Jurnal
Berita Ilmu Keperawatan

Jurnal Berita Ilmu Keperawatan
Vol. 16 (2) Tahun 2023
p-ISSN: 1979-2697
e-ISSN: 2721-1797

Community Preparedness Education and Training Program in Facing Earthquake Disasters: Literature Review

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Abstract: *Disasters due to earthquake natural events can have an impact on the community so that people who live in disaster-prone areas are the most disadvantaged parties. The community as a disadvantaged party must be equipped with disaster preparedness, one of which is a disaster risk reduction program. The purpose of this scooping review is to determine the description of the implementation of the earthquake disaster preparedness education and training program in the community. This research is a scooping review using Prisma flow chart in its implementation. The results of this study showed significant results in all articles (n=10) in improving community preparedness in earthquake disaster risk reduction. The methods used were the latest methods (virtual reality, animated videos, and games) and manual methods (lectures, discussions, and reading) with material on disaster concepts, management, and first aid. This research concludes that the role of the community and the importance of disaster preparedness education for the community is very important to be provided by conducting the latest or modern methods for more effective results.*

Keywords: *disaster, disaster management, disaster nurse, nursing disaster*

INTRODUCTION

Disasters are the consequences of hazards, vulnerabilities and capacity deficiencies (World Health Organization, 2007) whose impact can be sudden and limited or widespread and long-lasting, depending on resilience to address potential risks (UN Secretary-General, 2016). Worldwide, 387 natural disasters occurred, resulting in more than 10,000 deaths and other impacts (Emergency Event Database [EM-DAT], 2022). Earthquakes are a natural event disaster with a high number of occurrences and large impacts, ranking third (Emergency Event Database [EM-DAT], 2022). Indonesia as one of the countries with various hazards has a great risk of disasters, which ranks third in the world based on Indonesia's global risk index (WRI) score of 41.46 points in 2021, especially in the event of an earthquake (BNPB, 2022). This global risk index score includes the scope of exposure, vulnerability, susceptibility, capacity, and adaptation (World Risk Report, 2022).

The high risk of disaster in an area often coincides with the risk of complex impacts that may arise when a disaster occurs. Figures on the number of reported earthquakes, total deaths, number of people affected and damage caused by earthquakes from 1960 to 2018 across all continents recorded by EM-DAT (The Emergency Events Database [EM-DAT], 2019) show a clear trend that the number of reported earthquakes is increasing.

Disaster damages and losses are different and vary on each continent (CRED, 2022), depending on the amount of supporting capacity to inhibit and reduce structural and prevent loss of life (Birnbaum et al., 2016). Disasters are localized and occur in communities, making communities living in disaster-prone areas the most disadvantaged (Risk & Cmdrr, 2004; BNPB, 2012). Communities have local knowledge in coping with hazard events and have responsibility for their members who are

most at risk (who may be the poor or those less able to cope, or the most affected) (Risk & Cmdrr, 2004)

Disaster risk reduction in disaster-prone areas is a necessity that must be carried out optimally. Currently, the community has the responsibility to learn from disasters that occur to improve the recovery, rehabilitation and reconstruction phases in accordance with the learning principle of "Build Back Better" by USDRR (2015). Furthermore, the concept of disaster risk reduction is a shared responsibility of both government components, communities and other parties such as the business world, etc.

The concept of disaster risk reduction provided to the community is in the form of training related to disaster preparedness. The latest literature review only discusses the role and competence of nurses in the disaster preparedness phase (Labrague et al., 2016) and the importance of disaster-related education and training programs for nurses (Labrague et al, 2018). There is no literature review related to the role of the community and the importance of disaster preparedness education for the community. Therefore, the main purpose of this study is to conduct a scooping review related to the importance of training and education related to disaster preparedness, especially earthquake disasters in the preparedness phase is very important to do.

METHOD

This study is a literatur review research using PICO to develop feasibility. P (population) is the community, I (intervention) is earthquake disaster preparedness education and training, C (comparison) does not exist, and O (outcome) is community preparedness for earthquake disasters. The inclusion criteria for this study are a) The entire community/community aged 18-60 years, b) The disaster criteria is an earthquake, c) English full text journal, d) The journal publisher's time span is 10 years (2013-2023), e) Journal articles discuss disaster preparedness, f) Quantitative study research design. The exclusion criteria of this study are a) The research design does not include qualitative studies, case studies and review articles, b) Not available in full text, c) Not available in English. The search strategy was carried out on databases, namely ScienceDirect, Pubmed, SAGE journal, and ERIC. Keywords used included disaster, "disaster management", "nursing disaster", or "disaster nursing" and training or program or education.

