IMPROVING THE DISASTER PREPAREDNESS AT THE COMMUNITY LEVEL: A SYSTEMATIC REVIEW

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Abstract. The Sendai Framework for Disaster Risk Reduction 2015 adopted "Build Back Better" which involves consideration of the community to be encouraged to use their effort and their resources to participate in disaster risk reduction. Resources devoted to community preparedness can often be minimal and the evaluation of such efforts is not systematic. This study aimed to perform a systematic review of articles that cover the interventions of community disaster preparedness. Articles involving the interventions used to improve disaster preparedness in the community which were published during 2000-2023 and appeared in the international electronic databases, namely PubMed, Science Direct, and Google Scholar, were reviewed. The study quality was assessed with the criteria adapted from the Joana Briggs Institute (JBI) Critical Appraisal Tool. Of 705 publications initially identified, 10 studies (five randomized control trials, three community-engaged research, and two quasi-experimental research design) were eligible to be included in the review. The combination of discussions and disaster drill were the most studied of the interventions, and were therefore the most effective community preparedness intervention. By systematically exploring the type of intervention for disaster preparedness, this systematic review gives essential information to develop an intervention to improve community involvement for disaster risk reduction.

Keywords: community, disaster preparedness, systematic review

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INTRODUCTION

The Sendai Framework for Disaster Risk Reduction 2015 which aligns with the Sustainable Development Goals (SDGs) has shifted its focus on reducing losses and damage to reducing the existing disaster risk (UNDRR, 2015). This framework adopted "Build Back Better" which involves consideration of the environment, encouraging society to build resilience, reducing the impacts of future disasters, and encouraging sustainability in the community. Effective and inclusive local preparedness systems are needed to prevent, detect, and respond to disasters. By integrating local actors and communities into systems, societies can boost their preparedness (IFRC, 2023). For that purpose, the community should be encouraged to use their effort and their resources to participate in disaster risk reduction.

Many communities in Indonesia live in hazardous circumstances such as near active mountains, in coastal areas, and isolated areas which is difficult to access. In a recent World Disaster Report, Indonesia included the 10 countries that experienced the greatest disasters in 2020-2021 (IFRC, 2023). However, the levels of community participation in disaster risk reduction strategies in Indonesia were still low (Abdulharis *et al*, 2022; Kusumastuti *et al*, 2014). Many factors such as the low level of training and education, linking social capital and disaster experience were the main causes of the low level of community disaster preparedness.

In addition to preparing for disaster response, Indonesia's government has taken a proactive approach to disaster risk reduction. Training programs have been developed on disaster resilience and preparedness in the community. However, there is no consensus regarding the most effective programs in disaster preparedness. Moreover, the resources devoted to community preparedness in Indonesia can often be minimal, and the evaluation of efforts is not systematic. This makes

it difficult for practitioners to determine the specific intervention to improve community preparedness. This study examined the community interventions that have been used for natural hazard preparedness around the world, which of those techniques have been effective, and what research methods were used to evaluate community preparedness.

MATERIALS AND METHODS

Study design

This systematic review appraised and synthesized the literature examining the community intervention for disaster preparedness. The results of the systematic review were presented following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (Popay *et al*, 2006).

Search strategy

International electronic databases including PubMed, ScienceDirect, and Google Scholar were searched using specific keywords. Search terms used were "disaster", "preparedness", "community", "household", "intervention", and "training".

Study selection criteria

The process of selecting relevant articles for this study involved the application of inclusion and exclusion criteria. The inclusion criteria encompassed: a) an article with experimental design, b) published in English, c) published between 2000 to 2023, and d) primary studies investigating the intervention to improve disaster preparedness in the

community. Articles that reported only perceptions about the benefits of training or explained how the intervention should be implemented were excluded. Articles stating that the outcome of the intervention was not related to disaster preparedness were also excluded.

Quality appraisal

The study quality was assessed with criteria adapted from the Joana Briggs Institute (JBI) Critical Appraisal Tool (Barker *et al*, 2023). The following quality thresholds were used: low quality (0%-33% of criteria met), medium quality (34%-66% of criteria met), and high quality (67% or more of criteria met).

