

Enhancing Disaster Preparedness Through Tabletop Disaster Exercises: A Scoping Review of Benefits for Health Workers and Students

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Background: Tabletop Disaster Exercise (TDE) is a unique learning method through simulation designed to improve disaster preparedness. It is used every year to train health workers and students in disaster preparedness. However, no review has summarized the potential of TDE.

Purpose: This review aimed to identify the potential of using TDE to improve disaster preparedness among health workers and students.

Methods: A scoping review was used by following the guidelines of The PRISMA Extension for Scoping Reviews (PRISMA-ScR). A literature search was conducted using five primary databases: CINAHL, PubMed, ScienceDirect, Scopus, Taylor and Francis, and one search engine, Google Scholar. The keywords were “health workers OR health professionals AND nursing student OR Student AND tabletop exercise OR tabletop disaster exercise AND Disaster preparedness”. The inclusion criteria were full-text articles that can be accessed and published in English and primary studies.

Results: This scoping review includes 12 articles. Most of the studies included in this review employed quasi-experimental or pre-experimental designs. The studies were conducted across a variety of countries, including Indonesia, United States, Australia, Iran, Greece, Korea, Qatar, and India. The potential of TDE in improving disaster preparedness is divided into two groups: health workers and students. TDE can improve students’ knowledge, attitudes, self confidence and disaster preparedness. In addition, for health workers, TDE improves knowledge, attitudes, awareness, competence, understanding of roles in disaster management, preparedness, performance, triage skills, and self confidence in managing disaster incidents.

Conclusion: TDE, as a disaster management learning method, has great potential to improve disaster preparedness, emergency response, and the ability of health workers to deal with disasters. Nurse managers can design TDE based training and work with educational institutions to integrate it into the curriculum.

Keywords: disaster preparedness, health workers, student, tabletop disaster exercise

Introduction

Disasters are still a worrying trend in the 21st century. Based on data from the Global Natural Disaster Assessment, it was reported that 367 major natural disasters (excluding epidemic diseases) occurred worldwide in 2021, affecting 127 countries and regions. In 2022, more than 140 disaster events occurred in the Asia-Pacific region causing more than 7500 deaths, affecting more than 64 million people, and having an economic impact.¹ Indonesia is one of the countries with a very high risk of disasters, with 3239 natural and non-natural disasters occurring throughout 2023.² In addition, the COVID-19 pandemic has been the most trending global disaster to date.³

The damage caused by disasters is not only limited to physical aspects but also impacts mental, social, economic, political and cultural well-being in the affected areas.^{1,4} Asia-Pacific was the region most affected by disasters in the 2020–2021 period with the parameter of the most significant number of significant disasters, namely 333 cases with the number of people affected as many as 108.7 million and as many as 12,565 people died.³ In addition, earthquakes also caused significant damage, with losses estimated at \$12 billion, especially in Japan, China, the Philippines, and the Islamic Republic of Iran.¹

Due to the many severe impacts that arise from disasters, an appropriate strategy is needed to reduce the impact of disasters.¹ The strategy to reduce the impact of disasters is to prevent new “disasters” after a disaster occurs, which has developed from a focus on emergency response to a more holistic prevention strategy.⁵ Government Regulation No. 21 of 2008 states that disaster management includes disaster management planning, disaster risk reduction, prevention, integration in development planning, disaster risk analysis requirements, disaster risk analysis requirements, implementation and enforcement of spatial planning, education and training, and disaster management technical standard requirements.⁶ A critical focus in disaster impact management is education and training for both health service providers and students.^{7–9}

Health workers, including nurses, have an important role in disaster emergency response by applying knowledge and skills to minimize the impact of disasters and the health and life risks to victims.^{10,11} Their role is divided into three stages: before, during, and after a disaster. Beforehand, they must be trained in clinical skills and crisis management. They provide emergency communications, manage triage areas, and organize evacuations during a crisis.¹⁰ Afterwards, they provide individual care, support the reconstruction of facilities, provide psychological support, and assist in rehabilitation. This demonstrates the vital role of nurses, from preparation to recovery, in ensuring effective services for victims and affected communities.¹⁰