The search process carried out by researchers is as follows: (1) The first step, entering keywords in combination in the database used. In Science Direct, Pubmed, SAGE Journal, and ERIC using a combination of keywords ((disaster OR "disaster management" OR "disaster nurse*" OR "nursing disaster") AND (training OR program OR education)). (2) The second step, obtained a total of 1064 articles from four databases with a range of the last 20 years (2013-2023) (ScienceDirect = 270 articles, Pubmed = 78 articles, SAGE = 553 articles, and ERIC = 163 articles). (3) Then duplication was carried out on publication articles using Mendeley and deleted 61 articles. (4) After the duplication of articles was removed, the remaining 1003 articles were screened for titles and abstracts (985 articles were removed) so that the results were obtained as many as 18 articles. (5) Then full text screening was carried out and assessed according to the eligibility criteria. A total of 8 articles were excluded because: a) the article was not available in full text = 4 articles, b) non-quantitative research design = 2 articles, c) did not discuss disaster preparedness = 1 article, and d) not available in English = 1 article. (6) obtained a total of 10 articles that will be reviewed.

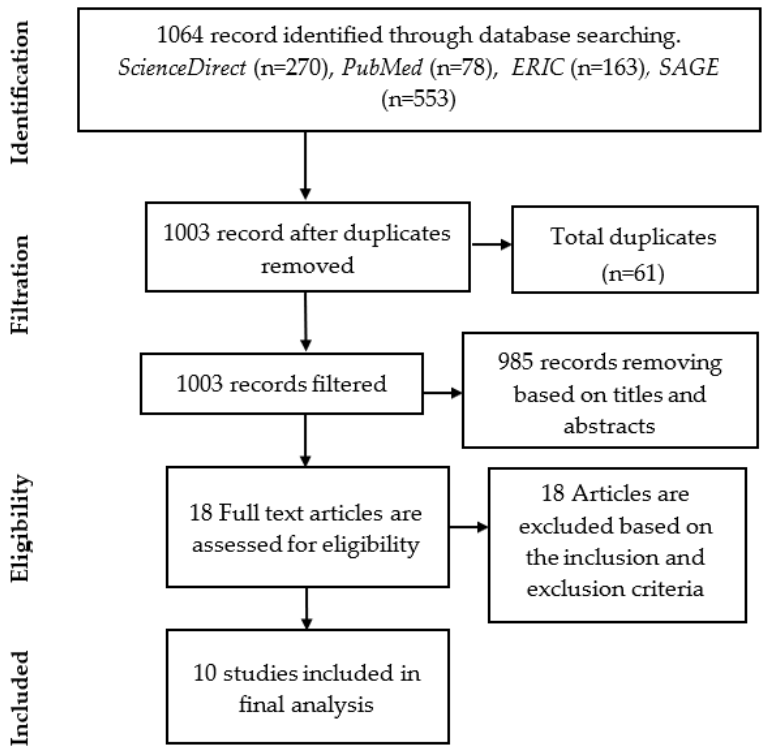

Figure 1. PRISMA Flow Diagram

RESULTS

The 10 extracted articles were analyzed and summarized based on author and year of publication and country, types and methods of education & training, content of education & training materials, duration of the program, participants and sample size, and outcomes. The authors identified 10 articles and presented them in tabular narrative form for inclusion in table 1.

Tabel 1. Analysis of Literatur Research

Author / Year (Country)	Types and methods of education & training	Content of education & training materials	Program duration	Participants and number of samples	Results
(Li et al., 2017) China	Virtual Reality (VR), videos, manuals with reading	Steps to avoid physical injury by avoiding dangerous items that are passed by when saving yourself during an earthquake	-	96 participants were divided into 4 groups of 24 people each	It was found that the knowledge of the participants after the training had increased with a marked increase in the mean value of each type of intervention and the most significant intervention that increased knowledge was by using the Virtual Reality (VR) method compared to using videos or reading manually.
(Feng et al., 2020) New Zealand	Immersive Virtual Reality (IVR) and Serious Games (SG)	Knowledge of evacuation best practices and self-efficacy in dealing with earthquake emergencies	20 minutes	93 participants (43 male and 50 female) Age between 20-29 years	Shows the results of increased knowledge after being given training with the results of p<0.001
(Gampell et al., 2021) New Zealand	Earthquake safe house video game	How to save yourself if an earthquake occurs indoors	2 minutes 20 seconds	19 participants Age between 22-60 years	Shows the results of the match score after being given a simulation game has increased compared to before being given a game simulation video
(Toyoda, 2020) Japan	S&G (Simulation and Gaming)	Evacuate by anticipating and mitigating impacts, restoring people's lives by managing shelters quickly	-	Japanese society	1. The results show that there is an increase in community resilience to large-scale earthquakes in Japan with a significant value of increased resilience if an earthquake occurs
(Amini et al., 2021) Iran	Lectures, questions and answers and group discussions	Education program based on the health belief model (HMB)	45-60 minutes for 3 weeks	120 women	The results showed that knowledge in the intervention group increased compared to the control group with p <0.001

