



MALAHAYATI INTERNATIONAL JOURNAL
OF NURSING AND HEALTH SCIENCE
ISSN 2620-9152 (Print)
ISSN 2621-4083 (Online)
DOI: 10.33024



ARTICLE INFORMATION

Received: May, 13, 2025

Revised: September, 29, 2025

Available online: September, 30, 2025

at : <https://e-jurnal.iphorr.com/index.php/minh>

Factors influencing nurses' readiness in natural disaster emergency response

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Abstract

Background: The response phase is crucial in a disaster, nurses at community health center play a strategic role in disaster response phase preparedness; however, the factors that influence the level of nurse preparedness in the disaster response phase have not been widely studied.

Purpose: To identify factors contributing to nurse preparedness during the disaster response phase.

Method: A quantitative multicenter study using a cross-sectional design was conducted involving nurses from 27 primary healthcare centers located in disaster-prone regions. Convenience sampling was used to recruit 225 nurses, with data collection taking place between February and March 2023. Instruments included a demographic questionnaire and the Emergency Preparedness Information Questionnaire (EPIQ). Data were analyzed using multivariate logistic regression.

Results: A total of 50.9% of nurses had low preparedness. Factors associated with preparedness in the response phase include education level ($p=0.002$), years of service ($p=0.049$), training ($p=0.001$), and disaster experience of serving in disaster ($p=0.001$). The logistic regression analysis identified the dominant factors in increasing preparedness, which include disaster training (20.6%), professional education level (5.16%), 11-20 years of service (1.39%), male gender (1.34%), and experience of serving in disaster (1.16%). Nurses who have received disaster training have higher preparedness compared to those with BTCLS and BLS training. This predictor is identified to improve response phase preparedness. Nurses can be given disaster training to improve preparedness.

Conclusion: The average level of nurse preparedness was categorized as low. The most dominant factor influencing nurse preparedness in the natural disaster response phase was disaster training.

Keywords: Community Health Nursing; Emergency Preparedness; Natural Disasters; Nurse; Primary Health care.

INTRODUCTION

Globally, there were 7,348 natural disasters with 1.23 million fatalities and 4.2 billion people affected. The Asian continent is the most affected continent in the world with 3,068 disasters, Indonesia is one of the 5 countries most affected by disasters with a total of 278 disasters (United Nations Office for Disaster Risk Reduction, 2020).

In 2022, there were 3,544 recorded disasters in Indonesia. Bantul Regency, Yogyakarta, Indonesia is

a disaster-prone area with a high disaster risk index score of 157.30. Community health centers as the first health facilities, must have adequate preparedness resources. Nurses, as the first responders, have an important role in disasters. However, several studies have revealed that nurses in Indonesia are less prepared to deal with real disaster situations (Lestari, 2017).

Nurse preparedness during the response phase is low because nurses are unaware of their roles and responsibilities in a disaster, leading to a lack of confidence in responding to disasters (Usher, Mills, West, Casella, Dorji, Guo, & Woods, 2015). Other studies have also shown that although nurses are aware of emergency response plans, they do not understand their level of preparedness during the disaster response phase, which causes them to feel inadequate and less confident in handling disaster situations (Öztekin, Larson, Akahoshi, & Öztekin, 2016). The inability of nurses to respond to disasters is closely related to the factors that influence it (Younos, Hasan, & Nasreen, 2021).

Previous studies on hospital nurses have explained that age, gender, education level, years of service, training, and experience contribute to overall preparedness. This study tries to identify the contribution of these factors to disaster response phase preparedness among nurses in disaster-prone areas.

The results of this study can help identify the gaps in the level of nurse preparedness during the response phase in disaster-prone areas, it can also serve as scientific evidence regarding the factors that contribute to the disaster response phase and provide solutions that can be used to improve nurse preparedness in disaster-prone areas.