In addition to health workers, adolescents play an essential role in disaster risk reduction.¹² Teenagers, especially students, need to gain adequate knowledge regarding disasters and adapt to the post-disaster environment through disaster preparedness education to build disaster-aware behaviour that will continue into adulthood.^{12–14} These findings highlight the urgency of implementing holistic disaster education for students so that they can prepare themselves to face the challenges of diverse disasters more effectively. In addition, previous studies have reported limitations in the proficiency of nurses and students related to various types of disasters, such as tsunamis, radiation, and bioterrorism in several countries.¹¹ Therefore, further development in disaster management education is needed to improve the readiness of nurses and students to face global challenges related to disasters.^{11,15}

Disaster preparedness is an essential element of an effective health system, especially in the face of emergencies that may threaten public safety.¹¹ One effective method for enhancing preparedness is through tabletop disaster exercise, which enable health workers and students to gain practical skills in managing a disaster response.^{15,16} Previous studies reported that tabletop and operational approaches improved nurses’ disaster preparedness more effectively than lecture-based education.¹⁷ Furthermore, the results of a recent systematic review reported a gradual increase in the number of disaster nursing education and training programs adopting a variety of approaches and technologies, one of which is the use of the tabletop exercise method.¹⁵ Thus, using a tabletop exercise approach can be a strategy to improve nurses’ readiness to face various disaster situations.

Several studies have reported that disaster education using the tabletop method can effectively improve knowledge, disaster preparedness, and other outcomes.^{18–22} The TDE simulation method is a simulation approach that uses media in the form of a disaster event map image projected onto a flat surface such as a board or table, which is then supported by a disaster scenario.^{21,22} Participants then engage in assigned roles to handle situations according to previously prepared scenarios.²² TDE has proven to be very effective in assisting disaster victims efficiently and effectively during emergency disaster management conditions.¹⁴

Based on the literature search, until now, no review study has specifically synthesised research results related to the potential of the tabletop exercise method in disaster preparedness for students and health workers. Previous studies only highlighted various SimEx exercises in emergency and disaster medicine and evaluated the challenges and obstacles in practical implementation, so this study does not explicitly discuss the potential of using tabletop exercises,²³ and previous similar studies are still in the form of review protocols.²⁴ Therefore, in the face of the increasing need for disaster

preparedness, additional review studies are needed to identify the potential of tabletop exercise methods in improving disaster preparedness in health workers and students.

Material and Methods

Study Design

The scoping review was conducted following the Arksey and O'Malley framework.²⁵ The PRISMA Extension for Scoping Reviews (PRISMA-ScR) was used to identify the use of TDE methods to improve the skills of nurses or health workers in disaster preparedness. A scoping review is a flexible methodological technique for exploring new, rapidly developing topics.²⁶ This design has a more comprehensive conceptual reach to explain relevant research results with a framework consisting of 5 core stages, including identifying review questions, identifying relevant research results, selecting studies, mapping data, compiling, summarizing and reporting results.²⁶

Eligibility Criteria

The process of selecting articles for this review was carried out by authors based on the PRISMA Extension for Scoping Review (PRISMA-ScR) (see [Figure 1](#)).²⁷ Research questions and eligibility criteria for research articles using the PCC (Population, Concept, and Context) approach. The research question of this review is “What is the potential of tabletop disaster exercise in improving disaster preparedness skills among health workers and students?”

P (Population): Health workers or Students

C (Concept): Tabletop exercise or Tabletop disaster exercise

C (Context): Disaster Preparedness

In this review, full-text articles that were not accessible, not in English, and secondary studies were excluded. The inclusion criteria in this review were full-text articles that were accessible and published in English and primary studies (original articles). Then, this review has no criteria for limiting the year of publication because it looks comprehensively at the potential for using TDE in improving the skills of nurses or health workers in disaster emergency response and preparedness.

