓	✓	✓	5/5	✓
Bronfman et al. (2020)	QN (DC)	✓	✓	✓	✓	✓	5/5	✓

QA = Quality assessment; QN (DC) = Quantitative descriptive; QN (NR) = Quantitative non-randomised; QL = Qualitative; MX = Mixed-Method; C = Can't tell

researchers familiarised themselves with the entire dataset via active and repeated readings. This process offered the researchers valuable orientation to the raw data and set the foundation for all subsequent steps.

The second process involved generating initial codes. Here the researchers organised data at a granular and specific level. During this stage, the researchers read all selected articles and extracted any data related to the main research question. The third process involved theme generation. The researchers practised inductive coding frameworks and attempted to note any interests, similarities, and connection between the extracted data

based on the coded data. The synthesis relied on an inductive coding framework where the themes were derived from the coded data. The themes developed were associated with the original data and reflective of the entire data set (Braun and Clarke 2019). During this process, nine main themes were developed. Then for each of the themes, the researchers repeated the same process to identify any possible sub-themes, which resulted in 18 sub-themes. The next process involved reviewing the developed themes. Here, the researchers examined the suitability of the main themes and sub-themes; they decided to combine three main themes: information seeking and sharing, awareness and experience sharing, into one theme, namely information seeking and sharing and experience sharing. The main themes were reduced to seven, keeping the 18 sub-themes. The themes and sub-themes were then presented to two experts in qualitative synthesis and community development and were asked to validate the themes and sub-themes. Both experts were also asked about the relevancy of the themes to the research questions. All seven themes and 18 sub-themes were maintained following this process.

3 Results

3.1 Background of the selected studies

From 28 articles, a total of six papers focused their studies in New Zealand (Doyle et al. 2018; Becker et al. 2017; McClure et al. 2016; Tipler et al. 2016; Paton et al. 2015; Kenney and Phibbs 2015), three in Taiwan (Chou et al. 2015; Jang et al. 2016; Han et al. 2017), two in Japan (Onuma et al. 2017; Guo and Li 2016), Israel (Kirschenbaum et al. 2017; Shapira et al. 2018), China (Chan et al. 2018; Cui and Han 2018), Chile (Bronfman et al. 2019, 2020), and Iran (Aryankhesal et al. 2017; Rostami-Moez et al. 2020). Meanwhile, each research study also focused on Thailand (Songlar et al. 2019), Serbia (Cvetkovic et al. 2019), the United States (US) (McGeehan and Baker 2017), Saudi Arabia (Azim and Islam 2016), Palestine (Cerchiello et al. 2018), Nepal (Ray 2017), Indonesia (Ismail et al. 2016), Portugal (Pacheco et al. 2020) and a study conducted in the US) and Turkey (Joffe et al. 2019) (see Fig. 2).

It was recorded that 22 studies focused on quantitative analyses (Rostami-Moez et al. 2020; Bronfman et al. 2019, 2020; Joffe et al. 2019; Cvetkovic et al. 2019; Songlar et al. 2019; Doyle et al. 2018; McClure et al. 2016; Tipler et al. 2016; Paton et al. 2015; Jang et al. 2016; Han et al. 2017; Onuma et al. 2017; Guo and Li 2016; Chan et al. 2018; Cui and Han 2018; Shapira et al. 2018; Azim and Islam 2016; Cerchiello et al. 2018; Ray 2017; Aryankhesal et al. 2017; Ismail et al. 2016) while the other five studies focused on qualitative analyses (Pacheco et al. 2020; Becker et al. 2017; Kirschenbaum et al. 2017; McGeehan and Baker 2017; Kenney and Phibbs 2015). One study employed the mixed-method approach (Chou et al. 2015) (see Fig. 3).

Regarding the year of publication, three articles were published in 2015 (Paton et al. 2015; Kenney and Phibbs 2015; Chou et al. 2015), seven studies were published in 2016 (McClure et al. 2016; Tipler et al. 2016; Jang et al. 2016; Guo and Li 2016; Kirschenbaum et al. 2017; Azim and Islam 2016; Ismail et al. 2016), six articles were published in 2017 (Han et al. 2017; Onuma et al. 2017; Ray 2017; Aryankhesal et al. 2017; Becker et al. 2017; McGeehan and Baker 2017), five papers were published in 2018 (Doyle et al.