RESEARCH METHOD

A quantitative multicenter design with a cross-sectional approach was conducted between February and March 2023 across 27 primary healthcare centers located in disaster-prone areas. Participant selection was guided by defined inclusion and exclusion criteria. The inclusion criteria consisted of nurses who had been employed for a minimum of one year at community health centers in Bantul Regency and who provided informed consent to participate. Exclusion criteria included nurses who were on leave or on study assignments during the data collection period.

A convenience sampling technique was used to recruit 225 nurses. The sample size was determined using the "rule of thumb" formula, which recommends a sample size ten times the number of variables studied. Based on this calculation, a minimum of 60 participants was required; however,

222 respondents were ultimately included to enhance the robustness of the data.

Data collection tools consisted of a demographic questionnaire and the Emergency Preparedness Information Questionnaire (EPIQ). The demographic form collected data on age (categorized according to Ministry of Health guidelines: 17–25 = late adolescence, 26–35 = early adulthood, 36–45 = late adulthood, 46–55 = early elderly, and 56–65 = late elderly), gender (male/female), educational background (vocational/professional), work experience (1–10, 11–20, 21–30, >30 years), training experience (categorized as 'ever' or 'never' with subtypes such as disaster training, BTCLS, and BLS), and disaster response experience (experienced/inexperienced).

The EPIQ, consisting of 35 items across eight domains—incident command system, triage ethics, epidemiology and surveillance, communication and connectivity, decontamination, psychological issues, special populations, and access to critical resources—was used to assess disaster preparedness. The questionnaire utilized a semantic differential scale ranging from 1 (not familiar) to 5 (very familiar). Preparedness levels were classified as high if the score was equal to or above the median value (119) and low if below.

The instruments had undergone validity and reliability testing and were authorized for use in this study. Data were analyzed using SPSS version 2022. Upon completion of the questionnaires, responses were checked for completeness, followed by descriptive statistical analysis. Normality of numerical data was tested using the Kolmogorov-Smirnov test. To explore associations between demographic/supporting factors and nurse preparedness in disaster response, Chi-square tests were used for bivariate analysis. Multivariate analysis was conducted using logistic regression to identify the most significant predictors of preparedness, with results presented using Prevalence Ratios (PR) and 95% Confidence Intervals (CI).

This study was carried out following ethical clearance from the FK-KMK UGM Ethics Committee, granted on February 7, 2023, under reference number KE/FK/0179/EC/2023, ensuring ethical standards and participant protection throughout the research process.

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DOI: <https://doi.org/10.33024/minh.v8i7.947>

RESEARCH RESULTS

Table 1. Characteristics of the Respondents (N=222)

Variable	Result	P-Value	PR (CI) 95%
Nurse Preparedness (n/%)			
(Mean±SD)	(0.491±0.501)		
High	109/49.1		
Low	113/50.9		
Age (n/%)			
Age (Mean±SD)(Range)(Year)	(38.09±9.77) (17-65)		
17-25 (Late adolescence)	11/5.0		Ref
26-35 (Early adulthood)	94/42.3		0.64 (0.11-3.55)
36-45 (Late adulthood)	68/30.6	0.303	1.27 (0.22-2.24)
46-55 (Early elderly)	36/16.2		1.60 (0.26-9.53)
56-65 (Late elderly)	13/5.9		2.18 (0.27-17.6)
Gender (n/%)			
Male	49/22.4		Ref
Female	173/77.6	0.018	1.34 (1.14-3.83)*
Education (n/%)			
Vocational	183/82.4		Ref
Professional	39/17.6	0.002	5.16 (1.85-14.36)*
Work Experience (n/%)			
1-10 years	103/46.4		Ref
11-20 years	88/39.6		1.39 (1.16-2.75)*
21- 30 years	27/12.2	0.049	0.34 (0.12-1.27)
>30 years	4/1.8		0.27 (0.33-2.30)
Training Experience (n/%)			
Never	19/8.6		Ref
Disaster Training	34/15.3		20.6 (1.66-255.8)*
BTCLS	156/70.3	0.001	0.22 (0.043-1.12)
BLS	13/5.8		1.19 (0.29-4.78)
Disaster Response (n/%)			
Experienced	128/57.7		Ref
Inexperienced	94/42.3	0.001	1.16 (1.07-1.33)*