(Bhandari et al., 2023) Japan	Lectures, discussions	Education about earthquake recognition, things to pay attention to before, during and after an earthquake, what not to do during an earthquake, how to drop cover and hold during an earthquake, what signs are used for disaster situations, emergency contact numbers, some important websites to get earthquake information and so on	45 minutes	165 participants, 67.88% male, and aged 18-46 years	Shows that the results of knowledge in the intervention group increased with p <0.001
(Arulmohi et al., 2017) India	Lectures and giving modules	Securing furniture, providing food and water, finding a designated evacuation center, preparing emergency kits, discussing disaster response with family members, seeking help from neighborhood residents and vice versa during a disaster	6 months	300 respondents, aged >18 years	Shows the results of household knowledge and readiness after being given the intervention increased with p <0.0001
(Jouhari et al., 2015) Iran	Training and workshops using pamphlets, books and CDs	Before an earthquake reduce the loss and damage caused by the earthquake to property and physical damage to people. During an earthquake: trained people know how to analyze a situation, self-rescue in a dangerous situation, first aid rescue, fire-fighting prevention, water supply in emergency situations. After an earthquake: organizing and planning to change the	1 week	80 people, aged between 43-51 years	Shows the results of community knowledge after being given the intervention increased significantly with p <0.001

		situation for the better in developed and developing countries resulting in human and socio-economic damage in the event of a natural disaster			
(Gesser-Edelsburg et al., 2021) Israel	Campaigns, lectures	What factors influence the magnitude of an earthquake in a place, the strength of buildings, location, distance from the sea, type of soil, earthquake magnitude, and earthquake preparedness, provide food and drink, do routine exercises with household members, move objects hanging on walls, and look for various sources of information on earthquake forecasting	40 minutes	834 people	The results showed that the knowledge of the community after being given the intervention increased significantly with $p<0.001$.
(Rajabi et al., 2022) Canada	Virtual Reality (VR) Technology Posters, animated films, live demonstrations	Places that can be used to protect yourself in the event of an earthquake indoors, how to manage anxiety in the event of an earthquake	Simulation for 10 seconds	20 people age 20-25 years	After the intervention, it was found that the average knowledge score of the group that given the intervention increased from 13 to 21.8

Program Types and Methods

Types and methods of disaster preparedness education and training programs developed for adults found based on 10 articles that have been extracted using modern methods, namely *Virtual Reality* (VR), *Immersive Virtual Reality* (IVR) and *Serious Games* (SG) , and S&G (*Simulation and Gaming*) . Education and training programs also still use traditional methods , namely reading manuals, earthquake safe house video games, lectures, debriefing and group discussions, providing modules, training and workshops using pamphlets, books and CDs, campaigns, posters, animated films, and live demonstration (Li et al., (2017) ; Feng et al., (2020) ; Gampell et al., (2021) ; Toyoda, (2020) ; Amini et al., (2021) ; Bhandari et al. , (2023) ; Arulmohi et al., (2017) ; Jouhari et al., (2015) ; Gesser-Edelsburg et al., (2021) ; Rajabi et al., (2022)). Types and methods in education and training consist of several materials that support improving community preparedness related to disasters due to natural earthquakes

