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Research Article

Hospital Safety Index and Healthcare Provider Preparedness for Disaster-Responsive Social Welfare in Lhokseumawe, Indonesia

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Abstract

Hospitals are critical institutions for maintaining health service continuity and social welfare during disasters, particularly in hazard-prone regions where emergency care, patient safety, and community protection depend on institutional readiness. This study aimed to assess the Hospital Safety Index (HSI) and describe healthcare provider preparedness for disaster response at Metro Medical Center General Hospital, Lhokseumawe, Indonesia. A descriptive exploratory case study was conducted from 25 to 31 March 2026 involving 100 healthcare providers and hospital personnel selected through purposive sampling. Data were collected using the HSI checklist and a 42-item preparedness questionnaire covering knowledge, attitudes, and practices. HSI data were processed using the official HSI calculator, while preparedness data were analyzed descriptively using SPSS version 27. The findings showed that the hospital achieved an overall HSI score of 0.98, placing it in Category A, with high structural safety, non-structural safety, and emergency and disaster management capacity. Healthcare provider preparedness was also generally favorable, as 70% of respondents demonstrated high disaster knowledge, 61% showed very good attitudes, and 47% reported very good disaster-related practices. However, 69% of respondents had not attended disaster training, indicating a critical gap between institutional safety status and sustainable workforce preparedness. This study implies that disaster-responsive hospitals require not only safe infrastructure and emergency management systems but also continuous, inclusive, and competency-based disaster training to strengthen healthcare workforce readiness, protect vulnerable populations, and support resilient social welfare in disaster-prone communities.

Keywords: Disaster Preparedness; Healthcare Provider; Hospital Safety Index; Resilient Hospital; Social Welfare; SDGs.

INTRODUCTION

Disasters increasingly challenge the continuity of health services, particularly in countries where geological, hydrometeorological, technological, and social hazards intersect [1], [2], [3]. Hospitals are not ordinary public facilities in disaster situations. They are life-preserving institutions that must remain safe, accessible, and functional before, during, and after emergencies. When hospital buildings, utilities, evacuation routes, communication systems, or healthcare workers are unprepared, the consequences extend beyond operational disruption. They affect patient safety, public trust, social protection, and the welfare of communities that depend on timely emergency care [4], [5], [6].

Indonesia provides a critical setting for studying hospital preparedness because of its exposure to earthquakes, tsunamis, floods, landslides, volcanic activity, extreme weather, disease outbreaks, and technological hazards [7], [8], [9]. Aceh Province has a particularly strong disaster memory after the 2004 Indian Ocean earthquake and tsunami. Lhokseumawe, located in Aceh, is also shaped by coastal and urban risks as well as a history of social vulnerability. In such settings, hospital preparedness should not be treated merely as a technical compliance issue. It should be interpreted as a welfare capability: the institutional capacity to protect patients, workers, families, and surrounding communities when hazards become emergencies.

The Hospital Safety Index (HSI) offers a structured approach for assessing whether hospitals are likely to continue functioning during emergencies. The World Health Organization and Pan American Health Organization describe the HSI as an assessment tool for rating hospital safety and identifying actions needed to strengthen preparedness, response, and recovery [10], [11]. The framework examines structural safety, non-structural safety, and emergency and disaster management capacity, thereby connecting physical infrastructure with organizational readiness. This multidimensional approach is important because a hospital can have competent staff but still fail during a disaster if utilities, evacuation pathways, supplies, communication systems, or structural protections are weak.

The relevance of HSI is also linked to the global disaster risk reduction agenda. The Sendai Framework for Disaster Risk Reduction 2015-2030 emphasizes understanding disaster risk, strengthening governance, investing in resilience, and enhancing preparedness for effective response and recovery [12], [13]. For hospitals, these priorities translate into risk assessment, safe infrastructure, trained personnel, functional emergency plans, and continuous institutional learning. Within the Sustainable Development Goals (SDGs), hospital preparedness is closely related to SDG 3 on health and well-being, SDG 11 on safe and resilient cities, SDG 16 on effective institutions, and SDG 5 when workforce participation, safety, and learning opportunities are considered from a gender-responsive perspective [14], [15], [16].