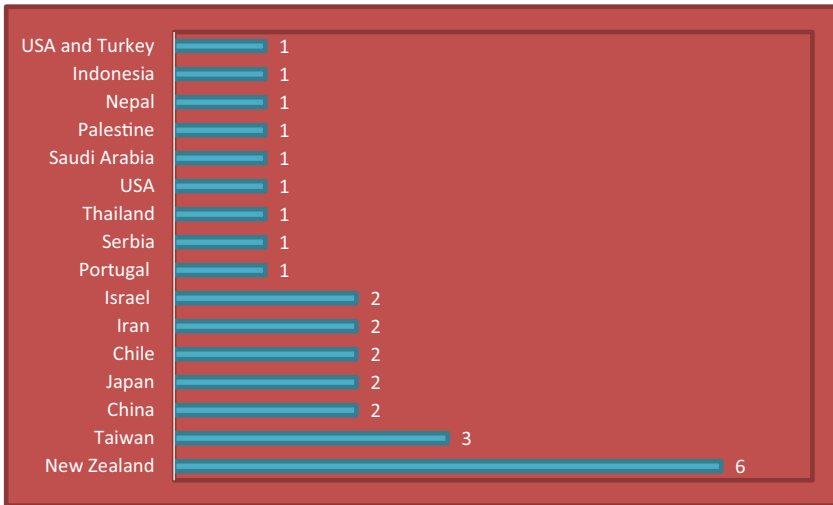


Fig. 2 Countries where the selected studies were conducted

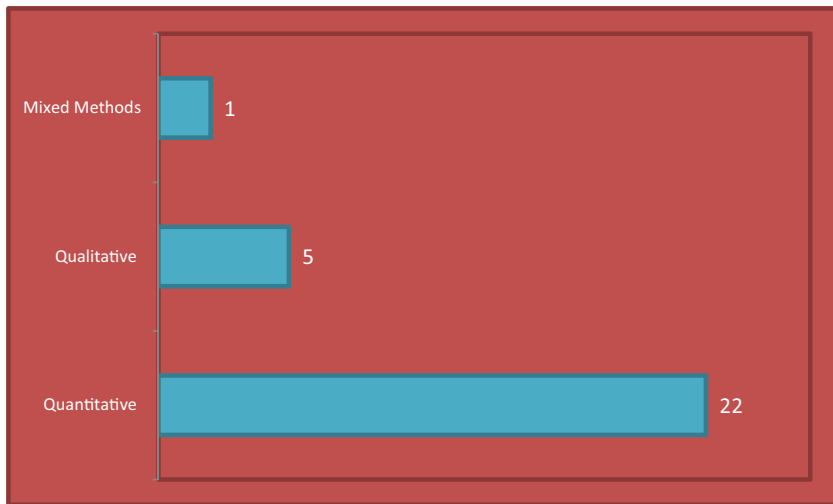


Fig. 3 Research design of selected studies

2018; Chan et al. 2018; Cui and Han 2018; Shapira et al. 2018; Cerchiello et al. 2018), four studies were published in 2019 (Bronfman et al. 2019; Cvetkovic et al. 2019; Songlar et al. 2019; Joffe et al. 2019), and three were published in 2020 (Rostami-Moez et al. 2020; Bronfman et al. 2020; Pacheco et al. 2020) (see Fig. 4).

Furthermore, the review revealed that 10 articles were published in the *International Journal of Disaster Risk Reduction* (Kenney and Phibbs 2015; Chou et al. 2015; Paton et al. 2015; McClure et al. et al. 2016; Becker et al. 2017; Onuma et al. 2017; Kirschenbaum et al. 2017; Cerchiello et al. 2018; Doyle et al. 2018; Shapira et al. 2018), two articles were published in *Disaster Prevention and Management: An International Journal*

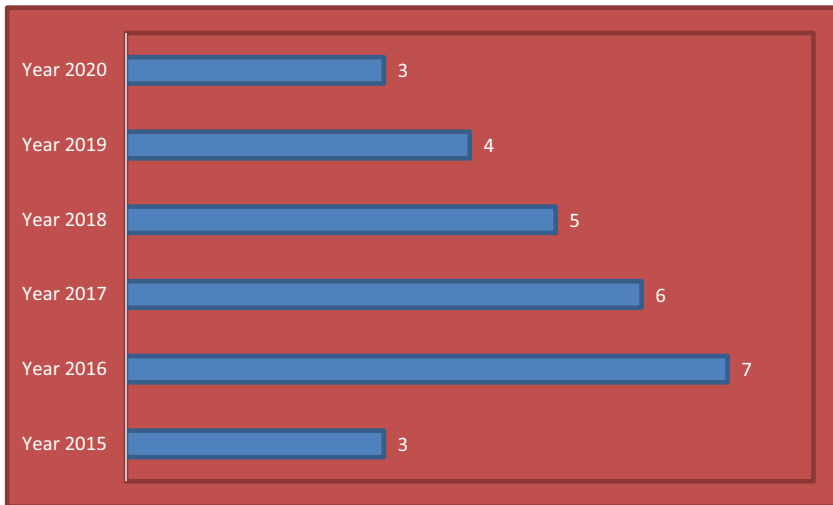


Fig. 4 Publication years of selected studies

(Guo and Li 2016; Tipler et al. 2016), and another two published in *Disasters* (Jang et al. 2016; McGeehan and Baker 2017). In contrast, only one article was published in the following journals: *Risk Analysis* (Bronfman et al. 2020), *Acta Geographica Slovenica* (Cvetkovic et al. 2019), *Journal of Health Research* (Songlar et al. 2019), *BMC Public Health* (Rostami-Moez et al. 2020), *Nature Human Behaviour* (Joffe et al. 2019), *International Journal of Psychology* (Pacheco et al. 2020), *Plos One* (Bronfman et al. 2019), *Disaster Medicine and Public Health Preparedness* (Aryankhesal et al. 2017), *Health Security* (Han et al. 2017), *International Journal of Disaster Risk Science* (Chan et al. 2018), *International Journal of Environmental Research and Public Health* (Cui and Han 2018), *Environmental Hazards* (Azim and Islam 2016), *Rural and Remote Health* (Ismail et al. 2016) and *The Professional Geographer* (Ray 2017). All selected journals had good quality as the journals were indexed by both Scopus and Web of Science databases. Most were ranked either in Quartile 1 or Quartile 2 (see Table 5).

