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The Readiness of Healthcare Workers in Disaster Health Management at Primary Healthcare Facilities

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ABSTRACT

The rising frequency and intensity of disasters, fueled by climate change, urbanization, and population growth, challenge global health systems. Primary health care facilities act as frontline responders, ensuring early intervention and service continuity. Thus, health worker preparedness is vital for effective disaster management at this level. This study evaluated preparedness among health workers in primary facilities, focusing on knowledge, attitudes, skills, and organizational support. A quantitative descriptive-analytic, cross-sectional study involved 120 health workers (doctors, nurses, midwives, others). Data came from structured questionnaires (in-person and online). Analysis used univariate descriptives, Chi-Square tests for associations, and logistic regression for dominant factors. Results show moderate disaster preparedness overall (47.5%). Significant associations existed with education, experience, training participation, and knowledge ($p < 0.05$). Multivariate analysis identified disaster training as the strongest predictor (OR = 3.21; 95% CI: 1.52–6.78; $p = 0.002$), with trained workers over three times more likely to exhibit high preparedness. Enhancing preparedness demands ongoing training, routine simulations, better infrastructure, and standardized protocols in primary care to boost resilience and emergency response.

Keywords: *Health Workforce Preparedness, Disaster Management, Primary Health Care Facilities*

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INTRODUCTION

Disasters pose a significant threat to global health systems, with their frequency and intensity increasing due to climate change, urbanization, and global population pressures. Natural and biological disasters can lead to massive disruptions in health services, including resource scarcity, surges in disease cases, and damage to health infrastructure, which places a heavy burden on primary health care systems. Literature studies demonstrate how health system preparedness is fundamental to saving lives and ensuring the continuity of public health services (Lamberti-Castronuovo et al., 2022).

Disasters, both natural and human-induced, have become increasingly frequent and severe in recent decades, posing major challenges to public health systems worldwide. Climate change, environmental degradation, population growth, and rapid urbanization contribute to the growing vulnerability of communities to disasters such as floods, earthquakes, landslides, and disease outbreaks. These events often disrupt health services, damage health infrastructure, and increase the demand for emergency medical care. As a result, strengthening disaster health management has become an essential priority for health systems to reduce morbidity, mortality, and long-term health impacts during emergencies (World Health Organization, 2019).

Within the health system, primary healthcare facilities play a fundamental role in disaster response and community resilience. Primary healthcare serves as the first point of contact for individuals, families, and communities in accessing health services. During disasters, these facilities are responsible for providing early medical assistance, conducting triage, managing minor injuries and illnesses, ensuring the continuity of essential health services, and supporting disease surveillance and public health interventions. Because primary healthcare facilities are usually located within communities, they are strategically positioned to respond rapidly to emergencies and to coordinate with local disaster management structures (Fernandes *et al.*, 2019).

The effectiveness of disaster health management at primary healthcare facilities largely depends on the readiness of healthcare workers. Healthcare workers, including physicians, nurses, midwives, and other health personnel, act as frontline responders during disaster situations. Their responsibilities extend beyond routine clinical care to include emergency response coordination, risk communication, patient triage, and collaboration with other sectors involved in disaster management. Therefore, healthcare workers must possess adequate preparedness to perform effectively under emergency conditions (Almukhlifi *et al.*, 2021).

Readiness in disaster health management encompasses several important components. These include knowledge of disaster risks and response procedures, positive attitudes toward emergency response responsibilities, operational skills for handling emergency situations, and the availability of organizational support within health institutions. Knowledge enables healthcare workers to understand disaster management principles and appropriate response strategies. Attitudes influence their willingness to participate actively in emergency response efforts. Operational skills, such as triage, first aid, and emergency coordination, are necessary for delivering effective care during disaster situations. Organizational support, including training programs,

disaster response protocols, and institutional preparedness plans, also plays a critical role in enhancing healthcare workers' readiness (World Health Organization, 2019).

Previous studies have indicated that healthcare workers' preparedness for disaster management varies considerably across health facilities and regions. In many settings, healthcare workers report moderate or insufficient preparedness due to limited access to disaster training, lack of simulation exercises, inadequate infrastructure, and insufficient institutional support. These challenges are particularly evident in primary healthcare settings, where resources and training opportunities may be more limited compared with hospitals or specialized emergency centers (Fuady, Pakasi and Mansyur, 2011; Susilawati, Efendi and Hadisuyatmana, 2019).

