



Enhancing Nurses' Competencies and Interdisciplinary Collaboration for Effective Public Health Emergency Preparedness

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Abstract

Background: The COVID-19 pandemic highlighted the critical role of nurses in public health emergencies, necessitating a reassessment of training and preparedness strategies. Competency-based training programs have primarily focused on technical knowledge, overlooking cultural and personal attributes that influence performance in crises. Enhancing collaborative efforts between nurses and pharmacists can further optimize responses to public health emergencies. **Methods:** A scoping review was conducted to evaluate the effectiveness of training programs aimed at developing nurses' competencies during infectious disease outbreaks. Assessment tools such as the Disaster Preparedness Evaluation Tool (DPET) and Emergency Preparedness Information Questionnaire (EPIQ) were analyzed across diverse geographic and cultural contexts, including their applicability in China, Saudi Arabia, the United Kingdom, and Indonesia. The implications of interdisciplinary collaboration between nurses and pharmacists were also examined, alongside constraints such as language bias and cultural perspectives in the reviewed studies. **Results:**

The findings revealed that competency-based training programs often neglect cultural and personal attributes, which are essential for fostering initiative and adaptability among nurses. Tools like DPET and EPIQ demonstrated reliability and validity in assessing disaster preparedness across various nations. Enhanced collaboration between nurses and pharmacists was shown to improve medication management, patient safety, and therapeutic outcomes during crises. However, conceptual and language biases in the studies reviewed limit generalizability. **Conclusion:** To better equip nurses for future public health emergencies, training programs must integrate cultural and personal competencies alongside technical skills. Collaborative interdisciplinary initiatives, particularly between nurses and pharmacists, can enhance emergency responses and patient care. Addressing the identified constraints in research methodologies will contribute to more comprehensive preparedness strategies and strengthen global healthcare resilience.

Keywords: Nurse training, Public health emergencies, Competency assessment, Interdisciplinary collaboration, Emergency preparedness

Significance | This study highlights competency-based training and nurse-pharmacist collaboration as critical strategies for improving public health crisis responses.

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1. Introduction

A public health emergency is defined as the occurrence or imminent threat of a health condition—such as an infectious disease outbreak or bioterrorism—that poses a significant risk of mortality, severe harm, or lasting impairment to a large population (World Health Organization [WHO], 2015; Santinha, Forte, &

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challenge the preparedness and resilience of governments, healthcare systems, and academic institutions globally (Lurie et al., 2013). Consequently, the effective response to public health emergencies has become a critical focus for governments and international organizations worldwide.

During public health emergencies, swift and effective medical interventions are essential to mitigate casualties and health risks (Brencic et al., 2017). Nurses, as frontline responders, play a pivotal role in emergency management by providing triage, first aid, and other critical services under challenging conditions with limited resources (International Council of Nursing [ICN], 2019; Guilamo-Ramos et al., 2021). However, the complexity of these roles necessitates advanced competencies, and inexperienced nurses often struggle to meet the demands of emergency responses without adequate training.

Competency, broadly defined as the integration of knowledge, skills, and abilities required for specific tasks, is fundamental to nursing practice during crises (US Department of Education, 2001). Assessing nurses' competencies enables healthcare institutions to design targeted training programs and conduct relevant research (Ling & Daily, 2016). Various nations have developed competency frameworks tailored to their unique healthcare systems and public health challenges. For example, the United States has focused on disaster management competencies in response to hurricanes and bioterrorism, while China's frameworks emphasize infectious disease control due to frequent outbreaks.

Previous studies have identified core nursing competencies during public health emergencies but often lack comprehensive categorization or adaptation to specific crisis scenarios (Horrocks et al., 2019; Al Thobaity et al., 2017). The COVID-19 pandemic underscored the urgent need for enhanced nursing competencies, spurring numerous studies to identify and address these gaps (Labrague & De Los Santos, 2020; Wu et al., 2021). Research highlights the importance of formal education and training programs in equipping nurses with the necessary skills to handle crises effectively.

