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Theoretical-based Training Programs in Disaster Nursing: A Systematic Review

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Systematic Review

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Abstract

Objectives: This systematic review aims to identify the theoretical-based frameworks and content of disaster training programs for nurses worldwide.
Methods: This systematic review was conducted following the PRISMA guidelines across 5 databases: Web of Science, PubMed, CINAHL, Cochrane, and Google Scholar. Studies were selected on disaster training programs for nurses and published within the past decade.
Results: This systematic review analyzed 14 studies that utilized a variety of theoretical-based disaster nursing training programs. Among the theoretical frameworks identified, the International Council of Nurses (ICN) framework emerged as the most frequently applied, likely due to its global applicability and comprehensive approach in disaster training programs. In contrast, other frameworks—such as the Bioterrorism Guidelines and Infectious Disease Response Guidelines from the Korea Disease Control and Prevention Agency, the Malkina-Pykh Mixed Model, the World Health Organization (WHO) framework, and the National League for Nurses/Laerdal Simulation Model, and others—were each used only once.
Conclusions: These findings suggest the ICN framework's potential to serve as a leading model for the development of future disaster training programs. Achieving an optimal balance of theory, practice, and evidence-based content is crucial for preparing nurses to respond effectively to disasters.

Nurses are the frontline health care providers during disasters. Those who receive proper disaster training demonstrate greater confidence, as well as improved disaster knowledge, skills, attitudes, preparedness, and competency.[1] Such training empowers nurses to deliver optimal care, support, and guidance to individuals and communities affected by disasters, ultimately helping to save lives and minimize the overall impact of such events.[2,3] Training programs built on a solid theoretical foundation are crucial for enhancing nurses' preparedness in disaster management.[4] It promotes a cohesive, systematic approach to training, effectively integrating new knowledge with established practices.[5,6] While existing research has primarily focused on the outcomes of disaster training, there remains a significant gap in understanding the theoretical foundations and content that underpin these educational programs. Clearly identifying the theories and core components used in disaster nursing training programs is essential for the development of standardized, evidence-based curricula. To address this gap, this review systematically examines the theoretical frameworks and content utilized in disaster training programs for nurses worldwide.

Materials and Methods

This systematic review followed the PRISMA 2020 Statement guidelines and was conducted through the following steps: 1) formulating the research question; 2) identifying relevant studies; 3) selecting the studies; 4) organizing the data; and 5) compiling, summarizing, and reporting the results. A systematic search was conducted by the primary author in this study using keywords, MeSH terms, and Boolean operators to identify studies published in English and Bahasa over the past decade. The literature searched covered 5 electronic databases: CINAHL, Cochrane, Google Scholar, PubMed, and Web of Science.

Setting study eligibility criteria in a systematic review ensures that the studies are relevant, comparable, and of adequate quality to provide meaningful insights into the research question. The eligibility criteria for this systematic review were: (a) reports of disaster training programs for nurses; (b) experimental, randomized controlled trials, or quasi-experimental studies; (c) training programs grounded in a theoretical framework; and (e) publications in English or Bahasa. English publications were included for broader scientific accessibility, while Bahasa was included due to Indonesia's high disaster risk and the prevalence of relevant local research. This language scope may introduce some bias, but it ensures relevance and feasibility within the

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review's context. The exclusion criteria were as follows: (a) studies without full-text availability, (b) conference abstracts, (c) studies published more than 10 years ago, (d) non-RCTs designs, (e) studies not focused on nurses, (f) duplicate entries, and (g) studies lacking a theoretical basis.

Data extraction is a crucial step in ensure that all necessary details are collected in a standardized manner to assess quality, compare results, and draw conclusions. In this systematic review, the data extraction process was independently conducted by 2 authors to reduce potential bias and ensure consistency. Any disagreements were resolved through discussion or consultation with a third reviewer. Inter-rater reliability was assessed using Cohen's Kappa, yielding a value of 0.80, which indicated substantial agreement between reviewers.