The focus of Women, Education, and Social Welfare is especially relevant because healthcare systems are strongly shaped by human-centered service delivery, workforce capacity, and social protection. The health and social workforce is highly feminized globally, and the World Health Organization reports that women constitute a substantial majority of the health and social workforce [17], [18], [19]. In many hospitals, nurses, midwives, and other frontline workers play decisive roles in triage, evacuation, patient monitoring, caregiving, psychosocial support, and communication with families during crises. Therefore, hospital

preparedness is not only a matter of buildings and equipment; it is also a matter of learning systems, equitable training access, occupational safety, and institutional support for workers who carry much of the operational burden during disasters [20], [21], [22].

Previous studies have assessed hospital disaster preparedness, risk management, and safety indices in various contexts, but gaps remain in connecting HSI results with healthcare provider preparedness and social welfare implications. Many assessments emphasize technical index scores without adequately explaining how workforce knowledge, attitudes, and practices support or limit the capacity of hospitals to function as welfare institutions. This gap is important because disaster resilience depends on the interaction between infrastructure, organizational systems, and frontline human behavior. In addition, local evidence from private or district-level hospitals in disaster-prone Indonesian cities remains limited.

Metro Medical Center General Hospital (RSU MMC) in Lhokseumawe is a Type D hospital and an important referral facility for the city and nearby areas. Preliminary observations in the thesis indicated several preparedness concerns, including limited evacuation ramp access to upper floors, the need for clearer disaster guidelines, limited bed capacity for mass casualty situations, and infrequent disaster training for staff. At the same time, the hospital has skilled healthcare providers and an important role in emergency triage, evacuation, and medical response. This combination makes RSU MMC a relevant case for examining how hospital safety and provider preparedness interact in a disaster-prone setting.

Accordingly, this study aims to assess the Hospital Safety Index and describe healthcare provider preparedness at RSU MMC Lhokseumawe. The article contributes to Education and Social Welfare by reframing hospital disaster preparedness as a learning-based and human-centered welfare issue. Its novelty lies in integrating HSI assessment with frontline provider preparedness and SDG-oriented interpretation. The article is organized into methods, results and discussion, conclusion, limitations, author information, and references.

METHODS

Research Design

This study employed a descriptive exploratory case study design. The design was appropriate because the research aimed to describe the safety status of a hospital and the preparedness profile of its healthcare providers rather than test causal hypotheses. The case study approach enabled an institution-specific understanding of disaster readiness within a hospital located in a disaster-prone area. The original thesis defined the study as a descriptive exploratory assessment of the Hospital Safety Index and healthcare provider preparedness at RSU MMC Lhokseumawe.

Research Setting

The study was conducted at Metro Medical Center General Hospital, Lhokseumawe, Aceh, Indonesia. The hospital functions as a local healthcare facility and referral point for Lhokseumawe and surrounding areas. Its disaster relevance derives from the broader hazard profile of Aceh and Lhokseumawe, including geological, hydrometeorological, technological, biological, and social risks.

Participants and Sampling

The study population consisted of 116 hospital employees, including medical personnel, health workers, and supporting staff involved in hospital operations. A purposive sampling technique was used to select participants who were relevant to disaster preparedness and hospital service continuity. The final sample consisted of 100 healthcare providers and hospital personnel, including specialist doctors, general practitioners, nurses, midwives, radiographers, laboratory staff, pharmacy staff, emergency unit staff, operating room personnel, ICU/NICU personnel, hospital facility staff, security staff, cleaning service personnel, committees, and hospital management representatives.