Data Collection and Analysis

Search Strategy

Identification of articles was carried out systematically using five main databases: CINAHL, Medline Ultimate, PubMed, ScienceDirect, Scopus, and Taylor and Francis, and also one search engine such as Google Scholar. The selection of these five databases was based on their comprehensive coverage and relevance to the scope of the research. These five databases are well known and widely used to access high-quality, relevant articles in the fields of health, medicine and social sciences. The keywords were “health workers OR health professionals AND nursing student OR Student AND tabletop exercise OR tabletop disaster exercise AND Disaster preparedness”. The author used the Boolean operators “AND” and “OR” to trim or expand the search results for various tenses.

Study Selection

Three authors independently selected studies that met the eligibility criteria. Using the Mendeley reference manager, the author checked for duplication in the initial selection process. Then, another author checked the title, abstract, and full text for relevance to the research topic and set inclusion and exclusion criteria. Furthermore, the author decided on whether there was a discrepancy in the election results. The results of the analysis and extraction were checked again by another to ensure that the articles met the inclusion criteria. All authors have no differences of opinion regarding the eligibility of the articles analyzed in this review.

Data Extraction and Analysis

In this review, data extraction from the studies is analyzed using a table that can describe in detail all the results related to the topic discussed. The information presented in the extraction table is related to the characteristics of the study: author, design, country, sample, intervention, comparison and research results. All included research is primary research.