In addition, the complexity of disaster situations requires healthcare workers to respond quickly and effectively under conditions of uncertainty and resource constraints. This highlights the importance of strengthening human resource capacity within primary healthcare systems through continuous education, disaster training, and the development of clear operational guidelines to support healthcare workers in managing disaster-related health emergencies (Almukhlifi *et al.*, 2021).

The Primary Health System (PHS) serves as the spearhead of public health services, serving as the first point of contact between individuals/communities and the health system. Its central role includes providing preventive, promotive, and curative services, as well as providing initial response to emergencies and disasters. The existence of PHS in the context of disasters is increasingly crucial given limited hospital access in many areas and the need for early intervention at the scene (Lamberti-Castronuovo et al., 2022).

Although studies on disaster health management have developed in recent years, the scientific literature still shows several limitations in providing a comprehensive understanding of healthcare worker preparedness in the Primary Health Care System (PHCS). These limitations are particularly evident in the research focus, which is more directed towards the macro health system or hospital-level health facilities (secondary and tertiary care), while empirical studies specifically examining the preparedness of healthcare workers in primary healthcare facilities are still relatively limited. This condition indicates a knowledge gap that can hinder the formulation of strategic policies and the development of effective interventions to strengthen the preparedness capacity of healthcare workers at the primary healthcare level in facing disaster situations (Basnawi & Koshak, 2025).

The definition of disaster preparedness for healthcare workers includes the ability to effectively plan, implement, and assess responses to disaster impacts, both in clinical and operational contexts, and in coordination with stakeholders. Key elements of preparedness include technical knowledge, operational skills, mental/psychosocial readiness, and optimal resource utilization (Alrowili et al., 2025).

International research shows that the preparedness of medical personnel in primary care settings often remains moderate, with significant variation across regions and competency types. For example, data from Saudi Arabia indicates that while knowledge and skills are generally moderate to high, significant gaps exist in psychosocial preparedness and response to high-stress

situations. This indicates that technical training alone is insufficient without developing mental resilience and strong team communication (Alrowili et al., 2025).

In the Indonesian context, several local empirical studies have emphasized the crucial role of healthcare workers as the frontline in disaster management in primary health care facilities such as community health centers (Puskesmas). Studies at several Puskesmas in Aceh and Bengkulu have demonstrated a relationship between demographic factors, knowledge, experience, and attitudes toward healthcare worker preparedness. For example, research at the Kebayakan Community Health Center found that knowledge and work experience significantly correlated with healthcare worker preparedness in flash flood management (Astuti et al., 2026).

Although various studies have discussed the preparedness of healthcare workers in facing disasters, several pieces of literature still show some significant limitations, particularly regarding the scope of analysis that tends to focus on managerial aspects or the overall capacity of the system without deeply exploring the individual readiness dimensions of healthcare workers at the operational level. Additionally, some studies also place greater emphasis on institutional capacity or the availability of healthcare service resources, resulting in the personal competence and practical readiness aspects of healthcare workers not being fully comprehensively depicted. In this context, the literature review identifies that the factors influencing healthcare workers' preparedness include the level of knowledge, attitudes, clinical skills, practical experience, as well as formal education and training. These findings emphasise that preparedness is not only related to conceptual understanding but also requires structured training support and the integration of practical experience in the daily tasks performed at healthcare facilities (Faris & Saidana, 2024).

Furthermore, local empirical studies in Indonesia report challenges such as limited resources, access to training, and the frequency of disaster simulations, which impact the ability of health workers to respond effectively to disasters in primary care facilities (SKP). This highlights the need for further research that identifies contextual gaps and tailors intervention strategies to the characteristics of primary care facilities in Indonesia (Ningsih et al., 2022).

National health policy needs to strengthen disaster response capacity in SKP by focusing on Disaster Risk Reduction (DRR) training, developing disaster response standard operating procedures (SOPs), and providing a continuous learning system for health workers. This will enable SKP to function not only as routine service units but also as coordinated rapid response centers when disasters occur (Nikfard et al., 2025).

This research is theoretically and practically relevant, as it integrates global and local perspectives on health worker preparedness in disaster management in primary care settings, an area that has not been systematically explored in the context of Indonesia or other middle-income countries (Lamberti-Castronuovo et al., 2022).