Variables and Instruments

Two main variables were assessed: the Hospital Safety Index and healthcare provider preparedness. The HSI variable measured hospital safety and disaster readiness across modules related to hazards affecting hospital safety, structural safety, non-structural safety, and emergency and disaster management. In the empirical analysis, the HSI calculator was applied primarily to structural safety, non-structural safety, and emergency/disaster management modules, while the hazard module was used to identify relevant threats. Healthcare provider preparedness was measured using a 42-item questionnaire covering knowledge, attitudes, and practices/skills in disaster response. The preparedness instrument used a Likert-type and categorical response format consistent with the thesis protocol.

Data Collection Procedure

Data were collected through field observation and questionnaires. HSI data were obtained using the HSI checklist, which contained detailed items on hospital safety and emergency readiness. Provider preparedness data were collected through a structured questionnaire administered to 100 respondents. Participants were informed about the purpose of the study, and responses were processed in aggregate to protect confidentiality.

Data Analysis

HSI data were processed using the Hospital Safety Index calculator in Microsoft Excel. The index classified hospital safety into three categories: Category C (0.00-0.35), Category B (0.36-0.65), and Category A (0.66-1.00). Category A indicates that the hospital is likely to continue functioning during disasters, although capacity strengthening remains recommended. Healthcare provider preparedness data were analyzed using descriptive statistics with SPSS version 27. Frequencies and percentages were used to describe respondent characteristics and preparedness dimensions.

Ethical Considerations

The study followed basic ethical principles for institutional and human-participant research. Participation was voluntary, data were reported in aggregate, and no personally identifiable information was presented in the article. The hospital context and findings were interpreted for quality improvement, preparedness strengthening, and public welfare purposes.

RESULTS AND DISCUSSION

Results

The results are presented in four parts: respondent characteristics, disaster training exposure, Hospital Safety Index findings, and healthcare provider preparedness.

Table 1. Demographic and professional characteristics of respondents (N = 100)

Characteristic	Category	Frequency	Percentage
Sex	Male	25	25.5%
	Female	75	75.5%
Age	25-31 years	46	46.0%
	32-38 years	44	44.0%
	39-45 years	7	7.0%
	46-53 years	3	3.0%
Education	Specialist	9	9.0%
	Medical doctor degree	6	6.0%
	Nurse profession (Ners)	9	9.0%
	Diploma in Nursing	38	38.0%
	Diploma in Midwifery	25	25.0%
	Other health/support qualifications	13	13.0%
Profession	Nurse	47	47.0%
	Midwife	25	25.0%
	Specialist doctor	9	9.0%
	General practitioner	6	6.0%
	Other health/support professions	13	13.0%
Length of work	1-6 years	68	68.0%
	7-12 years	20	20.0%
	13-18 years	12	12.0%

The respondent profile shows that the hospital preparedness system was assessed mainly through frontline providers. Women represented 75.5% of participants, reflecting the gendered composition of many healthcare workforces. Nurses and midwives were the largest groups, which is important because these professions are often directly involved in patient monitoring, evacuation support, triage assistance, and family communication during emergencies.

Table 2. Disaster training exposure among respondents

Training experience	Frequency	Percentage	Percentage
Had not attended disaster training	69	69.0%	25.5%
Had attended disaster training	31	31.0%	75.5%
Total	100	100.0%	46.0%

Although most respondents demonstrated positive preparedness indicators, 69% had not attended disaster training. This is a critical finding for Education and Social Welfare because disaster preparedness cannot depend only on individual experience or prior education. Hospitals require recurrent, inclusive, and competency-based learning systems so that all personnel, including newly recruited staff, understand their roles during emergencies.

Table 3. Summary of Hospital Safety Index results

Component	Mean safety index	Mean vulnerability index	Interpretation
Structural safety (Module 2)	0.94	0.07	High safety; minor structural vulnerability should still be monitored.
Non-structural safety (Module 3)	0.97	0.03	High safety; utilities, equipment, access, and support systems appear strong but require routine maintenance.
Emergency and disaster management (Module 4)	0.99	0.01	Very high emergency management readiness based on assessed indicators.
Overall Hospital Safety Index	0.98	0.02	Category A: the hospital is likely to remain functional during disasters, with continued strengthening recommended.