Extraction and synthesis of data

Two reviewers autonomously conducted the data extraction and appraisal process, and no significant disparities in comments or decisions were observed. The author became the first reviewer, and one research assistant was hired to be the second reviewer. The first reviewer used Microsoft Office Excel to extract the data. The following information: a) title, authors, publication year, country, b) study design, c) study population d) type of disaster, e) outcomes, f) intervention, and g) major results were used for data extraction. The first reviewer imported the included article and carried out the first quality appraisal and data extraction. The studies were then divided into two groups and assigned to the two reviewers. Therefore, we adopted the process of Popay *et al* (2006) for analyzing the included studies: a) identifying a framework to comprehend how findings from related studies operated, why, and for whom, b) synthesizing themes, c) exploring the relationship among the themes, and d) evaluating the robustness of the synthesis.

RESULTS

A total of 705 publications were gathered and organized in ZOTERO (https://www.zotero.org/download) to facilitate data management. After 97 papers were removed due to duplication and other reasons, 608 papers were screened by the reviewers. Further, 501 articles were excluded according to the review of the abstracts. In the full-text review, 41 articles were excluded. Among 66 abstracts that persisted after the selection of the eligibility, 10 studies remained for the final analysis (Fig 1).

Study characteristics

Characteristics of the included studies are presented in Table 1. All of the included studies were published in the search period (2009-2022). Out of 10 studies, 3 were conducted in the US, 2 in Iran, and 1 each in Georgia, India, Nepal, Malaysia, and Haiti. The sample sizes ranged from 91 to 619 participants. Various types of interventions were conducted in the included studies such as workshops, training, using media, discussion, and peer support. Three studies only mentioned the intervention for earthquakes. Two studies mentioned about flood preparedness, one study for both earthquake and flood, and four studies did not mention the specific disaster for their intervention.

Quality assessment of included studies

The quality characteristics of the included studies are presented in detail in Table 2. Two reviewers assess the internal validity category (low, medium, and high quality) for 10 studies included in this review. Seven studies were classified as high quality, 3 studies were classified as medium quality and the remaining study was classified as low quality.