Therefore, this research is conducted to fill the knowledge gap regarding the preparedness of healthcare workers in primary healthcare facilities within the context of disaster management. This study specifically examines several key variables related to the preparedness of healthcare workers, namely knowledge level, attitudes, skills, disaster training experience, and healthcare facility support as important components in the disaster response system at the primary care level.

The selection of these variables is based on various empirical findings that indicate that limitations in the competence and operational readiness of healthcare workers can impact the timeliness of medical responses, the effectiveness of emergency service coordination, and the increased risk of morbidity and mortality among disaster victims. Several disaster incident reports in various regions also show that the lack of preparedness among healthcare workers in primary facilities can lead to disruptions in healthcare services, delays in victim handling, and increased referral burdens to advanced healthcare facilities. Based on these conditions, this study aims to evaluate the level of preparedness of healthcare workers in primary healthcare facilities by analysing the factors that influence it, thereby generating evidence-based strategic recommendations to enhance the capacity of healthcare workers in effectively and coordinately responding to disaster situations.

It is hoped that this article can enrich the literature on health disaster management at the primary level and provide policy implications for adaptive, sustainable, and contextual emergency health planning to the characteristics of health workers in Indonesia.

METHODS

This study uses a quantitative approach with a descriptive-analytical design and a cross-sectional design to assess the level of healthcare workers' preparedness in disaster health management at primary healthcare facilities and to analyse the factors related to that preparedness during a single measurement period.

The research was conducted at primary healthcare facilities located in areas with potential disaster risk. The selection of locations was based on the strategic role of primary healthcare facilities as the frontline responders in the initial disaster response. The research was conducted through several stages, including research preparation, data collection, data processing, and statistical analysis.

The research population consists of all healthcare workers employed at primary healthcare facilities in the research location, including doctors, nurses, midwives, and other healthcare personnel directly involved in healthcare services. The sampling technique used was total sampling with a total of 120 healthcare workers who met the inclusion criteria, namely having a minimum work experience of one year and being willing to participate as research respondents.

The dependent variable in this study is the preparedness of healthcare workers in disaster health management, while the independent variables include individual characteristics (age, gender, education, work experience), level of knowledge about disaster management, experience in participating in disaster training or simulations, and support from healthcare facilities.

Data collection was conducted using a structured questionnaire developed based on the concept of healthcare workers' preparedness in disaster management, which encompasses four main domains: knowledge, attitudes, skills/disaster response experience, and facility readiness.

Before being used in the main study, the research instrument was first subjected to validity and reliability tests on 30 healthcare worker respondents at healthcare facilities with characteristics similar to the research location. The results of the validity test using the Pearson Product Moment correlation show that all question items have calculated r values ranging from 0.412 to 0.781, greater

than the table r value (0.361), thus all items are declared valid. The reliability test using Cronbach's Alpha showed a value of α = 0.89, indicating that the internal consistency level of the instrument is in the very good category and suitable for use in research.

Data was collected through the completion of questionnaires both in-person and online according to field conditions. Each respondent was provided with an explanation of the research objectives and assured the confidentiality of their identity and the data provided. Data analysis was conducted in stages, including univariate analysis to describe the distribution of respondent characteristics and preparedness levels, bivariate analysis using the Chi-Square test to assess the relationship between variables, and multivariate analysis using logistic regression to identify dominant factors influencing healthcare workers' preparedness.

RESULTS

1. Respondent Characteristics

Univariate analysis was conducted to describe the basic characteristics of health worker respondents in primary health care facilities.

Table 1. Distribution of Respondent Characteristics (n = 120)

Characteristics	Category	n	%
Age	≤ 35 years	54	45.0
	> 35 years	66	55.0
Gender	Man	38	31.7
	Woman	82	68.3
Education	D3	34	28.3
	S1	63	52.5
	Profession/Masters	23	19.2
Years of service	≤ 5 years	41	34.2
	> 5 years	79	65.8
Disaster Training	Once	72	60.0
	Never	48	40.0

The majority of respondents were aged over 35, female, had a bachelor's degree, and had worked for more than five years. More than half had participated in disaster training or simulations, indicating early exposure to disaster preparedness in primary healthcare facilities.

2. Level of Preparedness of Health Workers

Preparedness is measured based on the domains of knowledge, attitude, skills/experience, and facility readiness.