A total of 1303 articles were initially identified across 5 databases: Web of Science (n = 262), PubMed (n = 768), CINAHL (n = 171), Cochrane (n = 30), and Google Scholar (n = 72). After screening titles, abstracts, and full texts according to the inclusion criteria, 14 articles were included in the final analysis (Figure 1). Data extracted included author(s), publication year, country of origin, study design, sample characteristics, and key findings that met the inclusion criteria. Research quality of the 14 selected studies was evaluated using the Critical Appraisal Skills Programme (CASP) for Randomized Controlled Trials. The CASP tool includes 11 items assessing study design, methodology, results, and applicability. Each item was scored as "Yes" (1 point) or "No/Can't Tell" (0 points), yielding a total score ranging from 0-11. Scores were categorized as low (0-4), moderate (5-8), or high (9-11) quality (Table 1).

Results

This review identified 14 studies utilizing various theoretical frameworks for disaster nursing training programs, reflecting a wide range of approaches to enhancing nurses' disaster preparedness and competencies. The ICN Framework emerged as the most frequently used model, likely due to its global relevance and comprehensive approach to disaster nursing education. It provides a structured model encompassing all disaster phases—prevention, preparedness, response, and recovery—while emphasizing cultural sensitivity, ethical decision-making, leadership, and collaboration.[7] For instance, Al-Qbelat et al. used the ICN Framework in an 8-hour online training program for 50 emergency nurses in Jordan, covering disaster preparedness, triage, decontamination, basic trauma life support (BTCLS), and advanced trauma support. The training, assessed using the Disaster Preparedness Evaluation Tool (DPET), led to significant improvements in knowledge and preparedness.[8] Similarity, a study in Iran applied the ICN Framework to evaluate a nurse empowerment program, focusing on community-centered care, triage, patient safety, infection prevention, cultural competence, and psychological support, also yielding positive outcomes.[9]

Other frameworks were each used in a single study, reflecting the diversity of theoretical underpinnings in current disaster training programs. The Bioterrorism Guidelines and Bioterror Infectious

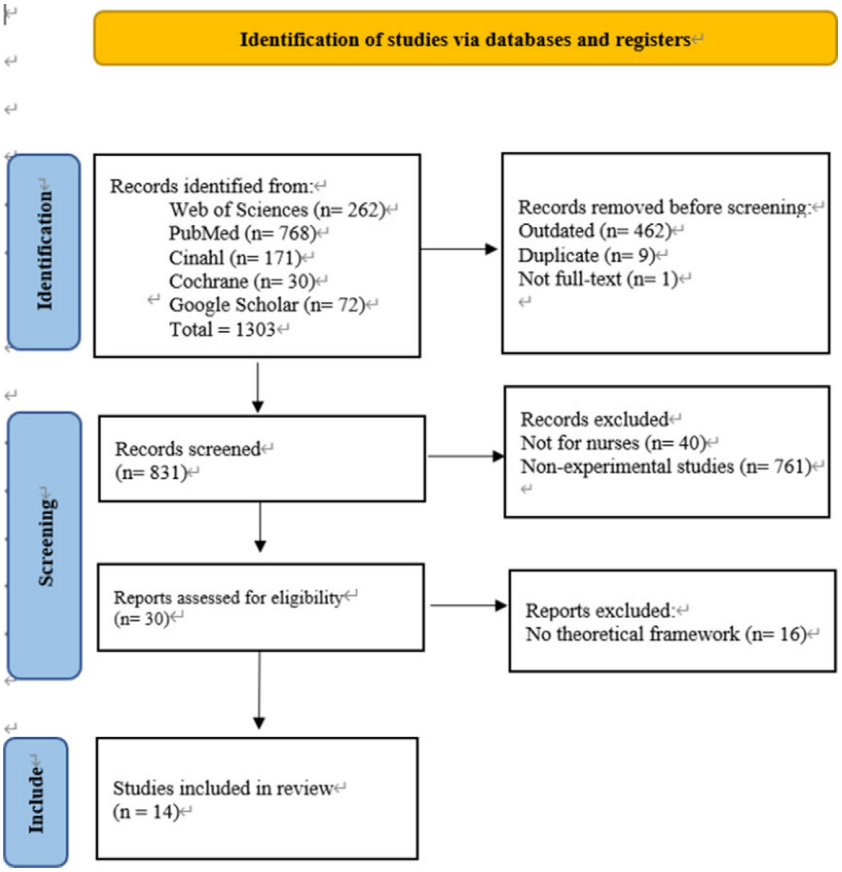


Figure 1. Flow diagram for this study.