3.2 The developed themes

The thematic analysis was undertaken on 28 selected articles resulted in seven main themes: (1) infrastructure-related, (2) information seeking and sharing and experience sharing; (3) related programme, training and campaign; (4) strong social relationship; (5) survival kits and supplies; (6) involvement, planning, training in evacuation or emergency drills; and (7) life-saving techniques and life protection. These seven themes further produced 18 sub-themes (see Table 6). Based on the results, seven themes and 18 sub-themes provided answers to the main research question of this SLR, “How do communities globally prepare for the threat of earthquakes?”. The background of the selected studies explained in the following section.

Table 5 Selected journals and their ranking

	Total number of selected articles	Indexed by WoS	WoS Quartile (referring to latest information)	Indexed by Scopus	Scopus Quartile (referring to latest information)
International Journal of Disaster Risk Reduction	10	✓	Q1	✓	Q1
Disaster Prevention and Management: An International Journal	2	✓	Q4	✓	Q2
Disasters	2	✓	Q2	✓	Q1
Risk Analysis	1	✓	Q1	✓	Q1
Acta Geographica Slovenica	1	✓	Q4	✓	Q2
Journal of Health Research	1	✓	-	✓	Q4
BMC Public Health	1	✓	Q2	✓	Q1
Nature Human Behaviour	1	✓	Q1	✓	Q1
International Journal of Psychology	1	✓	Q3	✓	Q1
Plos One	1	✓	Q2	✓	Q1
Disaster Medicine and Public Health Preparedness	1	✓	Q4	✓	Q3
Health security	1	✓	Q3	✓	Q2
International Journal of Disaster Risk Science	1	✓	Q3	✓	Q2
International Journal of Environmental Research and Public Health	1	✓	Q1	✓	Q2
Environmental Hazards	1	✓	Q4	✓	Q2
Rural and Remote Health	1	✓	Q4	✓	Q1
The Professional Geographer	1	✓	Q3	✓	Q1

Table 6 Findings

Authors/Theme	Infrastructure-related				Information seeking and sharing				Strong social relationship				Survival kits and supplies				Involvement, planning, training in evacuation or emergency drills				Life-saving techniques and life protection			
	SS	IN	PS	KN	EX	CM	PG	CC	SR	CA	BA	NB	PT	DP	EP	LS	SK	INS						
Chou et al. (2015)				✓	✓		✓							✓										
Paton et al. (2015)			✓						✓	✓	✓				✓									
Kenny and Phibbs (2015)			✓						✓	✓														
Azim and Islam (2016)			✓																					
Guo and Li (2016)	✓				✓				✓		✓			✓										
Ismail et al. (2016)				✓	✓						✓			✓										
Jang et al. (2016)				✓	✓																			
Kirschenbaum et al. (2017)				✓	✓				✓															
McClure et al. (2016)	✓	✓									✓			✓										
McGeehan and Baker (2017)											✓			✓										
Tipler et al. (2016)			✓		✓						✓			✓										
Onuma et al. (2017)			✓		✓						✓			✓										
Aryankhesal et al. (2017)	✓	✓			✓						✓			✓										
Becker et al. (2017)			✓		✓						✓			✓										
Han et al. (2017)		✓			✓						✓			✓										
Ray (2017)	✓				✓						✓			✓										
Chan et al. (2018)			✓		✓						✓			✓										
Cerchiello et al. (2018)			✓		✓						✓			✓										
Shapira et al. (2018)		✓			✓						✓			✓										
Doyle et al. (2018)					✓						✓			✓										
Cui and Han (2018)					✓						✓			✓										
Bronfman et al. (2019)			✓		✓						✓			✓										

Table 6 (continued)

Authors/Theme	Infrastructure-related			Information seeking and sharing, and experience sharing			Related programme, training and campaign			Strong social relationship			Survival kits and supplies			Involvement, planning, training in evacuation or emergency drills			Life-saving techniques and life protection		
Sub-themes	SS	IN	PS	KN	EX	CM	PG	CC	SR	CA	BA	NB	PT	DP	EP	LS	SK	INS			
Cvetkovic et al. (2019)	✓	✓	✓						✓		✓	✓									
Joffe et al. (2019)		✓										✓									
Songlar et al. (2019)	✓	✓	✓		✓							✓		✓							
Rostami-Moez et al. (2020)	✓	✓									✓	✓									
Pacheco et al. (2020)	✓	✓	✓								✓	✓									
Bronfman et al. (2020)		✓	✓						✓		✓	✓									
Infrastructure-Related	Information seeking and sharing and experience sharing			Related programme, training and campaign			Strong social relationship			Survival kits and supplies			Involvement, planning, training in evacuation or emergency drills			life-saving related techniques and life protection					
SS = Strengthen structure	KN = Information seeking			CM = Campaign culture			CC = Collectivist culture			BA = Basic needs (food, water, clothes, medication)			PT = Participation in evacuation drills			LS = Life-saving techniques					
IN = Interior	EX = Information and Experience sharing			PG = Programme/ Training			SR = Shared responsibilities			NB = Basic needs other than food, water, clothes, medication			DP = Disaster preparedness training			SK = Survival skills					
PS = Providing safe place/room and routes				CA = Community-agency relationship									EP = Evacuation planning			INS = Purchase insurance					