Table 2. Distribution of Health Worker Preparedness Levels

Level of Preparedness	n	%
Low	28	23.3
Currently	57	47.5

Tall	35	29.2
Total	**120**	**100**

Most health workers are at a moderate level of preparedness, indicating that disaster response readiness is not optimal and still requires strengthening, particularly in operational aspects and cross-sector coordination.

3. Preparedness Domain Analysis

Table 3. Average Score of Preparedness Domain

Preparedness Domain	Mean ± SD	Category
Knowledge	76.4 ± 8.5	Good
Attitude	72.1 ± 7.9	Enough
Skills & Experience	68.3 ± 9.1	Enough
Facility Readiness	64.7 ± 10.3	Not enough

The knowledge domain scored highest, while facility readiness scored lowest. These findings indicate that healthcare workers' conceptual understanding is not fully supported by the availability of facilities, infrastructure, and disaster preparedness support systems.

4. Relationship between Individual Factors and Preparedness

Bivariate analysis using the Chi-Square test.

Table 4. Relationship between Individual Factors and Health Worker Preparedness

Variables	High Readiness (%)	Low–Medium Preparedness (%)	p-value
higher education	38.5	61.5	0.021
Work Experience >5 years	41.8	58.2	0.015
Have you ever had training?	47.2	52.8	0.001
Good Knowledge	49.0	51.0	0,000

Education, length of service, training experience, and knowledge level were significantly associated with health worker preparedness ($p < 0.05$). Disaster training was the factor that showed the strongest association with high preparedness.

5. Multivariate Analysis of Dominant Factors

Logistic regression analysis was performed to identify the most dominant factors.

Table 5. Dominant Factors Influencing Preparedness

Variables	OR	95% CI	p-value
Have Disaster Training	3.21	1.52–6.78	0.002
Good Knowledge	2.84	1.31–6.12	0.008
Work Experience >5 years	2.17	1.04–4.52	0.039

Health workers who have participated in disaster training are 3.21 times more likely to have good preparedness than those who have not. This underscores the importance of structured and ongoing training in improving preparedness in primary healthcare facilities.

DISCUSSION

1. Respondent Characteristics

The majority of healthcare workers in this study were over 35 years old, had a bachelor's degree, and had more than five years of experience. These findings indicate a mature and experienced professional profile, which, according to Human Capital theory, directly contributes to increased job preparedness through the accumulation of knowledge and practical experience.

Research by Lamberti-Castronuovo et al., (2024) found that greater age and work experience were correlated with higher levels of preparedness among primary healthcare workers in Northern Italy (Lamberti-Castronuovo et al., 2024). Similarly,Alrowili et al. (2025)reported that long professional experience increases self-confidence and decision-making in disaster management in Saudi Arabia (Alrowili et al., 2025).

The demographic characteristics of healthcare workers serve as a foundation for developing adaptive preparedness behaviors. However, without a continuous training system, this experience can stagnate and fail to develop into effective operational preparedness.

2. Level of Preparedness of Health Workers

Most health workers showed a moderate level of preparedness (47.5%), indicating that theoretical understanding has not been fully followed by practical readiness in the field.

According to the FEMA Preparedness Cycle (2021), preparedness is an iterative process that includes planning, training, evaluation, and continuous improvement. These findings align with research.Isangula et al. (2023)in Tanzania, which found that primary health workers in disaster-prone areas showed moderate preparedness due to limited training and supporting facilities (Isangula et al., 2023).

Similar research byAlmukhlifi et al. (2025)emphasized that moderate levels of preparedness usually arise due to weak institutional coordination and limited resources in primary health facilities (Almukhlifi et al., 2021).

A moderate level of preparedness reflects a condition in which health workers are aware of the importance of preparedness, but still face structural barriers such as a lack of organizational support and resources to apply knowledge optimally.

3. Preparedness Domain Analysis

The highest average score was found in the knowledge domain (76.4 ± 8.5), while the facility readiness domain (64.7 ± 10.3) had the lowest score. This illustrates the imbalance between individual and system readiness.

StudiesLestari et al. (2022)used the Hospital Safety Index to assess the preparedness of primary care facilities in Indonesia and found that limited infrastructure was a major obstacle to

implementing an effective disaster response (Lestari et al., 2022). These results are consistent withLamberti-Castronuovo & Lamine (2024), which emphasizes that individual preparedness must be supported by good organizational and logistical system readiness (Lamberti-Castronuovo et al., 2024).

