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Training techniques, self-perceived levels of competence and evaluation of emergency nurses in relation to managing mass casualty incidents: a scoping review

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ABSTRACT

Introduction: the increasing frequency and seriousness of catastrophes require nurses to receive training and continuous update. This study aims at examining the international training techniques to manage mass casualty incidents, by analysing self-perceived levels of competence as well as evaluation methods for emergency nurses.
Materials and Methods: a scoping review was conducted between February and November 2024, and it included studies published between 2014 and 2024 from five databases, excluding those related to care settings different from intra-hospital emergency settings, and those related to training on COVID-19 or to the pediatric/obstetrics-gynecology field.
Results: after a selection based on inclusion and exclusion criteria and qualitative evaluation, 22 studies were included; they identified the main training techniques in simulations and face-to-face specific courses and highlighted a general low level of competence as well as the importance of standardized evaluation tools.
Discussion and Conclusion: the analysis answered the research question exhaustively and highlighted the importance of implementing structured and standardized training programs aimed at guaranteeing efficient nurse response at a global level.

Key words: disaster nursing, mass casualty incidents, teaching.

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Introduction

Mass casualty incidents – also known as disasters – refer to crises in which the number of victims is so high that it exceeds ordinary response capacity of healthcare facilities and emergency services. In these circumstances, resources are insufficient for prompt and efficient response so that extraordinary intervention and accurate coordination between organizations are required.[1,2] Potential causes of mass casualty incidents can be divided into two categories: natural disasters (earthquakes, floods, tornadoes, etc.) that according to the Centre for Research of the Epidemiology of Disasters (CRED) EM-DAT database amount to 4,601 worldwide between 2014 and 2024,[3] and man-made disasters (leakage of chemicals, arson, nuclear accidents, terrorism, war crimes, explosions, etc.).[4,5] In these situations, emergency nurses are the first healthcare professionals to aid victims, providing them with medical assistance:[6] disaster nursing entails methodical application of specific emergency nursing knowledge and skills aimed at implementing procedures that minimize lethal risks, reduce damage and improve health conditions.[7] With this type of assistance being a new focus area, the most common challenges in nursing are inadequate preparedness, poor research, ethical and legal issues, and the definition of roles during disasters.[8] In 2009, the International Council of Nursing (ICN) outlined a competency model for disaster nursing divided into four main areas: prevention, preparedness, response and recovery.[9] Preparedness is the most important step in responding to a catastrophe and it includes the ability to identify a catastrophic event, the triage activity and the definition of roles during disasters.[10] The increasing seriousness of future catastrophes – as projections show – makes it paramount for nurses to improve their competence and for organizations to guarantee the implementation of educational programs aimed at continuous update.[7] Continuous education is decisive to increase and improve clinical skills to reduce late treatment, unsatisfaction, waste of resources and mortality rate as well as to improve the quality of the care process.[11,12] Through a scoping review, this study aims at examining the main international training techniques for emergency nurses in managing mass casualty incidents, by analysing self-perceived levels of competence as well as main evaluation methods.

Materials and Methods

The review was structured according to the guidelines in the JBI (JBI's critical appraisal tools assist in assessing the trustworthiness, relevance and results of published papers) checklist [13].

A scoping review was conducted on five medical and scientific databases (PubMed, CINAHL, PsycInfo, Cochrane, Web of Science) between February and November 2024. The research question – elaborated following the PCC framework reported in Table 1 – is: identification of the main training techniques for emergency nurses, by analyzing self-perceived levels of competence as well as evaluation methods. The search string on PCC was: (((((disaster nurs*) OR (emergency nurs*)) AND ((maxiemergence) OR (mass casualty incident))) AND (disaster nursing training)) OR (disaster nursing preparedness)) OR ((maxiemergen-

cy training method) OR (mass casualty incident training method)). Every search string term was searched in the title. The research was filtered so to include only the articles published between January 2014 and November 2024, as established by inclusion criteria. The results were collected and managed through a Zotero citation manager. The source selection process is summarized in a PRISMA flow chart (Prisma 2020 Flow Diagram) (Figure 1).[14]

Inclusion/exclusion criteria

Inclusion criteria: the considered studies were in English and Italian; they concerned adults 18 years of age and over with no gender limits; they were available in full-text and only related to nurses; specifically, only articles about preparedness of intra-hospital emergency nurses in case of mass casualty incidents or disaster were included.