Note: *= Significance (p-value 0.005); Ref: reference category; Hosmer and Lemeshow Test of goodness of fit: p= 0.806 (>0.05); Nagelkerke R² = 46.9

Table 1 indicates that the majority of respondents (113 individuals or 50.9%) exhibited a low level of preparedness. Most nurses were in early adulthood (94 respondents or 42.3%), and the majority were female (173 respondents or 77.6%). In terms of educational background, the most common level was vocational nursing education, reported by 183 respondents (82.4%). Regarding work experience, 103 nurses (46.4%) had between

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1–10 years of service. A large proportion (203 respondents or 91.4%) had received training, with the most frequently attended being BTCLS (Basic Trauma and Cardiac Life Support) at 70.3% (156 respondents), followed by disaster training (15.3%) and BLS (Basic Life Support) training (5.9%). Additionally, 128 nurses (57.7%) reported having prior experience in disaster response.

Multivariate analysis using prevalence ratios (PR) assessed the strength of association for each factor. Age, using late adolescence as the reference group, was not significantly associated with preparedness in the response phase. However, male nurses were 1.34 times more likely to be prepared than female nurses. In terms of education, nurses with professional education were 5.16 times more likely to be prepared compared to those with vocational education. For work experience, those with 11–20 years of service showed a 1.39-fold increase in preparedness compared to those with 1–10 years, while those with 21–30 years or more than 30 years of service showed no significant association with preparedness.

Table 2. The Frequency Distribution of Nurse Preparedness Domains in the Response Phase of Natural Disasters Events (N=222)

Domain	Preparedness in the Disaster Response Phase	
	Low (n/%)	High (n/%)
Incident command system	108/48.6	114/51.4
Ethics in triage	88/39.6	134/60.4
Epidemiology and surveillance	105/47.3	117/52.7
Decontamination	85/38.3	137/61.7
Communication and connectivity	109/49.1	113/50.9
Psychological issues	110/49.5	112/50.5
Special populations	126/56.8	96/43.2
Access to critical resources	128/57.7	94/42.3

Table 2 presents the distribution of nurse preparedness across various domains. Six domains were classified in the high preparedness category: incident command system (51.4%), triage ethics (60.4%), epidemiology and surveillance (52.7%), decontamination (61.7%), communication and connectivity (50.9%), and psychological aspects (50.5%). Conversely, two domains—special populations (56.8%) and access to critical resources (57.7%)—were categorized as having low levels of preparedness.

DISCUSSION

The findings of this study indicate that the majority of nurses at community health centers in Bantul Regency demonstrated low levels of preparedness during the disaster response phase. This insufficient readiness is primarily associated with the lack of specific disaster training, with over 80% of respondents reporting no prior training in this area. Furthermore, gaps were identified in the disaster management planning documents, which

did not comprehensively cover all domains of disaster preparedness.

In terms of domain-specific preparedness, incident command system, triage ethics, epidemiology and surveillance, decontamination, communication and connectivity, and psychological issues were found to be in the high preparedness category. The high scores in these areas can be attributed to the presence of disaster management plans in the CHCs that include protocols and standard operating procedures relevant to disaster situations. Notably, nurses' familiarity with command systems and communication channels plays a crucial role in ensuring efficient coordination and reducing errors during emergencies, consistent with previous studies (Faturahman, 2021; Addiarto & Wahyusari, 2019).

In the triage ethics domain, respondents showed competence in conducting rapid assessments and applying ethical and legal principles in disaster scenarios, supported by the inclusion of triage protocols in the CHC disaster plans (Kusuma, 2021).

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Similarly, in the epidemiology and surveillance domain, nurses were well-informed about disease tracking, outbreak reporting, and post-disaster health risks, which reflects the availability of specific guidelines addressing these areas.