This scoping review aims to identify and integrate existing research on nursing competencies during public health emergencies. Key domains such as communication skills, self-protection, public health knowledge, ethical principles, and organizational cooperation are examined. Training programs, assessment tools, and competency models are also evaluated to inform future educational and clinical training initiatives. Enhanced nursing competencies not only improve individual performance but also strengthen the overall resilience of healthcare systems in responding to public health emergencies.

By synthesizing the existing literature, this review seeks to provide a foundation for developing structured training programs and competency assessment tools to prepare nurses for the multifaceted

challenges of future public health emergencies. The findings contribute to global efforts to enhance healthcare preparedness and ensure effective emergency responses.

2. Methodology

This study conducted a comprehensive scoping review to identify nursing competencies required during public health crises. The following databases were systematically searched to collect relevant studies and literature: PubMed, CINAHL, Scopus, Web of Science, ScienceDirect, Embase, Cochrane Library, WanFang, and ECRI. Additionally, grey literature was explored through the BASE and OpenGrey databases.

The inclusion criteria for the literature search encompassed studies addressing nursing competencies, training methodologies, and assessment tools relevant to public health emergencies. Articles published in English and Chinese were considered, reflecting the predominant languages of existing research in this domain.

To ensure methodological rigor, the study integrated both qualitative and quantitative data where available. Competency identification was further supported by theoretical frameworks such as the PPRR Model and the Iceberg Model, which were used to synthesize findings and provide structural clarity.

Limitations included the exclusion of non-English and non-Chinese studies and a focus on infectious disease outbreaks, which may not encompass competencies required for other public health crises.

3. Nursing Competence in Public Health Crises

Training programs can prepare nurses for public health crises by enhancing existing competencies and fostering the development of new skills. The focus of such training varies globally due to differences in healthcare systems and cultural contexts. In the United States, foundational training for public health nurses addressing emergency preparedness was established in 2002. Conversely, training in China gained prominence during the COVID-19 pandemic, emphasizing nurses' professional and technical competencies, particularly in critical care and the effective use of personal protective equipment (PPE). Online platforms were the primary medium for training delivery, incorporating methodologies like virtual reality simulation and mobile video learning. A prevalent pedagogical approach, just-in-time education, focuses on equipping individuals with practical skills in proximity to real clinical scenarios (McGarity et al., 2022). Another effective method, rapid cycle deliberate practice, utilizes immediate, targeted feedback to enable learners to refine their skills through repeated practice cycles (Yarmohammadian et al., 2011).

4. Identification of Prevalent Competency Domains

This scoping study aimed to identify key competencies required by nurses during public health crises, alongside assessment tools and training strategies that can enhance formal education and training programs. The predominant competency domains identified included communication skills, self-protection abilities, foundational knowledge of public health crises, legal and ethical principles, and organizational cooperation.

Effective communication is critical during prolonged crises, aiding nurses in navigating complex and high-stress scenarios (Lord et al., 2021). Despite its importance, hospitals often demonstrate insufficient preparation, inadequate communication, and a lack of emergency-trained nurses (Simonovich et al., 2021). Addressing these deficiencies through the development of advanced communication techniques is essential.

To mitigate infectious disease transmission during pandemics, nurses must adopt preventive measures to reduce infection risks (Patil et al., 2021; Ortega et al., 2020). During the COVID-19 pandemic, training on the proper donning and doffing of PPE proved highly effective in reducing infection rates among healthcare workers (Chiossi et al., 2021). Enhancing the training of healthcare professionals is imperative to prepare them for future pandemics.

A foundational understanding of public health emergencies involves knowledge of disease epidemiology, including etiology, incubation periods, and transmission dynamics. It also requires familiarity with principles of quarantine, contact tracing, diagnostic testing, and infection prevention strategies, as well as evidence-based pharmacotherapy. Nurses must also be well-versed in legal and ethical principles related to public health emergencies, including professional responsibilities, licensure requirements, and voluntary participation in emergency responses (Alfandre et al., 2021). Ethics and values form the backbone of resilience in public health emergency preparedness (Maketa et al., 2022). For example, the American Nurses Association's Code of Ethics for Nurses mandates compassionate care and respect for patients (American Nurses Association, 2001).