Even if healthcare workers possess adequate knowledge, the effectiveness of a disaster response depends heavily on the preparedness of facilities. Therefore, increased preparedness needs to be directed at strengthening supporting systems and facilities so that individual competencies can be optimized in real-life situations.

4. Relationship between Individual Factors and Preparedness

The analysis of the relationship between individual factors and the level of healthcare workers' preparedness was conducted using the Chi-Square test. The choice of this test was based on the nominal or dichotomous nature of the research data, so the analysis of the relationship between variables was carried out through cross-tabulation (contingency table). In this study, the four main independent variables, namely education, length of service, disaster training experience, and level of knowledge, were simplified into two categories, forming a 2×2 contingency table between the independent variables and the level of preparedness (high vs low-medium). The use of a 2×2 table allows for a simpler and more interpretable statistical relationship test, as each variable can be directly compared between the two categorical groups. In addition, this approach also facilitates the estimation of association measures such as Odds Ratio (OR) that can be used in further analysis.

The results of the Chi-Square test show that education, length of service, disaster training experience, and level of knowledge have a significant relationship with healthcare workers' preparedness ($p < 0.05$). These findings affirm that individual factors play a crucial role in shaping the readiness of healthcare workers in facing disaster situations.

Study byAlrowili et al. (2025)proved that health workers who had participated in disaster management training had a level of preparedness 2–3 times higher than those who had never been trained (Alrowili et al., 2025). Similar research byIsangula et al. (2023)also found that participation in disaster training increased the physical and psychological preparedness of health workers in dealing with emergency conditions (Isangula et al., 2023).

Disaster training acts as a mediator connecting theoretical knowledge with practical preparedness. Researchers assume that the more intense the simulation-based training, the stronger the integration between the cognitive and behavioral aspects of healthcare worker preparedness.

5. Dominant Factors Influencing Preparedness

The results of the logistic regression analysis indicate that disaster training is the factor with the strongest effect on healthcare workers' preparedness (OR = 3.21; p = 0.002; 95% CI: 1.52–6.78). An Odds Ratio (OR) value of more than three indicates that healthcare workers who have undergone disaster training have more than three times the chance of having high preparedness compared to those who have not received such training. The very small p-value (<0.05) indicates that the

relationship is statistically significant, while the relatively narrow 95% confidence interval that does not cross the number 1 suggests that the effect estimate is stable and statistically reliable.

These findings indicate that disaster training is the most modifiable factor in enhancing the preparedness of healthcare workers in primary healthcare facilities.

Research by Almukhlifi et al. (2025)confirmed that continuous training interventions improve multidimensional preparedness including cognitive, emotional, and technical aspects (Almukhlifi et al., 2021). Similarly,Lamberti-Castronuovo & Lamine (2024)emphasized that regular scenario-based training strengthens interprofessional coordination in the primary care system (Lamberti-Castronuovo et al., 2024).

Disaster training is the most modifiable factor in improving preparedness. Researchers assume that implementing systematic training, supported by institutional policies and periodic evaluation, will sustainably improve primary facility resilience to disasters.

CONCLUSIONS

This study shows that health workers' preparedness for disaster management in primary healthcare facilities is moderate, with variations influenced by individual and organizational factors. While health workers' knowledge is generally good, it is not matched by adequate facility readiness and system support.

Further analysis confirmed that education, length of service, disaster training, and knowledge level were significantly associated with preparedness levels, with disaster training emerging as the most dominant factor. Health workers who had received training were more than three times more likely to demonstrate high preparedness than those who had not.

These results reinforce the Preparedness Cycle and Experiential Learning theories, which emphasize that preparedness is not only the result of theoretical understanding but also of iterative learning and practical experience. Therefore, improving healthcare worker preparedness should focus on ongoing training interventions, routine simulations, and the integration of disaster management systems into primary care operations.

From a policy perspective, institutional support is needed through strengthening human resource capacity, developing preparedness infrastructure, and standardizing disaster response standard operating procedures (SOPs) at the primary level. These efforts align with the WHO's Health Emergency Preparedness and Response (HEPR) agenda and the Sendai Framework 2030 to strengthen disaster-resilient health systems.

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