3.2.1 Infrastructure-related

The first sub-theme under infrastructure-related was strengthening the structure of houses. In Saudi Arabia, for example, one way to prepare for earthquakes is by choosing a less vulnerable site for building their house and constructing a more robust dwelling with reinforced rods, cement, and concrete (Azim and Islam 2016). Similarly, McClure et al. (2016) revealed that people in New Zealand employ structural damage mitigation such as making the house quake safe, checking the house safety, or removing the brick chimney. Ray (2017) stated that house constructions in Kathmandu Valley are still built traditionally; not only does this construction practice preserve the local cultural values, but it also enables houses in this region to withstand strong tremors, further lessening the earthquake threat to people. The people in Iran typically replace their roof with higher quality material in ensuring that the roof will not collapse during an earthquake event (Rostami-Moez et al. 2020). Meanwhile, in Thailand, Serbia, and Portugal, people reinforce or secure their homes, repair house cracks, and build earthquake-proof houses (Songlar et al. 2019; Cvetkovic et al. 2019; Pacheco et al. 2020).

The second sub-theme was related to the interior arrangement. Some studies discovered that community members take precautions against earthquakes by fastening or bracing heavy objects such as shelves to walls, securing furniture at home, and shifting heavy objects to lower levels. These steps will further prevent objects from falling during tremors, hence, reducing injury risks and property damage (Bronfman et al. 2020; Pacheco et al. 2020; Joffe et al. 2019; Cvetkovic et al. 2019; Songlar et al. 2019; Han et al. 2017; Shapira et al. 2018; McClure et al. 2016). Another earthquake preparedness strategy practised by the community is by preparing safe places or rooms and routes. A safety area or room is vital to keep earthquake victims safe and provide shelter or a room for people who are displaced by a natural disaster (Bronfman et al. 2020; Pacheco et al. 2020; Bronfman et al. 2019; Cvetkovic et al. 2019; Songlar et al. 2019; Paton et al. 2015; Kenney and Phibbs 2015; Cerchiello et al. 2018; Aryankhesal et al. 2017). Tipler et al. (2016), who conducted a study in selected schools in New Zealand (representing 20 per cent of all NZ schools), concluded that a safe place was prepared for students and staff to assemble when evacuating the buildings, and people were also well informed about the availability of alternative routes to the assembly area. On the other hand, a unique study of earthquake preparedness among the Māori community in New Zealand (Kenney and Phibbs 2015) found that the local residents cooperated to build physical spaces, which also functioned as psychosocially protective spaces for distressed residents. This strategy was based on a specific cultural value *whakarurutanga* ('safety' or 'protection'), highlighting the significance of developing and maintaining a safe environment for those in need.

3.2.2 Information seeking and sharing, and experience sharing

The first sub-theme is related to the efforts of the community to seek information related to earthquake preparation. It was observed that the use of technology and communication technologies is prevalent as far as community preparedness for earthquakes is concerned. Some people reported that they would listen to radio forecasts about the occurrence of earthquakes, while others would typically search for and receive relevant information via official media or other social network sources (Ismail et al. 2016; Kirschenbaum et al. 2017; Jang et al. 2016). On the other hand, Chan et al. (2018) confirmed the effective use

of the Internet and mobile technology to access disaster-related information among community members.

The second sub-theme is related to information and experience sharing. Sharing activities that usually occur among colleagues and family members can further improve their preparedness efforts and response capabilities (Songlar et al. 2019; Becker et al. 2017; Onuma et al. 2017; Han et al. 2017; Tipler et al. 2016). Guo and Li (2016) and Chou et al. (2015) claimed that recalling past experiences is highly important to raise public consciousness and motivate people to take actions accordingly. Information and experience sharing with earthquake experts and earthquake survivors, for example, can further result in increasing knowledge at a broader level of society. Ismail et al. (2016) noted the significance of parents having healthy communication with their children regarding disaster preparedness and discussing with other family members beforehand where to reassemble if a disaster occurs. Additionally, some people would usually disseminate educational materials on preparedness (e.g. Family Home Storage and Family Finances pamphlets) and geological disaster education (McGeehan and Baker 2017; Cui and Han 2018).

3.2.3 Related programmes, training and campaigns

Under this theme, a total of two sub-themes were produced: programme/training and campaign. This theme is defined as any course of action conducted to reinforce the community's preparation against the threat of earthquakes. These efforts were undertaken by several organisations, including the government, to assist the community in understanding the nature of geological disasters and their impact (Cui and Han 2018). For example, the School Earthquake Safety Programme in Nepal involves teachers and parents. Its main content covers the retrofitting of school buildings and the development of soft skills for earthquake management (Ray 2017).

Similarly, a disaster prevention programme in Taiwan attempted to facilitate knowledge transfer and sharing experiences and skills required to identify early earthquake signs (Chou et al. 2015). Some disaster awareness media campaigns also offer related knowledge to the public (Ray 2017). In New Zealand, campaigns known as "Get Ready, Get Thru" and "Emergency Services" have been successfully aired as television advertisements to enhance community knowledge on earthquake threats (Becker et al. 2017).