Exclusion criteria: studies about care settings different from intra-hospital emergency were excluded, as well as articles about training related to Sars-Cov2 virus and articles related to the pediatric and obstetrics-gynecology fields.
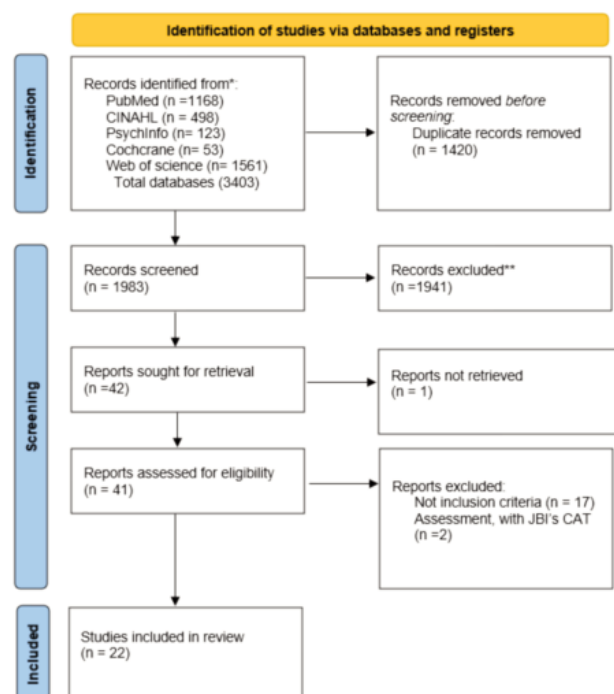

Figure 1. PRISMA Flow Diagram.

Table 1. PCC Framework.

P	Population	Nurses
C	Concept	Training techniques
C	Context	Mass casualty incident, intra-hospital emergency

Qualitative evaluation

The qualitative evaluation of the studies was carried out through JBI instruments[13] by using specific checklists for each type of analysis (Critical Appraisal Tool for analytical cross-sectional studies, Critical Appraisal Tool for qualitative research, Critical Appraisal Tool for systematic reviews and research syntheses, Critical Appraisal Tool for quasi-experimental studies). The qualitative evaluation of each included study was carried out by two authors independently. The items labeled as "unclear" were not considered evaluable. Each study had to score at least 75% in the employed checklist to be included in the analysis.

Results

The source selection process used a PRISMA 2020 flow chart (Figure 1),[14] serving a dual function of guide and graphic synthesis for each phase.

The research led to 3403 articles from databases that were exported into Zotero citation manager software; 1420 duplicates were removed.

The remaining 1983 articles underwent the following screening phase in which titles and abstracts were analyzed for each source. Based on inclusion and exclusion criteria, the screening excluded 1941 articles, while the remaining 42 were selected for the full-text analysis.

This last phase led to the exclusion of 18 articles, since they didn't meet inclusion and exclusion criteria for the following reasons: 1 study was excluded because it identified basic skills related to disaster management but did not identify training techniques or competence levels; 1 study concerned a training program for non-nursing multidisciplinary medical staff; 1 article was excluded because it exclusively concerned the importance of disaster preparedness in nursing curriculum; 1 study aimed at implementing an educational model by evaluating families and communities' preparedness level; 1 article exclusively concerned nurses' ability to assign a priority code in case of disaster; 5 articles were excluded because they exclusively aimed at validating evaluation scales on nurses' disaster preparedness; 1 study was excluded because it presented remote teaching for communities but not for nurses; 2 studies were excluded because they did not concern emergency nurses specifically; 1 study exclusively concerned trauma management and did not concern training techniques; 1 study exclusively concerned nurse coordinators' preparedness; 1 study was only available in Chinese; 1 study was only available in German.

One other study was excluded because it was not available in full text.

Two out of the 24 selected articles were insufficient according to the qualitative evaluation carried out through the JBI Critical Appraise Tool,[13] following the criteria illustrated in the previous paragraph.