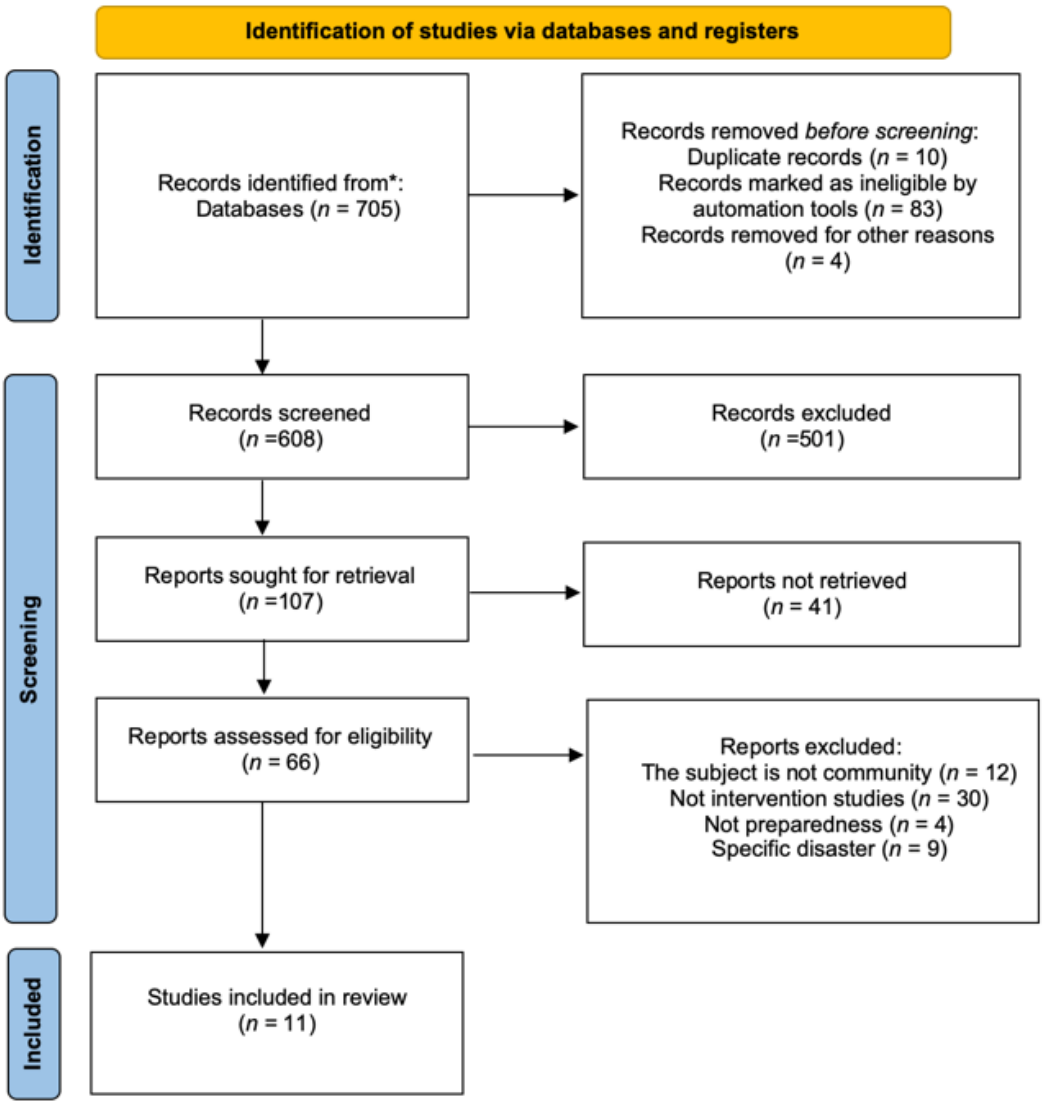

Fig 1 - Diagram of the process used to identify references for the review

Table 1
Characteristic of included studies

References	Year the study was conducted	Study location	Number of subjects	Type of disaster	Content of intervention	Description of intervention
Jamshidi *et al*, 2016	2011 to 2013	Iran	619	Earthquake	Educational intervention	3 days for the workshop and 10 days field work
Agarwalla *et al*, 2020	2018	India	300	Earthquake	Awareness program	Distribution of leaflet, demonstration of disaster response
Mhd Noor *et al*, 2022	2019-2021	Malaysia	284	Floods	Health Belief Model-Based Intervention (HEBI) for floods	Presentation, a group discussion, a video field visit, and mapping and revising community vulnerability
James *et al*, 2020	2014-2015	Haiti	480	Floods	The mental health integrated disaster preparedness intervention	3 days intervention group including facilitated discussion, space for sharing and hands-on disaster training
Eisenman *et al*, 2014	2010 to 2011	USA	91	Not mentioned	Training for disaster	Training for the peer-mentors and a series of four classes related to disaster preparedness
Ardalan *et al*, 2013	2011	Iran	250	Earthquake and flood	Community education intervention for earthquake and flood hazards	Discussion, participatory risk mapping, household emergency planning, and drill performance

Table 1 (cont)

References	Year the study was conducted	Study location	Number of subjects	Type of disaster	Content of intervention	Description of intervention
Thomas *et al*, 2018	2013 to 2015	Not mentioned	208	Not mentioned	The Ready CDC education intervention	1-hour education training, a training evaluation, 3 behavioral reinforcement contacts 3 weeks apart
Eisenman *et al*, 2009	2007-2008	USA	231	Not mentioned	Discussion about disaster preparedness	1-hour session of small group discussion vs receiving "media"
Welton-Mitchell *et al*, 2018	2015	Nepal	240	Earthquake	Mental health integrated disaster preparedness intervention	3 days intervention including facilitated discussion and providing peer-support
Glik *et al*, 2014	2006-2007	USA	187	Not mention	Health education and training about disaster	1-hour face to face discussion vs media received mailed

CDC: Centers for Disease Control and Prevention; USA: United States of America

Table 2
Quality of included studies

References	Study design	Study population, and sampling	Description groups	Outcomes	Measurement of outcomes	Analysis used to determine effectiveness	Quality
Jamshidi *et al*, 2016	Community engaged research	Systematic cluster sampling of household	6 months follow up	Knowledge, attitude, practice	Earthquake preparedness questionnaire developed by author with Cronbach's alpha over 0.7	Pearson's chi-square test and covariance regression	High
Agarwalla *et al*, 2020	Quasi-experimental research	Not clear	Post-test was done after 2 weeks	Preparedness	Earthquake preparedness at the household level; no information about Cronbach's alpha score	Paired t-test	Medium
Mhd Noor *et al*, 2022	Randomized control trial	Cluster	6 months follow up	Knowledge, skill, preparedness	Not informed the tools to measure outcome	Analysis of variance (ANOVA) and generalized estimating equations (GEE)	High

Table 2 (cont)