3.2.4 Strong social relationship

There were three sub-themes under the fourth theme of strong social relationships: shared responsibilities, collectivist culture, and community-agency relationship. A strong social relationship creates a sense of shared responsibilities, prompting a desire among the community members to help one another during hazards and disasters, lessening their dependence on government assistance (Becker et al. 2017; Guo and Li 2016). Bronfman et al. (2020) and Cvetkovic et al. (2019) stressed that people would commonly provide special care to the most vulnerable groups in the community during catastrophic events, such as the elderly, disabled, infants, and young children. Furthermore, it was revealed that residents living within a collectivist cultural context possess a better understanding of the information, resources, and other community needs since they relate to earthquake risks and preparedness much better than those in an individualistic cultural setting (Jang et al. 2016). In New Zealand, Māori risk management initiatives were collaborative, effective, and shaped by *kaupapa* (cultural values), especially the value of '*aroha nui ki te tangata*'

(extend love to all people) (Kenney and Phibbs 2015). The review also noted a strong community-agency relationship via established external linkages to government agencies (Paton et al. 2015). The Ministry for Māori Development and the traditional authority over the region where earthquakes commonly occur cooperate with the locals to strengthen the preparedness strategies in line with community needs, abilities, and interests (Kenney and Phibbs 2015).

3.2.5 Survival kits and supplies

The survival kits and supplies theme produced a further two sub-themes: basic needs, which consist of food, water, clothes, and medicine and the non-basic needs, which encompass kits and supplies other than the basic needs. The community members typically regard basic kits and supplies as the most important necessities to ensure their survival during emergencies like natural disasters. Ismail et al. (2016) and Onuma et al. (2017), who performed their research in Indonesia and Japan respectively, reported that the community would always store sufficient non-perishable food and clean water for at least three days in their home. Meanwhile, others would prioritise keeping enough supplies of canned food, clean clothes, first-aid kits, and medication (Bronfman et al. 2020; Rostami-Moez et al. 2020; Pacheco et al. 2020; Cvetkovic et al. 2019; Han et al. 2017; McClure et al. 2016; McGeehan and Baker 2017; Paton et al. 2015; Shapira et al. 2018; Chan et al. 2018; Cui and Han 2018).

Among the non-basic items that people would make available to prepare for earthquakes include vehicles, battery-operated radio at home, mobile phones, torches, batteries, flashlights, important documents, fire extinguisher, functional smoke alarms, cash on hand and items to barter, as well as filling bathtubs with water, stockpiling supplies and hygiene-related items, and making fire-related safety adjustments (Bronfman et al. 2020; Pacheco et al. 2020; Joffe et al. 2019; Cvetkovic et al. 2019; Songlar et al. 2019; Shapira et al. 2018; Chan et al. 2018; Doyle et al. 2018; Onuma et al. 2017; Ismail et al. 2016; McClure et al. 2016; McGeehan and Baker 2017). Interestingly, Iranians keep necessary contact numbers such as the local fire station, police, and other contacts for emergencies that are vital for pre/post-disaster times (Rostami-Moez et al. 2020).

3.2.6 Involvement/planning/training in evacuation/emergency drills

Three sub-themes were identified under this theme: evacuation drills, disaster preparedness training, and evacuation planning. Participation in evacuation drills is one of the most effective preparation strategies employed in the community (Bronfman et al., 2019; Songlar et al. 2019; Cui and Han 2018; Han et al. 2017; Onuma et al. 2017; Ismail et al. 2016; Jang et al. 2016). However, it must be noted that participation in evacuation drills should not simply occur at the individual level. For example, several schools in New Zealand indicated that they had actively involved families in the drill by directly informing students about earthquakes and encouraging them to discuss this material at home with their family members (Tipler et al. 2016).

The second sub-theme is disaster preparation training, which attempts to disseminate knowledge, experiences and skills needed to detect early seismic threats and events, where the training content includes information-sharing sessions with earthquake experts and knowledge and experience sharing with earthquake survivors (Bronfman et al. 2019; Chou et al. 2015; McGeehan and Baker 2017; Ismail et al. 2016; Onuma et al. 2017). Evacuation

strategies that may incorporate information on what to do, where to go, and meeting place during an earthquake are also among the activities planned in preparation for dealing with earthquake threats within the community (McClure et al. 2016; Shapira et al. 2018; Doyle et al. 2018). Some devise a more specific plan, such as a few schools in New Zealand that had formulated a unique method to trigger a building evacuation, especially if they could not use existing alert systems due to power failures or damage (Tipler et al. 2016).

3.2.7 Life-saving techniques and life protection

This main theme comprised of three sub-themes: life-saving techniques, survival skills, and insurance purchases. Ray (2017) and Cui and Han (2018) claimed that community members are orientated towards improved and effective life-saving techniques. Mastering these methods enable them to respond to a disaster. On the other hand, Tipler et al. (2016) discussed a specific life-saving technique called the turtle safe technique, where the individual crouches down on the ground and covers his or her head and neck with their arms, similar to a turtle. Another preparation activity of the community is purchasing insurance to prepare financially before and after natural disasters occur (Han et al. 2017; Cerchiello et al. 2018).

4 Discussion

Strengthening houses and public infrastructure is a good preparedness strategy to mitigate against earthquake threats (Azim and Islam 2016; McClure et al. 2016; Ray 2017). It is undeniable that no building is immune from foundation failure during an earthquake event. Nevertheless, in a less powerful quake, such problems can be evaded. For instance, the construction technique of removing brick chimnies reduces the risk of injury, while the use of anchor bolts to tie buildings to their foundation helps prevent the two from disintegrating or collapsing. This damage-reducing feature of preparedness is critical for people's safety and wellbeing during earthquake events, given that most deaths and injuries during earthquakes result from damaged or collapsing buildings falling on people (Pan et al. 2019; World Bank 2009).