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Table 1. Characteristics of included studies in systematic review

Author, Year	Country	Study design	Sample size	Core components	Theory framework	Outcomes	Limitations	Critique of research quality
Chang et al. 2024	South Korea	Quasi-experimental	Intervention: 23 Control: 22	The mobile-based bioterrorism response program. Topics: Overview of bioterrorism, Bioterrorism response system, and nursing care for patients with bioterror infectious diseases.	Bioterrorism Guidelines and the Bioterror Infectious Disease Response Guidelines from the Korea Disease Control and Prevention Agency.	Experimental group showed significant increases in knowledge of bioterrorism, attitude toward bioterrorism response, and bioterrorism response competencies.	Focused only on bioterrorism; lacks broader disaster competency coverage	Moderate
Aliakbari et al. 2023	Iran	Quasi-experimental	Intervention: 35 Control: 35	Workshops, hanging posters, and pamphlets. Topics: Communities: Immunization, basic needs, resource evaluation, and emergency intervention. Individuals/Families: Triage, safety, patient transfer, infection prevention, and cultural respect. Psychological Care: Mental health referrals. Vulnerable Groups: Ensuring access to essential services.	ICN	The all dimensions of competence scores significantly increased in the intervention group.	Cultural adaptation needed; implementation may be difficult in low-resource setting	Moderate
Al-Qbelat et al. 2022	Jordan	Quasi-experimental	50	Online educational training program Topics: disaster preparedness, triage, decontamination procedure, BTCLS and advance trauma support psychology of disaster.	ICN	Experimental group showed significant improvements on knowledge, skills, and personal preparedness for disasters after implementation of the educational program.	Global standardization is a challenge; resource dependency	Moderate
Said et al. 2022	Palestine	Nonequivalent controlled group trial	Intervention: 75 control: 75	Psychological first aid program with simulation and role-playing. The RAPID-PFA used in this study was modified based on the one used for in-person training. Focus on changes in self-efficacy, self-esteem, optimism, and anxiety levels, serving as key indicators of psychological preparedness	Malkina-Pykh and Pykh model	Experimental group showed significant improvements on psychological preparedness, optimism, self-esteem, and self-efficacy than control group.	Complex model; requires mental health professionals	High
Kim et al. 2022	South Korea	Non-equivalent pre- and post-control group research design	Intervention: 10 Comparison: 10 Control: 10	Intervention: Simulation based on the SENSE (Sharing-Explore-Notice-Support-Expansion): pre briefing, simulation running with a standardized patient. Comparison: offline training Control: self-directed learning.	WHO	Intervention group showed significantly improved psychological first aid performance knowledge, competence, and self-efficacy compared to those in the other groups.	WHO may not address long-term psychological needs in resource-poor areas	Moderate

(*Continued*)

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Table 1. (*Continued*)