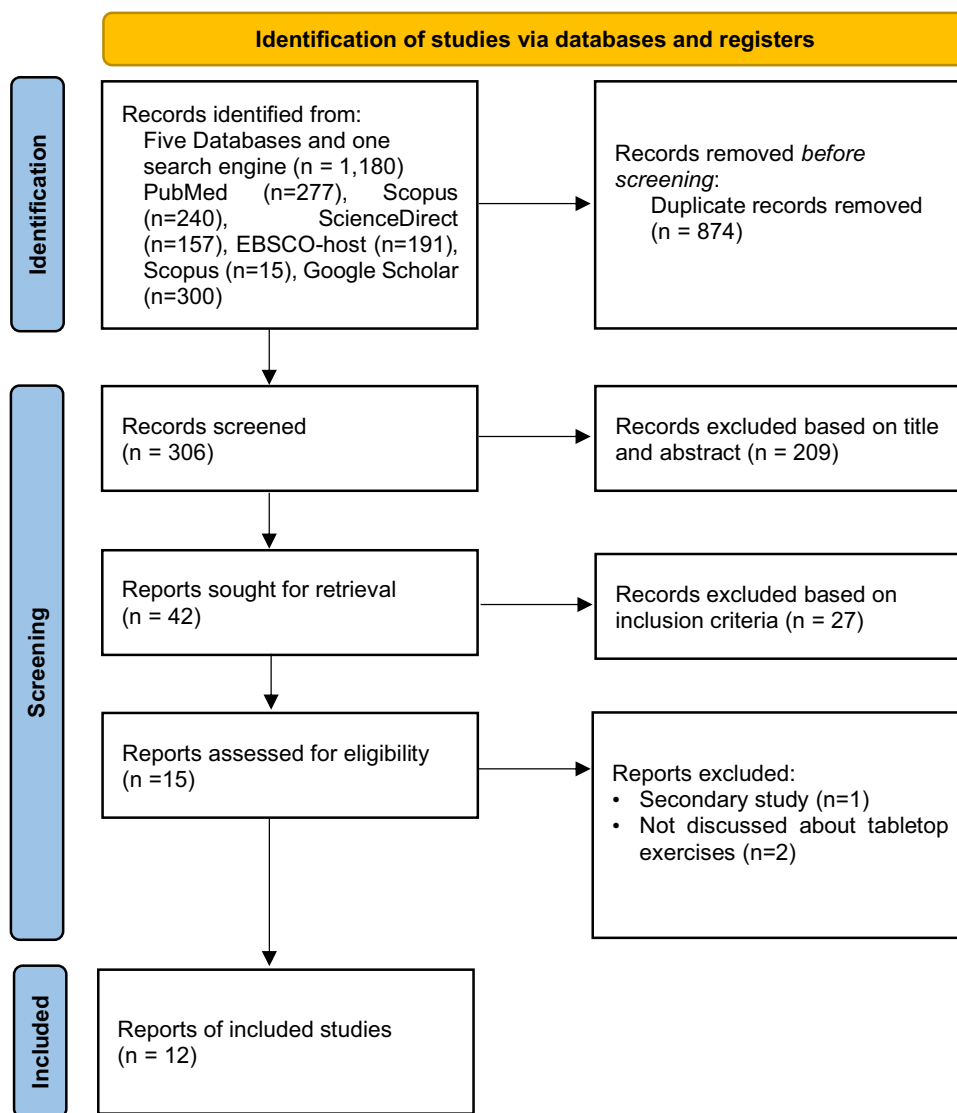


Figure 1 PRISMA Flow Diagram.

Note: Adapted from Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. Creative Commons.²⁷

Therefore, data analysis was carried out thematically with an exploratory descriptive approach. The data analysis process begins with the identification and presentation of data obtained in the form of tables based on the reviewed articles. After obtaining the data, all authors analyze and explain each finding based on the review results. Finally, the authors recheck the included studies to ensure and minimize errors.

Results

Study Selection

A total of 1180 articles were initially identified from five databases and one search engine, but 874 were removed due to duplication, leaving 306 articles. After screening by title and abstract, 209 articles were eliminated as irrelevant, leaving 42 articles for further review. Of these, an additional 27 articles were removed for not meeting the inclusion criteria, leaving 15 articles for eligibility assessment. In the final stage, three more articles were excluded, one for being a secondary study and two for not discussing tabletop exercises. Then, 12 articles were eligible for inclusion in the review (see Figure 1).

Characteristics of the Included Studies

In this review, most of the studies analyzed had experimental designs (pre-experimental, quasi-experimental, and RCT) (n=8) (See Table 1). The included studies were conducted in various countries, such as Indonesia (n=3), the United States (n=2), Korea, Australia, Iran, India, Qatar, and Greece. The included population consisted of health workers, including nurses, pharmacists, doctors, residents, paramedics, hospital administrators (n=238), and students (n=385), with a total of 623 participants.

Table 1 Data Extraction

Author (Years)	Design	Country	Sample	Intervention	Comparison	Results
Cha & Lee (2023) ²²	Pre experimental study	Korea	29 nurses	Tabletop exercise program for emerging infectious diseases (MERS, COVID-19, Ebola virus, and monkeypox). The experiment proceeded in a sequence of lectures, followed by drills, and finally, by the scenario-based tabletop exercise	No	This program can improve <ul style="list-style-type: none"> • Knowledge regarding emerging infectious diseases • Awareness of the measures for responding to emerging infectious diseases • Competence in responding to emerging infectious diseases
Watson et al (2021) ³²	Quantitative survey design pre and post-study	Australia	41 pharmacists	Disaster tabletop exercises (TTX) with workshop activities and scenarios.	No	This program can improve understanding of their role in a disaster and allow them to identify their strengths and weaknesses in disaster management.
Mirzaei et al (2020) ²¹	Quasi-experimental study	Iran	74 Nurses	The lecturing plus Tabletop exercise workshop for 8 h and 2 h tabletop exercises on the same day was presented by disaster health specialists.	Lecturing workshops 8 h presented by disaster health specialists	<ul style="list-style-type: none"> • Both programs can both improve knowledge, readiness, attitudes and performance. • The tabletop exercise method can improve the quality of education and critical skills and increase the level of nurses' preparedness against natural disasters.
Husna et al (2020) ⁷	Quasi-experimental study	Indonesia	80 nursing students	Tabletop exercises with the scenario of an earthquake disaster simulation.	No	The tabletop exercise had a positive effect in enhancing the knowledge ($p=0.001$) and the attitude of nursing students in disaster drills ($p=0.001$)

(Continued)

Table 1 (Continued).