According to the World Bank (2009), most deaths during natural disasters are caused by buildings collapsing, and most cases occur in the developing world. Pan et al. (2019) also reported that collapsing and damaged buildings (either severe or slight) during the 2016 southern Taiwan earthquake caused 115 deaths and injured another 114 residents of the Weiguan Jinlong Complex. Nevertheless, it should be noted that the lack of skills in house renovations or construction and other additional costs (e.g. cost of the materials or hiring contactors/expertise) might obstruct people from applying this construction technique (Russel et al. 1995). Moreover, not everyone can implement this strategy as home or room construction and renovation is not an ordinary or common skill that members of the society possess.

As for those with financial restraints, they might be obstructed by the extra costs incurred by contractors or via payment to experts. It has been acknowledged that re-designing the interior arrangement of houses will reduce the risks of becoming injured from collapsing objects (Han et al. 2017; Shapira et al. 2018; McClure et al. 2016). While allocating a safe room/place or routes and providing shelter or a room for people who are

displaced by an earthquake will help ease the impacts of such events (Paton et al. 2015; Kenney and Phibbs 2015; Cerchiello et al. 2018; Aryankhesal et al. 2017). Despite its importance, Russel et al. (1995) asserted that people demonstrate less interest in employing these measures as they require a significant amount of time, resources, and expenses. They further stated that those who rent would face various issues to implement this strategy; for example, the processes of installing cupboard latches and bolting furniture rely on access to utility equipment and the restriction of their living arrangements. In order to avoid a more serious conflict, renters would refrain from making any modifications to the property and its arrangement without obtaining the owner's permission.

It has been reported that information seeking and sharing of information and experience help to raise public knowledge and understanding of earthquake preparedness. According to Guo and Li (2016), seeking information voluntarily increases people's knowledge of the causes of natural hazards, their negative impacts, and humanity's powerlessness in controlling them. Shaffril et al. (2015) claimed that information seeking about natural hazards provides adequate information to the community, enabling them to produce reactive and proactive plans to face the phenomenon and reduce associated risks. Experience sharing is another important element in community preparedness since it offers the most authentic knowledge about a disaster and can also be the most easily accessible clue for judgements for future seismic threats (Guo and Li 2016).

Nonetheless, Paton et al. (2015) and Celci et al. (2005) expressed their concerns on several negative impacts of experience sharing. Celci et al. (2015) concluded that the interaction between experience and people's prediction on the magnitude of earthquake tremors could lead to underestimating the impacts of a potential future of these natural hazards, thus reducing their likelihood to prepare for any emergency. In contrast, Paton et al. (2015) examined the potential of Gambler's Fallacy, (i.e. the assumption that a future earthquake would not occur for several hundred years) in causing people to become less vigilant in preparing for potential seismic threats. The information and experience seeking and sharing process can be undertaken via verbal communication or via technology devices (Becker et al. 2017; Han et al. 2017; Tipler et al. 2016; Ismail et al. 2016; Kirschenbaum et al. 2017; Jang et al. 2016). As the elderly are generally expected to possess vast experience in life, their role in experience sharing is vital. However, they need to possess the right communication skills to effectively transfer their experiences to the younger generation (Shaffril et al. 2015).

In addition to the importance of senior community members, Hassan et al. (2010) focused on the roles of community leaders and colleagues to disseminate and share pertinent information and experiences as they are considered as a trusted and reliable source of information. Modern technology such as the Internet and smartphone devices has accelerated the seeking and sharing of knowledge and information. The community, especially the younger generation, can now search for earthquake-related information regardless of the time and their location. However, Omar et al. (2011) mentioned that factors such as technology phobia and negative attitude might deter senior members of the community from using modern technology devices, and they would prefer to rely on local radio to gain information on natural hazards.

Survival kits encompassing basic and non-basic necessities are vital preparations for those in earthquake threatening areas. Russel et al. (1995) claimed that the accepted rule of thumb of post-earthquake events includes the community being left or isolated 'on their own' for the initial 72 h; stores may be closed for several weeks, and roads may be unsafe. During this period, having a minimum of a three-day supply per person of the basic needs such as non-perishable food, clean water, first-aid kit, and medication

supplies is most essential for their survival (Han et al. 2017; McClure et al. 2016; McGeehan and Baker 2017; Paton et al. 2015; Shapira et al. 2018; Chan et al. 2018; Cui and Han 2018). Furthermore, since perceived earthquake preparedness is strongly associated with actual survival preparedness, the community will need to prepare the most commonly advocated preparation items such as a battery-operated radio at home, mobile phone, a well-charged torch, batteries, and flashlights (Shapira et al. 2018).

Even though evacuation drills might be seen as a nuisance to the community, it remains an effective strategy for emergency preparedness, and thus, must be well-planned to ensure it is in line with the community's abilities, needs, and interests (Cui and Han 2018; Han et al. 2017; Ismail et al. 2016; Jang et al. 2016). Several factors will influence the type of evacuation drills, such as building category, occupancy, identified risks, and the nature of the emergency simulated or tested (Pan et al. 2019; Annette et al. 2018; Nakaya et al. 2018). Hurricanes or earthquakes, for example, might require policymakers to produce different evacuation strategies. Also, given these diverse characteristics, ongoing involvement from the community is required to familiarise themselves with the drills.