The HSI results indicate that RSU MMC obtained Category A. This classification suggests that the hospital is likely to remain functional during disasters. However, Category A should not be interpreted as the absence of risk. The HSI framework itself emphasizes continuous improvement because even small deficiencies in evacuation access, utilities, communication, or staff coordination can become critical during mass-casualty events.

Table 4. Healthcare provider preparedness in disaster response

Dimension	Category	Frequency	Percentage
Knowledge	Low	9	9.0%
	Moderate	21	21.0%
	High	70	70.0%
Attitude	Poor	14	14.0%
	Good	25	25.0%
	Very good	61	61.0%
Practice/skills	Poor	16	16.0%
	Good	37	37.0%
	Very good	47	47.0%

The preparedness profile was generally favorable. Seventy percent of respondents had high disaster knowledge, 61% demonstrated very good attitudes, and 47% demonstrated very good practices or skills. These results suggest that the hospital has a strong human-resource foundation for disaster response. Nevertheless, the practice dimension was less dominant than knowledge and attitude, indicating that practical drills, simulation-based training, interprofessional coordination exercises, and role-specific disaster protocols should be strengthened.

Discussion

The findings show that RSU MMC has a strong institutional safety profile and a generally prepared workforce. The overall HSI of 0.98 places the hospital in Category A, meaning that the facility is likely to continue operating when disasters occur. This result is important because hospital functionality during emergencies is a core element of social welfare. Communities affected by disasters rely on hospitals not only for clinical treatment but also for triage, referral, family communication, psychosocial reassurance, and the preservation of public order.

From an HSI perspective, the strongest finding is that the hospital performed very well across structural, non-structural, and emergency management components. Structural safety refers to the ability of the building to withstand hazards and remain usable. Non-structural safety includes utilities, medical equipment, supplies, communication systems, access routes, and internal safety mechanisms [23], [24]. Emergency and disaster management covers planning, coordination, human resources, logistics, triage, evacuation, and continuity of essential services. These domains are interdependent. A hospital with a safe building but weak emergency procedures may still fail during a crisis, while competent staff may be constrained if utilities, access, or evacuation systems do not function [25], [26].

The HSI finding aligns with the global logic of safe hospitals. The WHO/PAHO HSI framework is intended to guide assessment of hospital capacity to continue providing services after adverse events and to identify actions required to improve safety, preparedness, response, and recovery [27], [28]. The present case supports this approach by showing that index-based assessment can provide practical evidence for hospital management. The HSI score offers a concise institutional picture, while module-level results identify areas where maintenance, monitoring, and training should continue.

Despite the strong HSI result, the study also reveals an important workforce-learning gap. Most respondents had not attended disaster training, even though many showed high knowledge and positive attitudes. This indicates that preparedness may be partly supported by professional education, work experience, informal learning, or prior exposure rather than systematic institutional training. From an Education and Social Welfare perspective, this is a vulnerability. Disaster preparedness requires recurring learning opportunities, scenario-based drills, standard operating procedure familiarization, evacuation simulations, interprofessional communication exercises, and evaluation feedback. Without institutionalized learning, preparedness may vary across departments, shifts, seniority levels, and newly recruited personnel.

The gender dimension is also relevant. Women made up 75.5% of respondents, and nurses and midwives constituted the largest professional groups. This pattern is consistent with the broader feminization of the health and social workforce. WHO reports that women account

for a large share of the health and social workforce globally [29], [30]. In disaster settings, this means that women healthcare workers are not only service providers but also key agents of institutional resilience. Gender-responsive hospital preparedness should therefore consider training access, occupational safety, psychosocial burden, shift arrangements, caregiving responsibilities outside work, and leadership opportunities for women in emergency planning.

