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IDENTIFICATION OF PREPAREDNESS AT GRAHA BUNDA GENERAL HOSPITAL IN DEALING WITH DISASTERS BASED ON HOSPITAL SAFETY INDEX

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Abstract

Indonesia as a country with a high level of disaster vulnerability requires optimal preparedness from all health service facilities, including hospitals. In this context, hospital preparedness is a crucial aspect to ensure the continuity of medical services in the event of a disaster. This study aims to evaluate the level of preparedness of Graha Bunda General Hospital in dealing with disasters based on the Hospital Safety Index (HSI) developed by WHO. The method used is a descriptive qualitative approach through in-depth interviews, field observations, and documentation studies of five key informants. The assessment was carried out on four main components: hazard preparedness, structural safety, non-structural safety, and emergency and disaster management. The results showed that the overall HSI score was at 73%, classified as category A, which reflects good general preparedness. The non-structural safety and emergency management components each obtained a score of 86% (category A), indicating high readiness in supporting the continuity of medical services during disasters. However, hazard preparedness (64%) and structural safety (57%) are still in category B, indicating the need to improve physical infrastructure and risk mitigation systems. This study recommends strengthening the early detection system, evaluation and strengthening of building structures, and continuous training for all hospital staff to improve overall preparedness.

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Introduction

Hospital preparedness in dealing with disasters is a crucial aspect in the health system, especially to ensure optimal services during emergency situations. Several studies have emphasized the importance of evaluating hospital preparedness, such as studies that develop conceptual frameworks to improve hospital disaster resilience (Purba et al., 2024). Other research also underscores the importance of preparedness evaluation (Moghadam et al., 2016), and the need for hospital preparedness in disaster-prone areas such as Indonesia (Alruwaili et al., 2019).

Research shows that hospitals become crisis handling centers during disasters, with the responsibility of providing optimal healthcare services under challenging conditions. Indonesia, as a disaster-prone region, has many hospitals that are not fully prepared to face emergency situations. Study (Feizolahzadeh et al., 2019) found that 85% of hospitals evaluated had low Hospital Safety Index (HSI) values, signaling significant vulnerability to natural disasters. Research (M.

Thomasian et al., 2021) in Latin America and the Caribbean and (Djalali et al., 2019) in Southeast Asia also revealed low preparedness scores at many health facilities.

In Indonesia, many hospitals have low HSI scores, indicating the need for increased preparedness in dealing with disasters. Research by (Sundoro et al., 2023) (Prayitno & Widiastuti, 2024) in Yogyakarta shows factors such as lack of staff training, inadequate infrastructure, and limited emergency medical equipment contribute to the low HSI score. Study (Indriani et al., 2023) in West Sumatra found that many hospitals do not have comprehensive emergency plans and have not conducted disaster simulations on a regular basis. (Yenni et al., 2021) revealed that despite the increased awareness, implementation on the ground is still far from adequate in terms of structural and non-structural safety, as well as risk management.

Hospital preparedness based on HSI is an important step to ensure readiness to face emergency situations. The HSI developed by WHO is a standard tool to assess hospital preparedness for disasters (Safarpour et al., 2022). Hospitals with low HSI scores tend to have difficulty handling mass casualty incidents, ensuring the availability of resources, and maintaining critical services (Ortiz-Barrios et al., 2020). The impact of inadequate preparedness includes operational disruptions, delays in critical medical care, infrastructure damage, patient and staff safety risks, inability to handle patient surges, stress on medical personnel, and damage to hospital reputations (Bajow & Alkhalil, 2014; Goniewicz & Goniewicz, 2020)

Research has highlighted the importance of structural and non-structural elements in hospital preparedness, including infrastructure security, emergency services, and trained personnel (Heidaranlu et al., 2016). Inadequate preparedness, as seen during the COVID-19 pandemic, can lead to the transmission of nosocomial diseases and hamper emergency response efforts (Tagashira et al., 2021). Disaster preparedness evaluations point to training, logistics, management, safety measures, communication, and resource availability as key factors that affect overall preparedness levels (E. Marcozzi et al., 2020).

The strategy to improve HSI involves a holistic approach, including infrastructure improvements, ongoing training for staff, and strengthening risk management. Some strategies include the implementation of a clinical pathway (Sativa Julianti et al., 2022), digital marketing (Sari Sembiluh & Sulistiadi, 2022), marketing mix strategy, architectural design Hospital Management Information System (Vieryna et al., 2023), analysis of nursing services and implementation of remuneration system (Santoso, 2019; Soetisna et al., 2015), as well as strategic planning optimization (Pakarbudi, 2022; Sumadi & As-Syafi'iyah, 2021).

Research on hospital preparedness for disasters has seen significant developments in recent years (Pomegranate & Putra, 2021). Recent studies emphasize a multidimensional approach that includes structural, non-structural, and managerial aspects in evaluating preparedness. Hospital capacity-building programs are increasingly leading to technology integration, scenario-based disaster simulation training, and the development of adaptive early warning systems. Research has also shown that collaboration between stakeholders—including government, civil society, and the private sector—is a crucial factor in building sustainable hospital resilience in the face of emergencies (Rajabi et al., 2017).