References	Study design	Study population, and sampling	Description groups	Outcomes	Measurement of outcomes	Analysis used to determine effectiveness	Quality
James *et al*, 2020	Randomized control trial	Random sampling	3-4 months and 6-7 months follow up	Preparedness	Self-reported disaster preparedness questionnaire developed by authors; reliability of the measure was acceptable.	t-test and Fisher's exact test	High
Eisenman *et al*, 2014	Randomized control trial	Not clear	Follow up assessment at 1 month.	Knowledge and behavior	Disaster preparedness items widely used in disaster studies with Cronbach alpha 0.75	t-test, Fisher's exact test, and generalized estimating equation (GEE)	High
Ardalan *et al*, 2013	Community intervention	Systematic sampling	6 months study period	Awareness and readiness	Questionnaires about awareness and readiness for disaster developed by author; Cronbach's alpha score 0.78 and 0.79	Linear and logistic regression models	High
Thomas *et al*, 2018	Community intervention	Convenience sampling	3 months post assessment	Knowledge, attitudes, community resiliency, and disaster preparedness	Disaster preparedness questionnaires developed by author; no information about Cronbach alpha	McNemar's, chi-square test and Wilcoxon analysis	Low

Table 2 (cont)

References	Study design	Study population, and sampling	Description groups	Outcomes	Measurement of outcomes	Analysis used to determine effectiveness	Quality
Eisenman *et al*, 2009	Randomized control trial	Randomized longitudinal cohort	3 months follow up	Improvement in stockpiling of disaster supplies	Barque's preparedness questionnaire; no information about Cronbach alpha	t-test or Wilcoxon rank sum test or Fisher's exact test and McNemar test	High
Welton-Mitchell *et al*, 2018	Quasi experimental design	Cluster random	2 weeks and 4 weeks after intervention	Preparedness, depression, PTSD, social cohesion. Help seeking related behavior	Disaster preparedness questionnaires developed by author with Cronbach Alpha 0.59	t-test, Fisher's exact test and chi-square of contingency tables	High
Glik *et al*, 2014	Randomized control trial	Randomized longitudinal cohort	Not clear	Communication plan and disaster supply kit	Disaster preparedness related behavior developed by author with Cronbach alpha 0.70 to 0.88	Person's chi-squared test or Fisher's exact test for study validity	Medium

Note: The quality was assessed with criteria adapted from the Joana Briggs Institute (JBI) Critical Appraisal Tool (Barker *et al*, 2023), *ie*, low quality: 0%-33% of criteria met; medium quality: 34%-66% of criteria met; High quality: 67% or more of criteria met

PTSD: post-traumatic stress disorder

All five studies were randomized control trials following a pre- and post-test design. Two studies were quasi-experimental designs. And three studies were community-engaged research. The outcome of all studies included disaster preparedness. However, two studies added the measurement for the psychological aspects such as depression level, post-traumatic stress disorder (PTSD) level, and so forth.

Results of included studies

Selected results from the included studies are reported in Table 3. The results summarized in Table 3 were selected for comparison in tabular form because these studies described a similar data analysis to measure the effectiveness of the intervention and also used a common measure of effect to report outcomes: mean percentage difference in point score of pretest and posttest.

From the 10 included studies, there were various types of intervention. Five studies conducted discussion as the intervention for improving disaster preparedness in the community. Two studies compared the small discussion and receiving media such as leaflets or pamphlets. The results from both studies showed that discussion has a larger improvement in disaster preparedness rather than receiving media. A study by Eisenman *et al* (2009) mentioned that among participants who did not have a family communication plan pre-intervention, 70.4% in the discussion group reported one at follow-up, compared to 42.3% in the media arm (p-value = 0.002). The discussion group had larger improvements in preparedness than did the media group for several key items such as stockpiling water, food, and blankets, and establishing a family communication plan. A study also mentioned that a significant shift over time from awareness to action and maintenance stages for

Table 3

Selected results of included studies

References	Mean scores of the Pre-test	Mean scores of the Post-test	Mean difference	Study design
Jamshidi *et al*, 2016	Knowledge level: Intervention 21.8, Control 14.9; Attitude: Intervention 4.3, Control: 4.4; Practice: Intervention 2.3, Control 2.7	Knowledge level: Intervention 24.8, Control 15.2; Attitude: Intervention 4.6, Control: 4.4; Practice: Intervention 6.08, Control 2.9	Not presented, increase, *p*-value <0.001	Two groups (intervention and control) tested in a randomized trial
Agarwala *et al*, 2020	5.45	7.84	2.39, increase, *p*-value <0.001	Single group of subjects tested both before and after a training intervention
Eisenman *et al*, 2014	Knowledge: Intervention 0.79, Control 0.74; Behavior: Intervention 0.56, Control 0.49	Knowledge: Intervention 0.87, Control 0.75; Behavior: Intervention 0.75, Control 0.54	Knowledge: 0.19, increase; Behavior: 0.08, increase, *p*-value <0.001	Two groups (intervention and control) tested in a randomized trial
Ardalan *et al*, 2013	Awareness: Intervention 5.43, Control 6.94; Readiness: Intervention 7.9, Control 5.09	Awareness: Intervention 21.4, Control 6.36; Readiness: Intervention 51.52, Control 7.95,	Awareness: 2.94, increase, *p*-value <0.001; Readiness: 5.52, increase, *p*-value <0.001	Two groups (intervention and control) tested in a randomized trial
Eisenman *et al*, 2009	Preparedness: Intervention 37.9, Control 29.0	Preparedness: Intervention 75.9, Control 52	Not presented, increase, *p*-value <0.001	Two groups (intervention and control) tested in a randomized trial