Author, Year	Country	Study design	Sample size	Core components	Theory framework	Outcomes	Limitations	Critique of research quality
Moon et al. 2022	Korea	Quasi-experimental	Intervention: 31 Control: 35	Competency-Based Triage Education Application (CTEA); 4 lectures, 12 text-based case studies (abdominal pain, dyspnea, fever, vomiting, epistaxis, simple treatment, cough, behavior, dizziness, vaginal bleeding, and traffic accidents), and 8 conversational scenarios (acute myocardial infarction, acute stroke, major trauma, congestive heart failure, acute hemorrhage, urticarial rash, appendicitis, and hyperventilation)	The Korean Triage and Acuity Scale (KTAS)	Triage competency and performance, and were significantly improved in the interventional group. Under triage error in the intervention group was significantly reduced compared to control group.	KTAS may oversimplify complex clinical conditions	Moderate
Noh et al. 2020	South Korea	Quasi-experimental	40	Triage (virtual simulation and tabletop exercise), incident command (tabletop exercise), procedures (part-task trainers), special situation (full bodies mannequin)	NLN/Laerdal Simulation Model	The evaluation of the program resulted in improvement in perception, crisis management, problem solving, and technical skills in disaster nursing.	High-cost equipment; may neglect emotional/psychological aspects	Moderate
Ghazali et al. 2020	Malaysia	RCT	Intervention: 69 Control: 74	Lectures discussions and performing triage using scenario-based questions in group.	Knowles' theory	The triage training improved the skills of the participants and the accuracy of triage decision-making across time.	Relies on learner motivation; may not fit high-pressure contexts	Moderate
Ghezeljeh et al. 2019	Iran	Quasi-experimental	Intervention: 30 Control: 30	Virtual social network (Telegram application). Hospital preparedness planning for disasters, guidelines for designing an early warning system for hospitals, explaining the process of activating the response program in hospital events, hospital incident command system (HICS), activating the HICS, and comprehensive guide to plan and response to HICS.	NHDPP	Post-test knowledge score was significantly higher in the intervention group compared to the control group. The post-test attitude score was higher than the pre-test attitude score on both groups.	Requires tech access; less interactive than face-to-face method	Moderate
Scott et al. 2018	USA	Quasi-experimental	708 Health care providers	Emergency Preparedness Training Course: didactics, small group discussion (communication and triage), and scenario-based learning (storm and influenza). Didactic presentations included background on emergency preparedness, PPE, teamwork, communication, and disaster triage.	CHPTER	Intensive EPT course can improve the disaster knowledge and comfort level of a diverse group of clinical providers as well as foster disaster-performance skills.	Resource intensive (personnel, time, funding)	Low

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Table 1. (*Continued*)

Author, Year	Country	Study design	Sample size	Core components	Theory framework	Outcomes	Limitations	Critique of research quality
Lee et al. 2018	China	RCT	Intervention: 64 Control: 64	Online training: intervention group watched a 14-minute video showing the basic response to a hospital fire and patient evacuation methods from the National Fire Protection Association (permission obtained) with Chinese subtitles written by the authors.	NHFPC	All 3 knowledge areas of fire prevention and evacuation (generic, hospital-specific, and total) were significant were significantly higher in the intervention group compared to the control group.	Limited focus; difficulty in adapting across health systems	High
Aluisio et al. 2016	India	RCT	Intervention1: 20 Intervention2: 20 Control: 20	Intervention group 1: CBL (case-based learning), cases focused on triage during various disaster scenarios, including blast, radiation, or chemical events. Intervention group 2: SE (simulation exercise with simulated patient).	The Clinical Practice of Emergency Medicine from American Board of Emergency Medicine	CBL group modality was superior to SE group in short-term disaster preparedness educational translation.	CBL needs trained facilitators; both methods resource-heavy	Moderate
Farra et al. 2016	USA	Quasi-experimental	64	Online and on-site training. Topics: History of disasters, one health all hazards, emergency management in health care organizations, and crisis leadership during disasters.	NCDMPH	The emergency preparedness score was significant improved after intervention. Participants successfully achieved overall objectives in all scenarios.	Does not address vulnerable populations (elderly, children)	Low
Pesiridis et al. 2015	Greece	A Switching Replications RCT	Intervention: 112 Control: 95	Definitions and essentials about disaster management; National emergency plans during disasters, Nurses' role during disasters and emergencies; Triage algorithms; Hospital evacuation procedures and safe transfer of patients; Decontamination procedures and the proper use of personal protective equipment (PPE) during Chemical, Biological, Radiological and Nuclear (CBRN) incidents.	van Meijel et al. model	The intervention improved nurses' knowledge and self-confidence levels while no significant changes were detected in behavioral intentions.	Needs trained mental health professionals; limited behavior change	Moderate

PS: A score range of 0-3 indicates low research quality for the reviewed article, 4-8 indicates moderate quality, and 9-11 indicates high quality, as assessed by the CASP tool.