Effective responses to public health emergencies often depend on interdisciplinary teamwork and multisectoral coordination. Organizational cooperation enhances rescue efficiency and improves overall response outcomes (Wang et al., 2022; Tambo & Al-Nazawi, 2022).

5. Competency Development through Methodologies and Frameworks

Methodologies and theoretical frameworks play a vital role in establishing a comprehensive skill set for nurses. The Delphi method, widely used in nursing practice, facilitates competency identification by fostering consensus among experts and enhancing acceptance of the results (Serra-Barril et al., 2022; Wielenga et al.,

2015). This approach typically involves assembling a panel of experts and conducting multiple rounds of anonymous surveys. Feedback from each round is integrated to refine the data until a consensus is reached (Barrios et al., 2021).

In China, the process of identifying competencies often begins with selecting a theoretical framework, analyzing relevant literature, and conducting qualitative interviews. The initial competency set is refined through Delphi expert consultations to achieve consensus. In the United States, a similar approach incorporates the Delphi method, followed by focus group discussions to evaluate identified competencies. Researchers frequently combine Delphi techniques with interviews to ensure scientific rigor and data validity. Panels of experts typically include professionals from diverse domains such as public health, infectious diseases, critical care, medicine, emergency nursing, and nursing management.

Frameworks like the PPRR model (Prevention, Preparedness, Response, and Recovery) are commonly used to structure disaster risk mitigation and emergency management (Jain et al., 2020; McLoughlin, 1985). This model delineates distinct phases of the disaster cycle and provides a structured approach to competency development. Additionally, the iceberg model is widely employed to synthesize competencies by distinguishing between observable skills and underlying attributes such as personal traits (Michibayashi et al., 2020; Galehdar et al., 2020). While personal attributes are excluded from the PPRR model, the iceberg model's emphasis on deeper competency layers offers a nuanced perspective on nurse training.

Preparing nurses for public health crises requires a multifaceted approach that includes targeted training, robust competency identification, and the integration of theoretical frameworks. Communication, self-protection, legal and ethical knowledge, and interdisciplinary cooperation emerged as critical competencies. Methodologies like the Delphi technique and frameworks such as the PPRR and iceberg models provide structured and scientifically sound approaches to competency development. By addressing gaps in training and preparedness, healthcare systems can empower nurses to respond effectively to future public health emergencies (Figure 1).

6. Training Programs for Nurses Focused on Emergency Competencies

Competency-based training programs are pivotal in enhancing nurses' preparedness for public health emergencies. Traditionally, these programs have emphasized knowledge and skills necessary for handling public health situations. However, the COVID-19 pandemic highlighted the importance of integrating cultural and personal characteristics into training, consistent with the iceberg model of competence. This model underscores the need to enhance