The findings support SDG 3 because hospital safety and workforce preparedness contribute directly to health service continuity and emergency care. They also support SDG 11 because hospitals are critical infrastructure within resilient cities and communities. The Sendai Framework emphasizes disaster risk governance, investment in resilience, and preparedness for effective response and recovery [31]. RSU MMC's HSI result suggests that the hospital has a strong foundation, but the training gap indicates that disaster governance should include continuous capacity building. In relation to SDG 16, hospital preparedness reflects institutional accountability, transparency, and service reliability during crises. In relation to SDG 5, the high representation of women in the healthcare workforce highlights the need for equitable and safe professional development in disaster preparedness.

The study also has policy implications. First, hospitals should use HSI assessment not as a one-time accreditation instrument but as a routine quality-improvement cycle. Second, disaster preparedness training should be mandatory, periodic, and role-specific. Third, simulation exercises should involve all departments, including clinical, administrative, security, logistics, facility, and cleaning service units, because disasters affect the entire hospital system. Fourth, hospital management should ensure that evacuation routes, ramps, signage, communication systems, emergency power, water supply, and mass-casualty protocols are tested regularly. Fifth, training records should be integrated into human-resource development systems so that newly recruited staff receive disaster orientation early.

These implications position hospital preparedness as a human-centered system rather than a purely technical assessment. The interaction between safe infrastructure and prepared healthcare providers creates what may be called disaster-responsive social welfare: the capacity of an institution to preserve life, reduce suffering, protect workers, and maintain equitable service access during emergencies. In disaster-prone regions, such capacity is essential for public trust and sustainable development.

CONCLUSION

This study shows that RSU MMC Lhokseumawe has a strong hospital safety profile and generally favorable healthcare provider preparedness for disaster response. The hospital achieved an overall Hospital Safety Index of 0.98, placing it in Category A and indicating a high likelihood of maintaining functionality during disasters. Provider preparedness was also positive, with most respondents showing high knowledge, very good attitudes, and good-to-very-good practices. However, the finding that 69% of respondents had not attended disaster training reveals a strategic gap between current readiness and sustainable preparedness. The article contributes to Education and Social Welfare by demonstrating that hospital resilience depends on both institutional safety systems and continuous workforce learning. Future hospital preparedness programs should prioritize periodic disaster training, simulation-based

drills, inclusive participation across professional groups, gender-responsive workforce support, and routine HSI reassessment.

LIMITATIONS

This study has several limitations that should be considered when interpreting the findings. First, the research was conducted in a single Type D hospital in Lhokseumawe, Aceh; therefore, the results cannot be generalized to all hospitals in Aceh or Indonesia with different institutional capacities, risk profiles, and resource conditions. Second, the descriptive exploratory design limits the ability to examine causal relationships between the Hospital Safety Index, healthcare provider preparedness, disaster training experience, and actual disaster-response performance. Third, healthcare provider preparedness was measured using self-reported questionnaire data, which may be affected by social desirability bias, recall bias, or overestimation of individual preparedness. Fourth, although the Hospital Safety Index provides a structured assessment of structural safety, non-structural safety, and emergency and disaster management capacity, this study did not include direct disaster simulations, real-time emergency drill evaluations, or longitudinal monitoring to verify hospital performance under actual disaster conditions. Future studies should involve multiple hospitals, combine quantitative assessment with qualitative interviews or observational data, and examine the effects of structured disaster training on healthcare providers' knowledge, attitudes, practices, and institutional response capacity over time.

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AUTHOR CONTRIBUTION

R. H. P. conceptualized the study, developed the research design, conducted data collection, performed data analysis, interpreted the findings, and drafted the initial manuscript. R. R. provided methodological and theoretical guidance, supervised the overall research process, contributed to the refinement of the study framework, and critically reviewed the manuscript for important intellectual content. C. H. contributed expertise in disaster preparedness and

healthcare systems, supported the interpretation of findings, strengthened the discussion on hospital safety and healthcare provider preparedness, and critically revised the manuscript. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

The authors used ChatGPT for word refinement during the preparation of this work. After utilizing the tool, the authors thoroughly reviewed and edited the content as necessary, assuming full responsibility for the publication's content.

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