The domain of decontamination also demonstrated high preparedness, with respondents knowledgeable about the use of personal protective equipment (PPE), environmental safety, and SOPs during disasters. The preparedness in the communication and connectivity domain highlights the importance of inter-sectoral collaboration and routine coordination meetings in strengthening communication pathways during crises (Yennizar & Dirhamsyah, 2015).

Respondents also showed high preparedness in addressing psychological issues, including identifying signs of stress and post-traumatic symptoms, and providing mental health support during disasters. This readiness is supported by CHC disaster guidelines, which include psychological care strategies, early intervention, and rehabilitation services (Hadi, Agustina, & Subhani, 2019; Bambi, Iozzo, & Lucchini, 2020).

Conversely, low preparedness was identified in the domains of special populations and access to critical resources. Respondents reported limited knowledge regarding care protocols for vulnerable groups and procedures for gaining informed consent in disaster settings. Although CHC plans record the number of special populations, they lack detailed guidelines on care approaches tailored to each group. Similarly, limited understanding of referral systems, healthcare facility capacity, and bed availability reflected a lack of routine training on the government's integrated referral system (SISRUTE), resulting in reduced efficiency during disaster scenarios (McNeill, Adams, Heagele, Swanson, & Alfred, 2020).

Analysis of demographic factors revealed that age was not significantly related to preparedness. The majority of respondents were in early adulthood (26–35 years), a productive age group. Although this group had high potential, they also represented the highest number of respondents with low preparedness, likely due to insufficient exposure to disaster training (Bagaskoro, Alamsyah, &

Ramadhan, 2022; Farida, 2010; Wahyuningtyas, 2020).

Similarly, gender was not statistically associated with preparedness, although more male nurses were found to have higher levels of preparedness compared to their female counterparts. This may be influenced by gender roles and societal expectations, which can affect access to training and disaster response experience. However, existing literature suggests that men and women have different but complementary vulnerabilities and strengths in disaster contexts (Cvetković, Roder, Öcal, Tarolli, & Dragičević, 2018; Baker, Alamri, & Aboshaiqah, 2019; Addiaro et al., 2019).

In contrast, education level showed a significant association with preparedness. Nurses with professional education (bachelor's level) demonstrated greater disaster preparedness than those with vocational (diploma) training. This supports previous findings that higher education enhances critical thinking and problem-solving abilities, both essential in disaster response (Setiawati, Utami, & Sabrian, 2020; Zeng, 2016).

Among supporting factors, work experience, training, and disaster response experience were all significantly associated with preparedness. Nurses with 11–15 years of experience were more likely to be in the high preparedness category, in line with studies showing that longer professional experience contributes to better response capabilities (Winarti & Barbara, 2021; Putri, Handini, Purba, Sitorus, & Siagian, 2022; Ihsan, Kosasih, & Emaliyawati, 2022). Similarly, nurses who had received disaster-specific training were more prepared than those with only BLS or BTCLS training, indicating that training content must align with disaster contexts to be effective (Park & Kim, 2017; Syahril, Fariya, & Alfian, 2021).

Disaster response experience was also a significant predictor, as nurses who had directly participated in disaster situations were more prepared. Firsthand experience enhances critical thinking, stress management, and decision-making under pressure, all of which are vital in disaster scenarios (Rizqillah & Suna, 2018).

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The multivariate analysis identified disaster training as the most influential factor in enhancing nurse preparedness. Unlike BLS or BTCLS, which focus on individual emergencies, disaster training is designed to address broader crisis situations involving mass casualties, public health challenges, and coordination across agencies (Sugino, Hapsari, Madyaningrum, Haryanti, & Warsini, 2014).

Effective disaster training should include four key components: (1) an overview of disaster health impacts and the nursing role across disaster phases, (2) command systems and multi-agency coordination, (3) life-saving interventions such as CPR and triage, and (4) trauma management (Alim, Kawabata, & Nakazawa, 2015). Furthermore, training should be expanded to include referral system usage and care for vulnerable groups, which were identified as major gaps in current preparedness.

CONCLUSION

The average level of nurse preparedness was categorized as low. The most dominant factor influencing nurse preparedness in the natural disaster response phase was disaster training.

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