Author (Years)	Design	Country	Sample	Intervention	Comparison	Results
Sholihah et al (2020) ¹³	Quasi-experimental study	Indonesia	104 high school student	TDE with scenarios containing disaster cases and the role of each respondent. The duration of TDE is ± 60 minutes, consisting of preparation, practice and simulation.	Educational film	Tabletop disaster exercise shows better results in improving disaster preparedness among students compared to educational films
Khan (2018) ³⁶	Randomized Controlled Trial	Qatar	106 participants consisting of 52 doctors and 54 nurses	Tabletop exercise for 60 minutes based on MCI scenario of 20 standardized cases, which are evaluated and triaged according to the START triage system	Written introduction of START triage and 20 scenarios of standardized cases which are triaged according to the START triage system	Tabletop exercise improved the triage skills of ER medical staff by 20% to 30% compared to paper-based written instruction techniques, and the time to perform triage was also almost halved.
Bistaraki et al (2011) ⁹	Quasi-experimental study	Yunani	56 participants (25 nurses, 13 physicians, 12 administrators and six paramedics).	The disaster training program was carried out for 2 days using a lecture method for 2 hours using PowerPoint, and the next day using tabletop exercises.	Did not take part in the training	This program effectively increased knowledge of hospital disaster management principles, provided an overview of the hospital disaster plan, and described the hospital incident command system and communication strategies.
Fathoni et al (2019) ¹⁴	Quasi-experimental study	Indonesia	36 Nursing students	Tabletop Disaster Exercise	Standard simulation module	There is a significant difference in knowledge between TDE simulations and simulations. Students who undergo TDE simulations know more about managing time in disaster response simulations.
Sena et al (2021) ¹⁹	Quantitative descriptive with educational intervention study design	United States of America	18 Residents	A lecture introduced the incident command system (ICS) and triage concepts, followed by a tabletop scenario with a disaster scene or emergency department map.	No	This program can increase perceived confidence in the resident's ability to manage disaster incidents

(Continued)

Table 1 (Continued).

Author (Years)	Design	Country	Sample	Intervention	Comparison	Results
Krishnan et al (2024) ³⁷	Educational interventional study	India	103 medical students	The online intervention group received disaster preparedness module training via the Microsoft Teams platform. The session involved tabletop-based simulation exercises covering the disaster cycle, hazard vulnerability analysis, incident chain of command, and disaster communication.	The onsite intervention group underwent the same training, which was conducted face-to-face in the institution's clinical skills laboratory or medical simulation centre.	After the intervention, there was a statistically significant increase in knowledge and confidence in both the online and face-to-face groups.
So Marvin et al (2019) ³⁵	Mixed-methods design	United States, with participation from Iowa, Kansas, Missouri, and Nebraska	26 paediatricians and public health practitioners from 4 states.	This is a virtual tabletop exercise (VTTX) designed to simulate a disaster scenario. The exercise includes three modules depicting a smallpox outbreak scenario in which state teams are asked to respond to communication, collaboration, and vaccination planning challenges.	No	Virtual tabletop exercises (VTTXs) were positive and demonstrated increased knowledge and confidence in pediatric emergency preparedness. Overcoming barriers to improve emergency preparedness
Pate et al (2016) ³⁴	Descriptive, evaluative research with pre and post-survey approach	United States of America	98 pharmacy student	Laboratory activities using tabletop scenarios. This activity consists of three phases: introduction, escalation, and rapid fire.	No	Implementation of a tabletop can improve students' overall knowledge, confidence, and understanding of their role as pharmacists in an emergency response.

Study Outcome

Table 2 shows that several outcomes were successfully identified in this review. The outcomes are divided into two populations: students and Health Workers. The student population's outcomes consist of knowledge, attitude, self-confidence, and disaster preparedness. Meanwhile, when viewed from the population base of health workers, there are seven outcomes: knowledge, awareness and competence, understanding of the role in disaster management, readiness and attitude, performance, triage skills, confidence, and perceived confidence of ability to manage disaster incidents.

Tabletop Disaster Exercise Method

In this review, there were two categories of TDE methods. These methods were divided based on online and offline implementation (see Table 3). Most studies practice this TDE method directly (offline) with participants, and almost all of them conduct simulations based on prepared scenarios. Disaster scenarios include natural disasters (cyclones, earthquakes, floods, and others) and non-natural disasters (emerging infectious diseases, mass casual incidents, and fire).