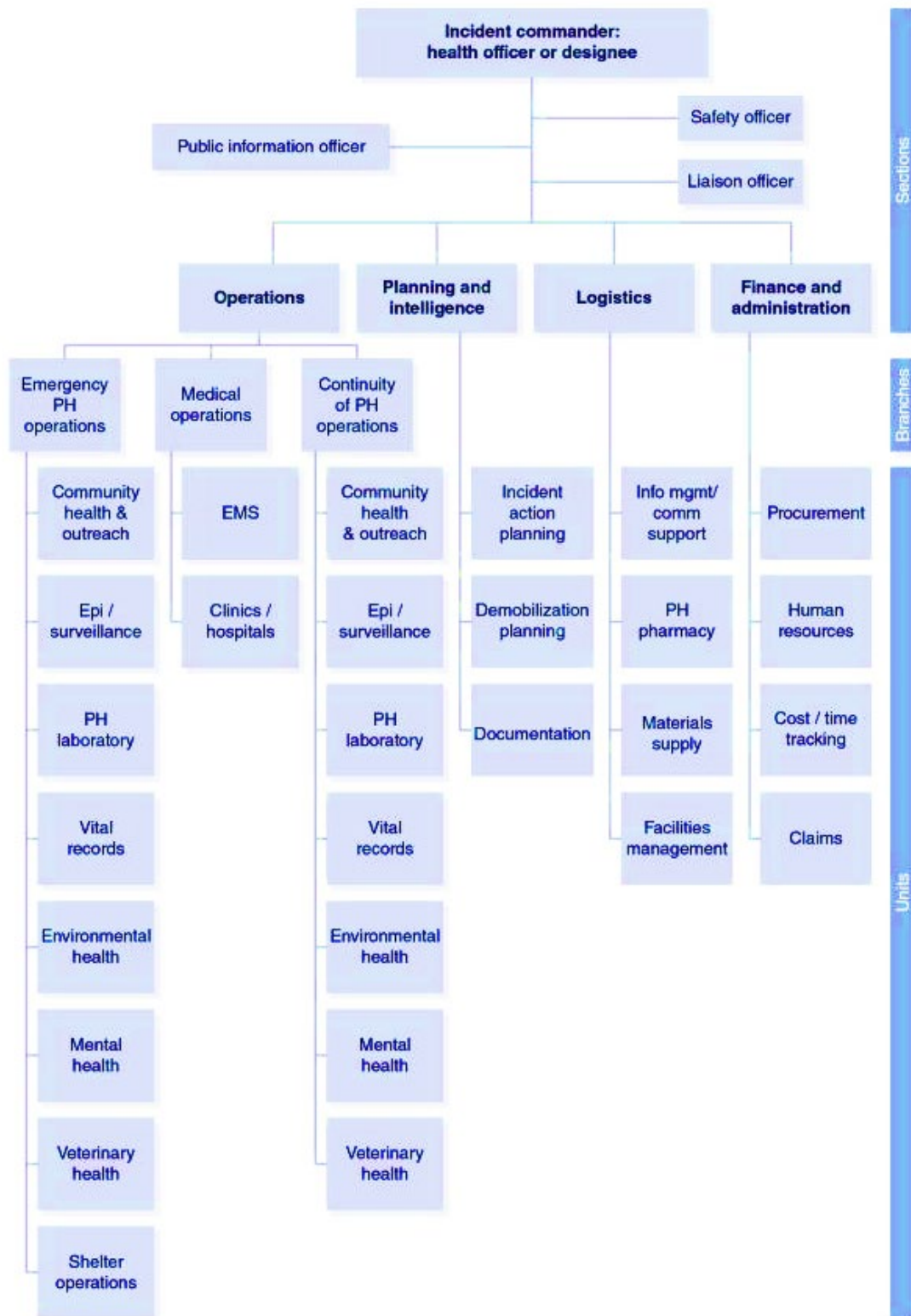


Figure 1. Public health incident command chart (epi/surveillance within operations section (Rottman et al., 2005).

cultural competencies, fostering nurses' initiative and readiness to deliver care during public health crises. Cultural training enables nurses to adapt their practices to meet diverse patient needs, a skill particularly vital in global pandemics. Moreover, personal attributes such as social roles and beliefs, which influence individual behavior and performance, have often been overlooked in training programs. Integrating evaluations of these attributes can improve the selection of nurses for frontline roles and facilitate the implementation of competency-based scientific human resource management.

China's collectivist culture, which emphasizes solidarity and communal goals, significantly influences nurses' responses to public health crises. Chinese nurses have demonstrated remarkable dedication during emergencies, with many considering their efforts during COVID-19 as fulfilling their professional calling (Chen et al., 2015). To evaluate and enhance these competencies, tools such as the Disaster Preparedness Evaluation Tool (DPET) and the Emergency Preparedness Information Questionnaire (EPIQ) have been widely used. The DPET assesses nurses' competencies across three disaster phases: pre-disaster, mitigation, and response. This tool has been translated and validated in various countries, including Korea, Japan, Indonesia, China, Iran, Jordan, Thailand, and Saudi Arabia (Fung et al., 2008; Martono et al., 2019; Öztekin et al., 2016; Al Khalaleh et al., 2012; Tabiee & Nakhaei, 2016; Al Thobaity et al., 2015). Research supports the validity and reliability of the DPET in these regions (Azizpour et al., 2022). Similarly, the EPIQ comprises components addressing personal information and competencies related to disaster preparation. It has been utilized in nations such as the United Kingdom, Malaysia, Saudi Arabia, Iran, and Korea (Chua et al., 2022; Ghazi, 2021).