Program Material

The materials in the education and training program for disaster preparedness due to natural earthquake events provided to the community are based on the Health Belief Model (HMB) (Amini et al., 2021). The materials provided in education and training are divided into three major parts, namely: (1) Disasters due to earthquake events in general: factors affecting the strength of earthquakes, building strength, location, distance from the sea, soil type, earthquake magnitude, and earthquake preparedness, providing food and drink, conducting routine exercises with household members, moving objects hanging on the wall, and looking for various sources of earthquake forecast information (Gesser-Edelsburg et al., 2021), (2) Disaster management due to earthquake natural events: things to pay attention to before, during, and after an earthquake, what not to do during an earthquake, how to drop cover and hold during an earthquake, early warning to use, emergency contact numbers, some important websites to get earthquake information and so on (Bhandari et al., 2023). Securing furniture, providing food and water, finding designated evacuation centers, preparing emergency equipment, discussing disaster planning with family members, seeking help from neighborhood residents and vice versa in times of disaster (Arulmohi et al., 2017). Knowledge of best indoor evacuation or self-rescue practices and self-efficacy in the face of earthquake emergencies to anticipate and mitigate impacts, restoring people's lives by quickly managing shelters (Feng et al., 2020; Gampell et al., 2021; Toyoda, 2020). Places that can be used to protect themselves in the event of an indoor earthquake, how to manage anxiety in the event of an earthquake (Rajabi et al., 2022) and (3) First aid in the event of an earthquake with steps to avoid physical injury by avoiding dangerous items that are passed by when escaping if an earthquake occurs (Li et al., 2017). Before an earthquake, reduce losses and damage caused by the earthquake to property and physical damage to people. During an earthquake: trained people know how to analyze a situation, self-rescue in dangerous situations, first aid rescue, fire prevention and fighting, water supply in emergency situations, After an earthquake: organization and planning change the situation for the better in developed and developing countries resulting in human and socio-economic damage in the event of a natural disaster (Jouhari et al., 2015).

Program Evaluation Results

The evaluation results of the earthquake disaster preparedness nursing education and training program from ten articles found that all articles stated that after being given training and education to the community regarding what to do when facing an earthquake disaster, the knowledge of the community increased significantly. Research conducted on 96 participants in China, found that participants' knowledge after training increased with the mean value of each type of intervention increased and the most significant intervention that increased knowledge was by using the Virtual Reality (VR) method compared to using videos or manuals by reading (Li et al., 2017). Furthermore, research conducted in New Zealand, after being given an intervention using Immersive Virtual Reality (IVR) and Serious Games (SG), showed the results of increased knowledge after being given

training with the results of p<0.001 (Feng et al., 2020). Furthermore, research in New Zealand, using earthquake safe house video games, showed that the match score after being given a simulation game increased compared to before being given a video simulation game (Gampell et al., 2021).

Research conducted in Japan using the S&G (Simulation and Gaming) method resulted in an increase in community resilience to large-scale earthquakes in Japan with a significant value of resilience increasing in the event of an earthquake (Toyoda, 2020). Research conducted in Iran using lecture, question and answer and group discussion methods, showed that the knowledge in the intervention group increased compared to the control group with p<0.001 (Amini et al., 2021). Next, the results of a study using the lecture method, discussion, showed the results of knowledge in the intervention group increased with p<0.001 (Bhandari et al., 2023). Research conducted in India using the lecture method and providing modules, showed the results of knowledge of household readiness after being given the intervention increased with p<0.0001 (Arulmohi et al., 2017). Furthermore, research conducted in Iran using training and workshop methods using pamphlets, books and CDs, showed the results of community knowledge after being given intervention increased significantly with p<0.001 (Jouhari et al., 2015). Research conducted in the State of Israel using the campaign and lecture method, showed that the results of public knowledge after being given the intervention increased significantly with p<0.001 (Gesser-Edelsburg et al., 2021). Meanwhile, research conducted in Canada using the Virtual Reality (VR) Technology method, posters, animated films, live demonstrations, after the intervention was given, it was found that the average value of knowledge of the group given the intervention increased from 13 to 21.8 (Rajabi et al., 2022).

DISCUSSION

Research *literature review* aims to summarize the results of several previous studies that provide an overview of implementation of earthquake disaster preparedness education and training programs in the community . Disasters caused by earthquakes are one of the major disasters that have caused the greatest losses worldwide in recent decades (Greer, 2012) . How to minimize the impact of disasters requires public awareness and readiness in dealing with disasters (Wardhana, 2018). The form of increasing public awareness is by providing knowledge about earthquake disaster preparedness for the community through disaster preparedness education and training programs.

Types and Methods

The types and phases of disaster in the earthquake disaster preparedness nursing education and training program focus on programs or training carried out to prevent damage and things that can be done before, during, and after an earthquake occurs. Disaster preparedness education and training programs are carried out using interesting methods to increase interest. Traditionally, earthquake safety has been taught through simulation exercises, which are often mandated in schools located in areas with a high risk of earthquakes. Seminars, maneuvers, posters, lectures and instructive films have all been offered as an option to convey these standards to the public. However, these informative techniques lack depth and emotion and cannot fully represent the message to the viewer. As a result, the effectiveness of these teaching initiatives often falls below of expectations (Chittaro et al., 2009). These traditional method generally experiences problems because it is not standardized as a whole, the exercises carried out are not effective in increasing preparedness for emergency situations such as earthquakes (Ramirez et al., 2009). One of the main suggestions for improvement is to develop more realistic simulation drills.