disaster communication plans and supplies in both study arms; however, the shift in stage for a communication plan for those in the 'discussion' study arm was significant (p-value <0.0001) than for those in the media arm (Glik *et al*, 2014).

An increase in disaster preparedness scores from the pretest to the posttest was also reported in 4 studies that carried out disaster training for improving disaster preparedness. James *et al* (2020), Eisenman *et al* (2014) and Ardalan *et al* (2013) combined the disaster training and workshop, meanwhile, Thomas *et al* (2018) only conducted the disaster training. Workshops also became the options for community intervention. However, the workshop was always conducted with another type of intervention such as fieldwork and training. Fieldwork, risk mapping, receiving media, and peer support can be an option for conducting community intervention in disaster preparedness.

Regarding the content of the intervention, considering the psychological aspect of delivering the intervention is needed to prepare for the disaster's impact holistically. Greater depression symptoms and lower social cohesion were associated with less disaster preparedness (Jamshidi *et al*, 2016). In addition, the effect of the intervention on preparedness was mediated by mental health, and the effects on mental health were likewise mediated by preparedness (James *et al*, 2020).

DISCUSSION

Disaster preparedness is essential for communities to be prepared for disasters, mitigate their effects, respond to community needs after a disaster, and launch effective recovery efforts. However, this review found that communities are not sufficiently prepared for disaster response and management. This finding supports previous studies that identified

many communities lacking knowledge and preparedness for disasters (Jamshidi *et al*, 2016; Eisenman *et al*, 2014). It emphasizes prioritizing training to increase communities' preparedness for disaster.

This review highlights the effective training methods for improving community disaster preparedness. The combination of discussion and drill was the most studied of the intervention. Discussion was found to play an important role in the communities taking other steps toward disaster preparedness. Meanwhile, drill performance was considered the final step of communities' readiness (Ardalan *et al*, 2013). Using both discussion and drill as the training for disaster was applied in many countries such as Iran, Malaysia, and so on (Ardalan *et al*, 2013; MhdNoor *et al*, 2022)

Another important finding from this review is adding the psychological aspect to the content of disaster training. The disaster-affected people may experience negative mental health consequences such as post-traumatic stress disorder (PTSD), anxiety, depression, and others (Heanoy and Brown, 2024). The mental health-integrated disaster preparedness intervention is effective in enhancing resilience among communities (Wellton-Mitchel *et al*, 2018).

The strength of this review is that the explanation of intervention is based on existing literature, which minimizes assumptions about the author. This review covers broader literature on the topic because we included articles on a range of study designs and types of natural disasters. By systematically exploring the type of intervention for disaster preparedness, this systematic review will give essential information to develop an intervention to improve community involvement for disaster risk reduction. One of the limitations of this review is our decision to exclude studies that were published before 2000 and studies that use other language than English. Despite the efforts to provide a complete report

on the overall level of scientific rigor in disaster intervention research, the review may not adequately capture all literature due to restrictions.

In conclusion, the combination of discussions and disaster drills was the most studied intervention, and was, therefore, the most effective community preparedness intervention – this could be due to the personal and collaborative nature of discussion compared with many other interventions and the opportunity to respond to individual information needs at the time of the discussion. However, other types of intervention such as field work, risk mapping, receiving media, and peer support peer-mentors also useful for improving the disaster preparedness level of the community. Due to the various interventions for disaster preparedness, the disaster medicine community must carry out scientifically rigorous research on community intervention effectiveness, develop standardized training evaluation methods, and disseminate those findings to a broad audience.

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CONFLICT OF INTEREST DISCLOSURE

The author has no potential conflicts of interest to disclose.

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