Therefore, 22 studies were included in the final review: 11 analytical cross-sectional studies, 2 qualitative studies, 7 systematic reviews, and 2 quasi-experimental studies.

The articles included in the analysis are reported in *Supplementary materials, Table 1* that describes and summarizes the main features and results of the study. The table consists of different columns: title and summary, year of publication, author, journal, country of origin, study design, study timing and setting, sample size, outcomes, and main results.

Presentation of the main results

One of the main training techniques used in emergency nurses' educational programs is simulation (with full-scale actors or virtual reality) – with a focus on the importance of briefing and debriefing activity – followed by specific face-to-face courses.[15-28]

Studies show that nurses do not perceive themselves to be properly prepared and skilled to manage a disaster which reveals the necessity to implement new specific educational programs.[19,29-33] Moreover, a recurring theme in many studies is working safely and efficiently in emergency settings; continuous education is identified as the main instrument to improve such competence, and simulation is identified as the most efficient training technique for disaster preparedness.[19-28] A decisive strategy for disaster nursing training is the use of specific validated evaluation scales to identify lacking competencies and subsequently develop proper and specific educational programs.[16,19-23,28-30,33-35]

Discussion

This study led to the identification of the main training techniques and evaluation methods for emergency nurses working in disaster settings; moreover, it revealed more interesting themes.

Training, self-perceived levels of competence and self-confidence

Many studies – concerning different geographical areas and cultural settings – highlighted that nurses' self-perceived levels of competence related to mass casualty incidents are generally low or moderate which reveals significant lack of knowledge and competencies required for efficient response to disasters.[19,20,22,26,29,36]

Leodoro *et al.*, Sultan *et al.* and Öztekiÿn *et al.* underline that nurses are insecure about themselves and their competencies; such lack of confidence jeopardizes the efficacy of their response during emergency[29,31,33] and shows the need of targeted intervention to solve the problem. In response to this matter, Saida *et al.* identify advanced teaching methods as a fundamental instrument to improve nurses' self-confidence and self-efficacy related to disaster preparedness; it is also suggested that implementing teaching activities – such as team continuous training, practical exercise, CPR training or courses in orthopedics and hemostasis – may significantly increase nurses' ability to handle emergency situations.[32]

Main competencies

Overall, nurses consider both their theoretical and psychological competencies to be inadequate; it is essential that nurses acquire sound basic knowledge on disaster management - including the use of protective equipment and the management of infectious diseases - which prioritizes skills such as cardiopulmonary resuscitation, mass casualty triage and first aid techniques. Psychological competencies are crucial as well; nurses need to be prepared to offer psychological support to the victims and to manage their own post-disaster stress and trauma.[17,22,29,32] The study by Azizpour *et al.* is interesting since it identifies accurate triage during a mass casualty incident as a fundamental element to give prompt assistance based on proper severity classification; it also underlines the crucial role of other priority skills such as developing and implementing detailed emergency plans, managing mass immunization campaigns, organizing large-scale evacuation, and managing biological weapons.[23]

Education limits and lack of experience

Many studies highlight that nurses acknowledge the importance of disaster preparedness and training but many of them do not feel properly prepared. The causes for this lie in insufficient disaster-related practical experience as well as in poor specific education.[19-21,25,31,36] According to research by Usher *et al.* and Leodoro *et al.*, nurses claim to rarely take part in educational courses and specific disaster-related exercise even if they show strong interest in such activities. Lack of access to these learning opportunities significantly limits the capacity to effectively response to emergencies. Moreover, many nurses state to not know disaster management protocols in their workplace; in fact, many of them admitted having never read protocols or not even knowing about their existence.[17-19,31]

Many studies show that nurses taking part in specific courses consisting in well-organized continuous training and practical exercise have significantly higher levels of disaster preparedness.[15,19-21,23,28-30,32] Studies by Al-qbelat *et al.* and Tas *et al.* showed that an educational program on disasters can significantly improve knowledge, skills and preparedness of emergency nurses; results provide clear evidence of the necessity to implement continuous educational programs related to disasters.[18,28]