Disease Response Guidelines from the Korea Disease Control and Prevention Agency focused on agent identification, surveillance systems, and interagency coordination.[10] A study in South Korea applied this framework in a 3-week training program, resulting in significant improvements in participants' knowledge and response competencies.[11]

The Malkina-Pykh Mixed Model, grounded in systems theory, supports the assessment and management of emergencies by integrating human, technological, environmental, and social factors.[12,13] In Palestine, a modified version of this model was used to evaluate psychological preparedness and personality traits following Psychological First Aid (PFA) training, demonstrating positive outcomes in mental health support during emergencies.[14]

The WHO PFA framework emphasizes compassionate, immediate psychological care through a non-intrusive, supportive approach aimed at reducing distress and promoting recovery.[15] In a South Korean study involving 75 nurses, training based on this model significantly improved PFA competence and self-efficacy.[16]

The NLN/Laerdal Simulation Model utilizes high-fidelity simulations to develop both technical and emotional skills in disaster response.[17] A study in South Korea training 40 emergency nurses using this model reported significant improvements in critical thinking, teamwork, and triage skills under high-stress conditions.[18]

The Hospital Preparedness for Disasters framework focuses on operational readiness, including triage, resource management, and psychosocial support.[19] A study conducted in Iran applying this model demonstrated substantial improvements in nurses' preparedness for disaster response.[20]

CHPTER's Emergency Preparedness Training Program uses a structured, interactive curriculum encompassing disaster medicine, emergency response, public health, and crisis leadership.[21] A 2018 study titled Preparing for the Surge employed lectures, group discussions, and scenario-based learning, significantly enhancing disaster knowledge, comfort, and performance skills among health care providers.[22]

The Clinical Practice of Emergency Medicine Model centers on triage, communication, patient safety, and professional development.[23] Aluisio et al. used this model in a randomized trial in Iran to train nurses in disaster triage, leading to improved decision-making and practical triage performance.[24]

The NCDMPH Framework provides training resources and research to strengthen situational awareness, communication, and decision-making in disaster contexts.[25] Farra et al. implemented this framework through a hybrid online and in-person program, resulting in improved preparedness scores.[26]

Van Meijel's Model focuses on disaster-specific clinical skills and decision-making.[27] A 2015 study used this model to design a training program targeting chemical, biological, radiological, and nuclear (CBRN) response, which led to significant knowledge gains among nurses.[28]

The Korean Triage and Acuity Scale (KTAS) serves as the foundation for a triage-focused training program aimed at improving communication, decision-making, and emergency performance.[29] In a South Korean study, Moon et al. reported significant improvements in triage competency following KTAS-based training.[30]

Knowles' Adult Learning Theory emphasizes self-directed learning, the use of prior experience, and practical, problem-solving opportunities.[31] A study in Malaysia applied this theory to a training program for health care professionals, yielding positive results in triage confidence and practical skills.[32]

The NHFPC Framework from China emphasizes preparedness, disaster management, and strengthening health care systems.[33] Lee et al. implemented an online training based on this framework that focused on fire safety and emergency prevention, resulting in notable improvements in health care workers' safety knowledge.[34]

Overall, the ICN Framework demonstrated the most frequent use and broadest applicability among the reviewed studies. It offers a broad, internationally recognized structure that integrates competencies in preparedness, response, recovery, and mitigation. This makes it particularly adaptable across diverse health care settings and disaster scenarios. In contrast, the diversity of other frameworks reflects an ongoing lack of standardization in disaster nursing education. While each model offers unique strengths—ranging from psychological support to triage accuracy—their comparative effectiveness remains largely underexplored. Additionally, the ICN framework emphasizes both individual and system-level competencies, which may contribute to more robust and transferable training outcomes compared to other models that focus primarily on clinical procedures or localized protocols. In addition, these findings emphasize the need for further evaluation and the integration of best practices to guide the development of a unified, evidence-based approach to disaster nursing training.

Discussion

This study systematically reviewed disaster training programs for nurses, highlighting various theoretical frameworks and content used over the past decade. These programs cover topics like disaster competency, response, preparedness, psychological support, triage, simulation models, and educational frameworks. Despite varying strengths and challenges, all frameworks aimed to deliver structured, comprehensive disaster training programs.