According to Annette et al. (2018), policymakers should consider several demographic factors such as gender, race, income, education, homeownership, and housing type, which have been shown to influence community evacuation behaviour. However, despite these factors, Nakaya et al. (2018) confirmed that some of the community might not be interested in involving themselves in evacuation drills, especially among those who have never been affected by natural disasters and those who do not understand the necessity for evacuation. Likewise, individuals who have a strong attachment to their place (i.e. home) might cause self-conflict and inter-conflict with the rescue team during the process of evacuation and transferring them to a safe area.

Nevertheless, a strong social relationship amongst the community offers several benefits regarding earthquake preparedness. According to Becker et al. (2017) and Guo and Li (2016), a community with a strong social bond will have a sense of shared responsibilities which will inspire them to help one another, either before (e.g. building a safe room), during (e.g. offering assistance during evacuation process), or after a disaster has occurred (e.g. raising money for disaster relief). This sense of togetherness will also prompt them to check on other families, colleagues, and neighbours and offer assistance wherever possible (Becker et al. 2017). Secondly, it has shown that a strong social relationship will enhance the community's independence from government support. For example, Gismondi (2012) demonstrated how the local people in Kawaguchi, Japan, responded to the isolation of the affected area and the inaccessibility of government support by organising and sharing resources. They cooperatively rebuilt several physical infrastructures and a commuting road, resulting in easy access for the rescue and emergency teams. Shaffril et al. (2017) also added that this strong social relationship would form a solid understanding and lessen internal conflicts, further ensuring the effectiveness of rescue plans. They also stated that this type of relationship increases trust among each other, thus encouraging knowledge and experience sharing. Interestingly, the same research suggested that the firm or solid bond within the community shall accelerate the victims' recovery process from trauma, shock, and dented emotions caused by natural disasters.

Typically, relevant training and programmes on earthquake preparedness are conducted at the community level by those most concerned. This strategy aims to facilitate the transfer of necessary knowledge, experiences, and skills to detect early earthquake threats while concurrently educating the public about survival skills vital during and after the disaster. In addition to meeting the learners' needs, abilities, and interests, the training and

programmes should be well-integrated with broader public participation and continuous support from the authorities (Shaffril et al. 2013; Chou et al. 2015). For example, programmes that address the cause of tremors might attract little interest if compared to those focusing on the impacts of earthquakes on the community's socio-economic routines.

Some community members also practise life protection strategies such as purchasing life insurance. Not only does having life insurance allow those insured to cope with any uncertainties, but it also has a significant role in risk reduction and avoiding more considerable losses. Nevertheless, there are several issues related to this strategy that need further consideration. First, community members who are insured might be less interested in understanding and implementing such strategies. Egbelakin et al. (2018) related this situation to the social norm of moral hazards. In this condition, the individual becomes involved in a risky event knowing that they (the insured) are secured against the risk and that the other party bears the losses. Second, as purchasing insurance requires additional costs and financial commitment, this strategy might not be a popular option for poor and low-income groups. Third, there is a risk of denial coping—when they think the damages caused by an earthquake are controllable—and Gambler's Fallacy—the assumption that a future earthquake would not occur for several hundred years, which might influence the community for not buying insurance to address or cover natural hazards (Paton et al. 2015; Russell et al. 1995). Survival skills and life-saving techniques are important elements for community preparation against the threat of earthquakes. Mastering survival skills can reduce the risk of injury and death to the individual while knowing life-saving techniques will enable individuals to save and protect other communities if the situation arises (Han et al. 2017; Onuma et al. 2017). Furthermore, survival skills and learning life-saving techniques allow the community to reduce its dependence on emergency teams; this is especially important when the emergency team is late or unable to enter the disaster area due to damage to basic infrastructure (Han et al. 2017; Bronfman et al. 2020).

5 Implications, research gaps and recommendations for future studies

Several implications resulted from this study. According to the World Bank (2009), most deaths caused by natural disasters are caused by building collapses attributed to seismic or earthquake events. Therefore preparation strategies related to strengthening or reinforcing houses and public infrastructure should be further investigated by researchers in this field. However, this review concluded that the community often shows less interest in employing these measures since they require considerable time, resources, and expense. This situation offers a future opportunity to government agencies, the private sector, NGOs and other interested parties to assist the community in addressing and overcoming the issues (i.e. lack of technical experts, resources and financial support), which then enable them to improve their surrounding infrastructure to withstand the threat of earthquake events.

In this review, themes related to life-saving techniques, survival skills and insurance were less evident than other themes. Similarly, limited research has been conducted to review and examine these preparation elements. Therefore, researchers and other scholars should explore how these elements can further strengthen the preparation strategies for communities. Likewise, for place attachment, scholars should examine how a positive affective bond between people and place and their closeness to objects and places can strengthen their preparation towards earthquake threats. Furthermore, government agencies, the private sector, NGOs and other interested parties need to examine how the

community can sustain their wellbeing and survive during the post-earthquake term. They also need to have sufficient information given its importance since different individuals and community members might respond differently to the impacts. Some might be slightly affected, others might be severely affected, and their strategy to sustain and survive might be worth investigating.