Considering all this, a systematic and multidimensional approach is fundamental. Öztekiÿn *et al.* claim the need for a global educational curriculum to align disaster preparedness at an international level and recommending it as compulsory;[33] on this account, Hamid *et al.* suggest developing a three-level program aimed at creating a continuous and feasible education.[24]

Scenario-based simulation training

Research showed that scenario-based simulation is one of the most efficient techniques to improve practical skills and to increase self-confidence; such method is extremely useful because it provides a safe space to exercise with no risks for patients. This type of training helps nurses to promptly and expertly respond to critical situations which enhances their practical preparedness.[15,16,18,119,25,27-31,33,36] To this end, the multimodal simulation technique suggested by Noh *et al.* shows that using different simulation modalities can improve participants' skills in emergency response and it also highlights the value of integrating different educational techniques. This method variety – combined with structured briefing and debriefing – can significantly enhance training effectiveness.[15-35]

Self-perceived levels of competence and personal features

Self-perceived levels of competence are not only influenced by participation in specific education and continuous training but also by other factors and peculiarities; several studies show that male nurses report higher perceived levels of disaster preparedness than female nurses;[17,19,21,22,30] other studies highlight that older nurses with more experience score significantly higher points when it comes to competence and emergency management.[17,19,21,30,32,33]

Some interesting research indicates that nurses priorly involved in disasters or mass casualty incidents report significantly higher levels of preparedness; the study by Chegini *et al.* in particular, detected that nurses with experience related to disasters have a better perception of their core competencies compared to those with no experience;[30] the study by Wang *et al.* also links participation to rescue missions and specific training to higher perceived levels of competence.[22]

Standardized evaluation of preparedness

As far as the evaluation process of nurses' preparedness is concerned, many studies demonstrate the importance of using validated evaluation tools that guarantee proper assessment of nurses' preparedness in managing mass casualty incidents. Using validated questionnaires such as the Emergency Preparedness Information Questionnaire (EPIQ),[21,29] the Disaster Preparedness Evaluation Tool (DPET),[19,20,22,28,33,36] the Triage Decision-Making Inventory (TMDI),[23] the Nurse Competencies Disaster Scale (NCDS)[21] and the Nurses' Perception of Disaster Core Competencies (NPDCC)[39] (see *Supplementary materials, Table 2*) is fundamental to evaluate nurses' competencies regarding preparedness, response and post-disaster management; this type of approach makes it easier to identify areas that need improvement and to assure a more efficient response to crises. Studies by Geng *et al.* and Noh *et al.* detect something interesting; starting from Kirkpatrick four-level model on the evaluation of educational programs - participant satisfaction, acquisition of competence, behavioral changes, patient outcome – they highlight the importance of "long-term" evaluation since it is the less reviewed area in most evaluation tools. This results in a lack of long-term data that limits our understanding of the overall learning effectiveness.[27,35]

In this regard, new evaluation models are suggested in the study by Wang *et al.*, in which the concept of "five dimensions of awareness" – disaster management, post-disaster knowledge and skills, pre-disaster knowledge, knowledge and skills in the workplace, and pre-disaster awareness – is introduced as an attempt to provide a complete picture aimed at detecting the areas in need of improvement;[22] an even more structured idea is the multimodal simulation suggested by Noh *et al.*, based on Kirkpatrick and ADDIE models. However, it is still necessary to keep exploring and implementing evaluation methods for the long-term effects and the impact on patient outcome to better understand how efficient learning programs are.[35]

Conclusions

The review detects some of the main international training and updating techniques to provide emergency nurses with proper competence in disaster nursing and management; it also analyses self-perceived levels of competence and methods employed in the evaluation process. Even if there is proof of the effectiveness of such programs, we still lack an internationally recognized uniform learning plan to proper address nurses' needs in this specific field.

This research stands as a starting point for future studies aimed at identifying and improving newer and more efficient training techniques. The implementation of specific and standardized educational programs as well as validated evaluation tools is paramount to guarantee continuous training and to improve nurses' technical and psychological competencies as a way to reach better care and greater professional satisfaction.

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Online supplementary materials

Table 2. Data extraction table – features and main results of the studies included in the literature review

Table 3. Validated questionnaires for self-perceived disaster preparedness evaluation in nurses