The ICN framework is recognized for its comprehensive approach to disaster competency training, emphasizing the knowledge, skills, and attitudes needed for nurses to effectively respond to disasters.[35] It provides clear guidelines that integrate disaster preparedness into nursing practice, focusing on individual competencies and the health care system readiness. Two studies used the ICN framework for nurse training, as it offers a globally recognized, evidence-based model for disaster preparedness, response, and recovery, overall readiness.[36,37] While enhancing areas like risk assessment, emergency response, triage, and psychosocial support, the ICN framework help nurses provide effective care during crises.[7] However, its implementation can be challenging in resource-limited settings and may require adaptation to fit cultural contexts, which could impact its global standardization.

In contrast, the Bioterrorism Guidelines are more focused in scope, offering detailed, protocol-driven strategies for detection, treatment, and coordination in the context of bioterrorism.[38] While these guidelines are practical for highly specific threats, they may lack the broader competency development emphasized in the ICN framework and require significant contextual adjustments for use in national systems such as South Korea's. This comparison illustrates that while the ICN framework supports a more comprehensive and transferable training model, context-specific guidelines like those for bioterrorism offer depth in targeted areas but may fall short in preparing nurses for a wide range of disaster scenarios.

When comparing the psychological support components, frameworks such as the Malkina-Pykh Mixed Pykh Model, the WHO model, and Van Meijel et al.'s crisis intervention model provide culturally sensitive, evidence-based guidance but face limitations in sustained application due to the need for specialized mental health personnel. This gap highlights an area where integration across models could be beneficial—for instance,

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embedding mental health protocols within broader simulation or competency-based frameworks to create more well-rounded training. The Malkina-Pykh Mixed Pykh Model offers a holistic approach from qualitative and quantitative aspects to disaster psychological response, integrating psychological, physical, and environmental dimensions.[13,14] Its adaptability, scientific rigor, and use of technological tools make it valuable, but its complexity can be overwhelming in resource-limited settings.

The WHO framework provides accessible, evidence-based psychological support and culturally sensitive approaches ideal for a broad range of responders, but may not address long-term psychological needs, especially in resource-poor areas.[39] Van Meijel et al.'s model also offers structured psychological interventions during crises but requires trained mental health professionals, which may be scarce during large-scale emergencies.[48]

Simulation-based frameworks like the NLN/Laerdal Simulation Model, CHPTER, and KTAS prioritize hands-on, experiential learning. The NLN/Laerdal Simulation Model focuses on active learning and realistic simulations in disaster training, emphasizing high-fidelity simulations to improve decision-making, problem-solving, and critical thinking.[40] Its strengths include collaboration, feedback, and debriefing, enhancing learner engagement. However, the high cost of simulation equipment limits its widespread use, and while effective for clinical skills, it may not fully address the psychological and emotional complexities of real-life disaster scenarios.[41,42] Similarity, the CHPTER framework focuses on hands-on training through simulation, but its resource demands such as time, personnel, and funding may limit its application in resource-limited settings.[22] In contrast, the KTAS provides a simple system for triage training, promoting fast decision-making in emergencies.[44] However, it may overlook complex medical conditions, leading to oversimplified triage decisions in some cases.[45]

Frameworks grounded in public health and interdisciplinary collaboration, such as the NCDMPH and NHFPC, take broader system-level approaches. The NCDMPH framework is useful for disaster response and preparedness, emphasizing interdisciplinary collaboration and communication in disaster response, with a strong focus on adult patient care.[46] However, this framework is limited on vulnerable populations, particularly children and the elderly.[47] Other frameworks, like NHFPC, integrate disaster education with public health and family planning, offering a holistic approach to disaster response. The strength of NHPC lies in its comprehensive nature, addressing both immediate needs and recovery, but its implementation can be challenging due to varying health care systems and resources.[33] The Hospital Preparedness for Disasters plan enhances institutional coordination but often struggles in underfunded settings and tends to neglect the psychological needs of patients and providers. [29,43] Complementing these, the Clinical Practice of Emergency Medicine model addresses both physical and mental health during crises, yet its effectiveness is constrained by the need for specialized training and substantial resources.[23] In contrast, Knowles' Theory of Adult Learning supports self-directed, experience-based disaster education, promoting adaptability and learner engagement. Nonetheless, its reliance on individual motivation and autonomy may limit its applicability in high-pressure or resource-limited environments. [49]