Modern methods using *virtual reality* and *simulation and gaming* are suggested to outperform traditional training methods regarding knowledge retention (Chittaro & Buttussi, 2015). The main advantage of using virtual reality and simulation for training is that it allows practice in hazardous conditions and can provide a credible virtual environment in which participants can explore and behave as close to reality as possible. Modern methods have the potential to provide an engaging environment for participants to navigate life-like and calming hazards to respond effectively to them. Technological advances can overcome engineering and construction challenges in recent years,

particularly in construction safety and facility management, so the use of modern methods can be considered as a reason for conducting education and training related to disaster preparedness (Mudiyanselage et al., 2021; Moeinifard et al., 2022; Lotfi et al., 2022; Rajabi et al. 2022; Shakerian et al., 2022; Rajabi et al., 2022; Beigi et al., 2022). But the drawback of using modern methods is the use of sophisticated tools that require large costs. The use of a training system using a PC that is equipped with a good processor, large memory, and the use of other hardware becomes a weakness in modern methods if the budget for these facilities is not approved. The use of sophisticated tools in modern methods is still carried out in groups of young adults who are familiar with the use of the latest technology. There is no research using a population of children and the elderly using modern methods, so this method still has to be investigated for its effectiveness in certain populations (Feng et al., 2020).

Program Material

Disaster drills and practices have been shown to reduce the risk of various health morbidity and mortality during disaster situations (Shaw et al. 2004). Disasters due to earthquake natural events have an impact in terms of physical losses and facilities and infrastructure so it is very important to design and build buildings that are resistant to natural disasters. In addition, timely reaction and proper evacuation practices after an earthquake significantly reduce earthquake-related losses (Alexander, 2012; Bernardini et al., 2016). Studies have found that, during an earthquake, the greatest potential hazard to a person in a room is being struck by falling or flying objects (e.g. lamps, mirrors, hanging ornaments) (Schwebel et al., 2016; Ham et al., 2017), or heavy furniture that could fall over (e.g. tall shelves, bookcases, cupboards). A person is more likely to be injured by a falling object than killed in a collapsing building, provided the building was constructed following seismic code regulations (Ott & Freina, 2015; Schwebel et al., 2016). Ellidokuz in his research in Turkey in 2002 observed that the most important risk factors in morality and losses due to earthquakes were the state of the destruction of the earthquake and the place where (unsafe place) the person was at the time of the earthquake (Feng et al., 2020) so that identification of safe places must be effective in reducing the effects of destruction. In addition, the tendency for losses in the form of physical damage can occur during an earthquake. Raissi in his research on earthquakes shows that an important priority in training is bleeding (Ericsson, 1984). Materials on disasters in general, management before, during and after the acident, and first aid are things that can be provided to the community in carrying out training and education activities related to earthquake disaster preparedness.

Program Evaluation Results

Involving individuals and communities in disaster preparedness measures is highly recommended for most disaster-prone areas (Ryan et al., 2020). Overall, the results of the evaluation found that there was an increase in the preparedness of the community after being given education and training related to earthquake preparedness. As training and practice are focused on meeting the needs of the local community, this is likely to have a greater impact (Ku & Matani, 2001; Jouhari et al., 2015). Interventions that only focus on providing information relating to hazards or risks have not been shown to improve disaster preparedness practices, but interventions when combined with training and two-way interaction between participants and interventionists have shown some better results (Gabriela & Fuentes, 2015; Lindell & Perry, 2012). Chittaro and Sioni (2015) suggest that repeated exercises can be introduced to improve learning outcomes. The conclusion that can be drawn from the evaluation is that education and training on disaster preparedness can increase community preparedness in dealing with disasters, but the need for further training must also be considered.

CONCLUSION

Education and training programs using traditional techniques in the form of lectures , discussions , reading modules, and live demonstrations related to disaster preparedness due to natural earthquakes can increase knowledge among the public but have not been effective. The use of the latest /modern programs in the form of *Immersive Virtual Reality* (IVR) or *Serious Games* (SR) can

increase community preparedness in a more effective and standardized manner . In addition, the modern methods used allow it to be carried out in scenarios that are described as dangerous and more realistic. Preparedness materials provided in general can be in the form of disasters caused by earthquakes in general, disaster management due to natural earthquakes, and first aid in earthquakes . Implementation of earthquake disaster preparedness education and training activities can improve community preparedness in dealing with future disasters. This activity is more effective with advanced training and training so that the material presented is more understandable and becomes a necessity that cannot be separated by the community in preparing for an earthquake

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