Accordingly, based on SLR, several research gaps were identified. First, there is a need to understand why people are reluctant to spend money and effort to fortify their physical infrastructure even though building and infrastructure collapse has been given as the leading cause of death during an earthquake event. Second, there is a need to acquire a good understanding of life-saving techniques, survival skills, and insurance purchase. These themes, while important, are not discussed in previous studies. Furthermore, although previous studies have stressed the importance of place attachment, there is a need to understand this aspect from developing a preparation strategy rather than from a risk perspective. The existing gap can be narrowed if future scholars focus on conducting qualitative and mixed-method approaches, producing a more systematic integrative review, and developing more publication standards. The empirical data of this research illustrated that a quantitative research design extended the existing literature on earthquake preparedness, thereby presenting a significant gap for qualitative and mixed-method design studies. It must also be pointed out that both approaches have distinct advantages and should therefore be investigated by future scholars. The qualitative design offers a source of well-grounded and comprehensive explanations of processes in identifiable local contexts, driving empirical data to produce much richer data that transcends quantitative statistics (Ridder 2014).

On the other hand, the mixed methods approach enhances data validity, informs the collection of the second data source, assists with knowledge creation, and concurrently integrates the components that provide more depth and detail to the findings and drawing conclusions (McKim 2017). Future research of community preparedness for earthquake events should also focus on the integrative review technique that combines various research designs. However, despite several issues such as the hazards of synthesising diverse types of literature caused by different epistemological approaches, political and cultural contexts, including political and scientific infrastructure (Sandelowski et al. 2006), Heyvaert et al. (2011) and Dixon-wood et al. (2005) claimed that integrating several research designs in a review study is plausible.

6 Conclusion

Since predicting future seismic events is almost impossible, more effort must be directed towards improving community preparedness to transform the public perspective from 'If an earthquake strikes' to 'When an earthquake strikes'. The present study has systematically reviewed previous studies related to community preparedness for earthquakes. By adopting this approach, any claims of rigour in some of these studies be challenged, allowing for the identification of gaps and providing opportunities for future study. In this study, employing an SLR approach, 28 articles were appraised for their quality. Also, since the review depended on the heterogeneity of research designs, thematic analysis was conducted on the 28 selected articles, resulting in seven main themes: (1) infrastructure-related; (2) information seeking and sharing and experience sharing; (3) related programme, training and campaign; (4) strong social relationship; (5) survival kits and supplies; (6) involvement,

planning, training in evacuation or emergency drills, and (7) life-saving techniques and life protection. These themes were categorised into 18 sub-themes.

The review concluded that strengthening individual or public infrastructure is important as most deaths due to natural disasters are caused by building collapse. Understandably, having a more sturdier dwelling or building can save more lives if an earthquake or seismic event occurs. It was noted that some community members take appropriate action by seeking information on earthquake preparation through several sources, while others have no problem in sharing information and experiences regarding hazards or natural disasters. The government and other interested parties also organised programmes, training and campaigns. The main purpose is in providing knowledge and assisting the community in understanding the nature of geological disasters and their impact. The review also concluded that having a stronger social relationship provides benefits to the community by creating a sense of shared responsibility, enhancing the community's independence from receiving government support, reducing internal conflicts, and increasing trust.

Furthermore, having survival kits and supplies available to the community is vital, especially after an earthquake. Ensuring all basic necessities are available and prepared, such as food, water, clothes, and medication, will ensure people can survive during such events. To further enhance their survival, the community's involvement, planning, training in evacuation or emergency drills will help to inform the community about information and activities to carry out during an earthquake event. For example, in training programmes, participants will be informed of what actions and activities to prioritise, where they need to congregate (i.e. safe place) during an earthquake event. Lastly, life-saving techniques adopted by the community demonstrate their willingness to acquire more 'paramedics' and medical staff, which increases the possibility of saving and protecting more lives. On the other hand, insurance was demonstrated as one of the best preparation strategies, although not all community members could afford to buy such insurance.

Nevertheless, there are several limitations inherent in this study. While Gusenbauer and Haddaway (2020) suggested 14 databases having the potential to search for relevant articles, due to limitations regarding access to these databases, only three databases were used, namely Scopus, Web of Science and Science Direct, supported by other databases, namely Emerald, Taylor Francis, Springer Link and Sage Journals. Secondly, the appraisal of the quality process relied on MMAT. It was anticipated that the articles would highlight variations in quality if examined based on different quality assessment tools. As such, it suggests in the future to examine either a greater number or fewer articles compared to the 28 articles finally reviewed in this study using various assessment tools. Shaffril et al. (2021) emphasised that a quality assessment is not simply aimed to seek perfect articles but rather to assist in searching for articles that suit the purpose of the review. Thirdly, although performing meta-analysis is encouraged in SLRs due to its advantages of acquiring a better estimation of relationships that exist in the population than in single studies, including its ability to minimise bias, this review opted to focus on a qualitative systematic literature review (QSLR) given the heterogeneity of methods used in the selected studies.

Other studies such as by Jansen (2020), Chen (2018) and Bonaiuto et al. (2016) have emphasised the effect of place attachment concerning the preparation of community strategies for earthquakes, although different in this SLR. However, having said that, since place attachment is significantly related to the perception of risk (Jansen 2020; Bonaiuto et al. 2016), this could be the main reason why this theme is not emerging since the review focused on a preparation strategy rather than the perception of risk.

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Declaration

Conflict of interest The authors declare no conflict of interest involved in the study.

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