Table 2 Summary of Disaster Emergency Response Skills Based on Population

Population	Outcomes/Skill	Study
Students	Knowledge	[7, 14, 37]
	Attitude	[7]
	Disaster preparedness	[13]
	Self Confidence	[34, 37]
Health Workers	Knowledge	[9, 21, 22, 35]
	Awareness and competence	[22]
	Understanding of role in disaster management	[32]
	Readiness and attitudes	[21]
	Performance	[21]
	Triage skill	[36]
	Perceived confidence of the ability to manage disaster incidents	[19]
	Self Confidence	[35]

Table 3 Tabletop Disaster Exercise Methods

Study	Category	Simulation	Lecture	Scenario/Material
Cha & Lee (2023) ²²	Online	Yes	Yes (Online)	Yes (Emerging infectious disease)
Watson et al (2021) ³²	Offline	Yes	Yes (Offline)	Yes (Cyclone event)
Mirzaei et al (2020) ²¹	Offline	Yes	Yes (Offline)	Yes (Earthquake event)
Husna et al (2020) ⁷	Offline	Yes	N/I	Yes (Earthquake event)
Sholihah et al (2020) ¹³	Offline	Yes	N/I	Yes (Flood event)
Khan (2018) ³⁶	Offline	Yes	N/I	Yes (Mass Casualty Incident)
Bistaraki et al (2011) ⁹	Offline	Yes	Yes (Offline)	Yes (Fictional internal fire event)
Fathoni et al (2019) ¹⁴	Offline	Yes	N/I	Yes (Disaster scenario)
Sena et al (2021) ¹⁹	Offline	Yes	Yes (Offline)	Yes (Disaster scenario)
Krishnan et al (2024) ³⁷	Online and Offline	Yes	Yes (Offline and Online)	Yes (Disaster cycle, hazard vulnerability analysis, incident chain of command, and disaster communication)
So Marvin et al (2019) ³⁵	Online	Yes	Yes	Yes (Smallpox outbreak scenario)
Pate et al (2016) ³⁴	Offline	Yes	Yes	Yes (Infectious disease)

Discussion

This review identifies the potential of using tabletop disaster exercises (TDE) to improve the disaster preparedness of health workers and students. The review results showed that TDE has great potential to improve students' knowledge, attitudes, and disaster preparedness, as well as readiness, knowledge, attitudes, competence, confidence, and understanding of the role of health workers in disaster management and triage skills of health workers.

TDE is a specific learning method for responding to disasters by simulating disaster location maps, which aims to improve the competence and abilities of groups trained in disaster management.⁷ TDE can be carried out in a special room or classroom that

allows for simulation of the preparedness of various disaster management elements.²⁸ This simulation has various benefits, including increasing the role, knowledge and skills in disaster management.²⁹ TDE also triggers effective teamwork that enables the proper knowledge and attitudes in each training session to be directly applied during a disaster or extraordinary event.³⁰

This review's findings conclude that the TDE method's potential as a strategy to improve disaster preparedness in students and health workers is quite significant. In the student population, this review found that the TDE method effectively improved knowledge and attitudes in providing victim management in disaster response simulations, roles in disasters, and identifying strengths and weaknesses in managing disasters,^{7,14} and improving disaster preparedness.¹³ Therefore, these findings support the further development of disaster management education curriculum so that it will significantly contribute to facing global challenges related to disasters.