Conclusion

Synthesis of these frameworks suggests that no single model fully addresses all dimensions of disaster training for nurses. A hybrid approach—combining the structured competencies of the ICN framework, the experiential depth of simulation-based training, and the systemic focus of public health models—may provide a

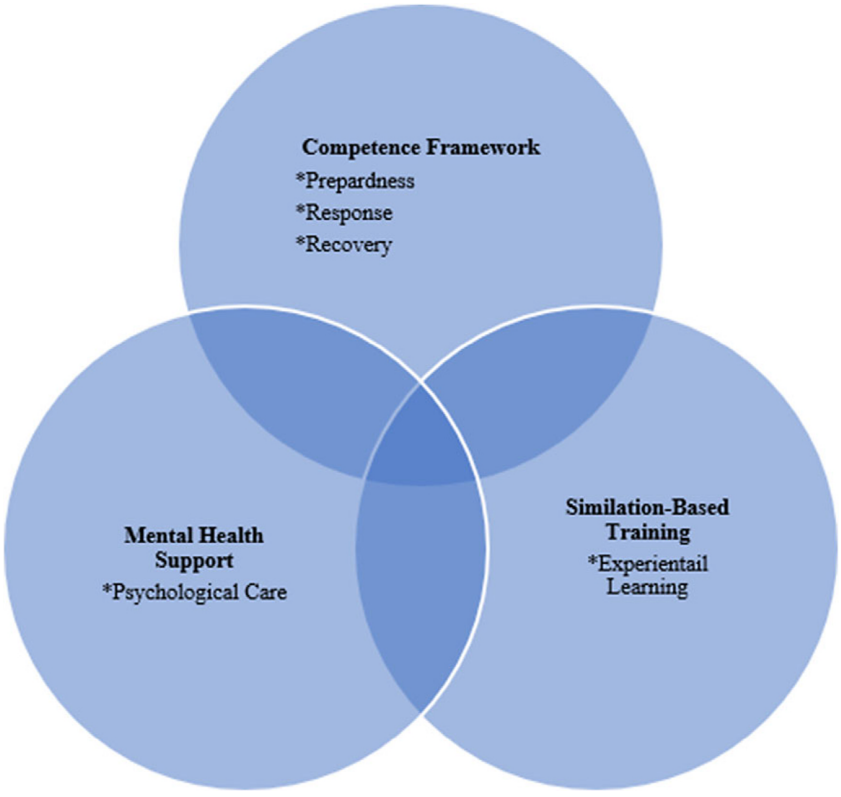


Figure 2. A hybrid framework for disaster training for nurses.

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more comprehensive and adaptable solution. To support this, nursing curricula should incorporate modular disaster training that integrates clinical, psychosocial, and system-level competencies, with simulation exercises and scenario-based learning as core components (Figure 2). Policymakers should prioritize the development of standardized yet flexible training guidelines that can be adapted across various health care settings and resource levels. Additionally, integrating mental health support into general disaster training—particularly for long-term care and vulnerable populations—should be a core requirement. Future research should focus on evaluating the effectiveness of such integrated models in diverse clinical and geographical contexts to inform evidence-based curriculum design and policy implementation.

Limitations

This systematic review provides valuable insights for designing education and training programs to enhance disaster knowledge, skills, and preparedness among nurses. However, it is important to note that the review is based on only 5 databases, focusing on full-text papers published in the past 10 years, including only English and Indonesian articles, and variability in study quality and methodological approaches across the included articles may have contributed to heterogeneity in the results. These limitations suggest that the conclusions drawn should be interpreted with caution, particularly when applying them to different cultural, linguistic, or health care settings. Future reviews should consider broader inclusion criteria and more diverse data sources to enhance the comprehensiveness and transferability of the findings.

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Ethical standard. This systematic review used publicly available secondary data and did not involve animal or human subjects, so ethical approval was not required.

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