7. Consequences for Nurse Administration

Nursing administration plays a critical role in preparing nurses for public health crises. Managers must prioritize the enhancement of nurses' capabilities, reinforce relevant training programs, and plan for future pandemics. Identifying competency domains, as highlighted in this review, can inform the development of educational curricula and clinical training programs. Implementing these strategies can accelerate nurses' acquisition of essential skills, enabling them to respond effectively to emergencies. Competency evaluation tools, such as the DPET and EPIQ, can aid nurse managers in selecting skilled personnel, ensuring high-quality care, providing feedback on training outcomes, and refining training initiatives.

By focusing on the integration of practical skills with personal and cultural competencies, nurse administrators can create a workforce better equipped to handle complex public health challenges. Moreover, fostering a culture of continuous learning and

adaptability is essential in ensuring the sustainability of these efforts.

8. Implications and Collaboration of Nurses and Pharmacists

Collaboration between nurses and pharmacists is indispensable for optimizing public health emergency responses. During crises, these professionals can leverage their complementary expertise to provide comprehensive patient care. Nurses, often on the frontline, possess critical insights into patient needs and healthcare delivery dynamics. Pharmacists contribute specialized knowledge in pharmacotherapy, medication management, and the prevention of drug-related complications. This partnership can enhance medication management, ensuring patients receive safe and effective treatments during emergencies.

For instance, during an outbreak, nurses can identify patients requiring medication adjustments or at risk of errors due to evolving treatment protocols. Pharmacists can then ensure timely access to essential medications and monitor for adverse drug interactions. This collaboration not only improves patient safety but also optimizes therapeutic outcomes.

Joint training initiatives can further strengthen this partnership, fostering effective communication and coordinated care. Scenarios simulating joint nursing and pharmacy responses to emergencies can build trust and mutual understanding, preparing both professions for real-world challenges. Additionally, interdisciplinary teams can provide a more holistic approach to public health preparedness and response. By incorporating diverse perspectives, healthcare organizations can develop robust protocols and guidelines, enhancing the resilience of the healthcare system. This collaborative framework is crucial for effectively addressing future public health crises.

9. Constraints

Several constraints were identified in this scoping review. Conceptually, the review focused primarily on nursing competencies during infectious disease outbreaks, with limited consideration of other types of disasters. This narrow scope highlights the need for further research encompassing a broader range of emergencies. Additionally, language biases were evident, as the included studies were restricted to English and Chinese. Future research should explore competencies documented in studies published in other languages to provide a more comprehensive understanding. Finally, implicit biases stemming from researchers' cultural backgrounds may have influenced their perspectives, underscoring the importance of cross-cultural validation in competency assessments.

10. Conclusion

In conclusion, enhancing nurses' competencies through targeted training programs is critical for effective public health emergency responses. Integrating cultural and personal attributes into competency assessments fosters readiness and resilience among healthcare professionals. Collaboration between nurses and pharmacists optimizes patient care, particularly in medication management and interdisciplinary teamwork. Utilizing validated assessment tools like DPET and EPIQ ensures robust training and resource allocation. Addressing conceptual, linguistic, and implicit biases can improve the scope of research and preparedness strategies. By prioritizing these measures, healthcare systems can strengthen their capacity to manage future crises, ensuring high-quality, coordinated care during public health emergencies.

Author contributions

F.F.M.A. conceptualized and supervised the study. A.A.M.A. contributed to data analysis and manuscript drafting. T.M.A. and S.H.A. participated in data collection and methodology development. M.M.A. and A.M.A. supported project administration and revisions. M.S.A. contributed to data validation, while B.T.A. provided critical review and final approval. All authors reviewed and approved the final manuscript.

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Competing financial interests

The authors have no conflict of interest.

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