TDE also has the potential to improve various important aspects of disaster preparedness for health workers, including nurses. Previous studies reported that TDE can improve health workers' understanding of the basic principles of hospital disaster management for natural and non-natural disasters such as pandemics, provide an overview of hospital disaster plans, and explain hospital incident command systems and communication strategies.^{9,21,22} TDE also has the potential to increase health workers' awareness, readiness, competence, performance and self-confidence in dealing with disasters.^{19,21,22,31,32}

The most essential thing in disaster preparedness is forming the best team to react effectively in a disaster situation.³³ Therefore, various skills and experiences are needed in responding to disaster events.⁷ Knowledge will improve good preparation for disasters.^{9,34,35} Simulations and discussions facilitate an overview of the division of roles and responsibilities in disaster management.⁷ In addition, health workers must also possess triage skills because this will make it easier for them to prioritize someone who needs transportation, evacuation and treatment in the field or hospital.³⁶ Meanwhile, self-confidence will increase management capabilities when a similar disaster incident occurs.^{19,34,35,37} These capabilities must be developed to form a better team in disaster management.²¹ Therefore, through the TDE method, these capabilities can be increased and optimized so that health workers are ready to face future disasters.

The factors influencing the implementation of learning with the TDE method are very diverse. The knowledge and skills of participants, such as medical personnel in the context of disasters, play a vital role in the success of TDE.⁷ In addition, the readiness of organizations such as hospitals to face crises and awareness of the importance of exercises such as TDE also influence the implementation of this method.³¹ A well-designed and effective training program in terms of management planning can improve participants' understanding of disaster response.³⁸ Another factor that is no less important is the availability of resources, including time, facilities, and training materials.^{15,39} Finally, a good understanding of the disaster scenarios used in TDE and the ability of participants to respond to them realistically are also essential factors in the success of this method.^{7,9} By considering all these factors, TDE implementation can be more effective in improving preparedness and response to emergency or disaster situations.

While the TDE has excellent potential for improving many important aspects of disaster preparedness, this method has some drawbacks. The lack of realism in the exercise may limit the ability of participants to provide a true test of the capabilities of the crisis management system during an emergency.¹⁴ TDE tends to only superficially test team plans, procedures, and capabilities without practical demonstration.¹⁴ However, this method also has many advantages, such as being easy to do and being able to bring together various professions that have never worked together before, enabling cross-disciplinary collaboration.⁷ In addition, lower costs, easier availability of facilities and equipment, and greater participation of learners in disaster education.²⁰ Although its implementation has many limitations, the TDE method's use in increasing disaster preparedness is effective both online and offline.³⁷ Due to the various advantages and benefits obtained from the application of the TDE method, this review has provided a comprehensive overview so that it is hoped that it can become an alternative method in developing disaster management curricula both in educational institutions and in the health practitioner environment.

Strengths and Limitations of Study

There are several limitations to this review. First, the limited research with experimental design on this topic means that the results of this research extraction are still considered less comprehensive. Second, the participants recruited are still very few and quite heterogeneous (health workers and students) due to the limited research on health workers. However, this review does not limit the publication year criteria so that the author gets comprehensive pooled data. In addition, this review also divides the two outcomes based on the population so that this can minimize the bias effect of using the TDE method. Then, the

novelty of this review lies in the extraction of Table 3, which presents the characteristics of TDE commonly used based on the articles analyzed so that this will make it very easy for readers to understand the essence of the TDE method.

Conclusion

This review concludes that from the 12 articles analyzed, the use of the TDE method has great potential in improving various aspects of disaster preparedness in health workers and students. TDE can be utilized in diverse disaster scenarios, both natural and non-natural, including infectious disease outbreaks such as pandemics. The findings of this review underscore the potential of TDE to significantly enhance disaster preparedness, emergency response, and the ability of health workers and students to effectively manage disaster situations. This method improves not only the practical skills but also the confidence of participants in responding to emergencies.

These results suggest that TDE can play a pivotal role in developing and strengthening disaster management capacities in healthcare settings and educational institutions. It provides an effective means to equip students and health workers with essential skills and knowledge in handling disaster situations. This review illustrates how TDE can be integrated into training programs, offering a comprehensive approach to disaster management education. It also presents an alternative for academics and healthcare practitioners to develop curricula focused on disaster response, with TDE as a central component of both the teaching process and ongoing education. Given the limited number of experimental studies evaluating TDE, the author suggests that future research is needed to increase the generalizability of the findings, ensuring that the renewal of information and improvement of service quality can be optimized.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare no conflicts of interest in this work.

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