A literature review shows that the evaluation of hospital preparedness using the Hospital Safety Index (HSI) has substantial theoretical and practical implications (Giovanni et al., 2024). From a theoretical perspective, the use of HSI has contributed to the development of conceptual models to measure the resilience of hospitals in the face of different types of disasters, especially in developing countries. The results of this evaluation also provide empirical data that strengthen the health policy framework in disaster risk management in the health service sector. From a practical standpoint, HSI helps identify system weaknesses that may not be detected in conventional assessments and provides a basis for more targeted resource allocation.

This study raises the topic "Identification of Preparedness at Graha Bunda General Hospital in Dealing with Disasters Based on Hospital Safety Index" with the aim of evaluating and increasing hospital preparedness capacity in dealing with disaster situations. The selection of this location is based on the geographical position of Graha Bunda Hospital which is located in a disaster-prone area and its active involvement in disaster risk mitigation programs. Although studies have examined the application of HSI in various contexts, there are still gaps in the mapping of the preparedness of private hospitals in areas with high potential risks, particularly in the operational aspects and internal coordination in responding effectively to disasters. Therefore, this study is important to provide an empirical picture of hospital readiness in a local context that has not been widely revealed in the previous literature. Through this approach, the researcher aims to gain a contextual and comprehensive understanding of the perceptions and experiences of key informants related to hospital preparedness in the face of disasters.

Method

This study uses a qualitative approach with a descriptive design to describe in depth the phenomenon of hospital preparedness for disasters based on the Hospital Safety Index (HSI). The

research location is at Graha Bunda General Hospital, East Aceh Regency, with implementation time starting from June to August 2024.

The population in this study includes all staff and management involved in hospital emergency preparedness and response procedures (Hayati & Husna, 2018). The research sample was determined using a purposive sampling technique with a total of five people selected based on their strategic roles. The informants consist of hospital directors, medical officers, security officers, and facility managers. The inclusion criteria in this study include staff who have worked at least one year in the hospital and have direct involvement in disaster preparedness activities. The exclusion criteria include staff who are not actively working, such as long leave, or who are not willing to provide information.

The research instrument was developed based on indicators from the Hospital Safety Index, which consists of four main modules: hazard preparedness, structural safety, non-structural safety, and emergency and disaster management. The HSI form has 151 indicators that are assessed on a low, medium, and high scale, with a scoring scheme that results in a percentage classification of the level of preparedness (HSI Guide, 2017).

Data collection was carried out through in-depth interviews, field observations, and documentation studies. The data collected includes primary, secondary, and tertiary data to support the validity and richness of the information. In addition, the narrative analysis approach is used to understand the structure of the story, the meaning of the experience, and the narrative pattern of the informant (Amrullah et al., 2024).

The stages of narrative analysis include interview transcription, theme identification, and structured narrative preparation based on the informant's real experience in the field (Almuida et al., 2023; Dahlia et al., 2023). This process is strengthened with direct quotes and reflections on relevant theories, resulting in conclusions that fully describe the preparedness of Graha Bunda Hospital in dealing with disasters.

Result

Graha Bunda General Hospital is a health facility located in East Aceh and has become a reference for the surrounding community. The hospital provides general and specialist medical services, such as outpatient, inpatient, surgical, and emergency services. Graha Bunda Hospital has a vision to become an excellent and independent hospital in health services, as well as a mission to provide services with Islamic nuances and support local government health programs.

This study involved key informants and key informants who have an important role in hospital preparedness. All identities of the informants are disguised to maintain confidentiality.

Table 1. Research Informant

Informant Code	Position	Background and Roles
K1	RSU Leader	Managing hospital strategy, >10 years experience
K2	Facilities Manager	Civil engineering background, >8 years experience
U1	Head of K3	Responsible for safety training
U2	Head of Medical Section	Coordination of medical services in emergency situations
U3	Emergency room doctor	Playing a direct role in disaster management

Information from in-depth interviews was used to assess hospital preparedness based on Hospital Safety Index (HSI) indicators.

Preparedness Analysis Based on HIS Components

1. Hazard

Assessments of potential hazards show that most types of hazards that may affect hospitals are classified in categories A and B. Hospitals demonstrate good preparedness in dealing with geological and technological hazards, but need to improve in dealing with social and biological hazards.

Table 2. Recapitulation of Hazard at Graha Bunda Hospital

Types of Hazards	Range Score	Percentage	Dominant Categories
Geological	11–12	73–80%	A
Hydro-Meteorological	10–11	67–73%	A
Climatological and Biological	8–9	53–60%	B
Technologist	10–13	67–87%	A
Social	7–8	47–53%	B
Total Hazard Index	10	64%	B

Source: Primary Data, 2024

The interview showed that Graha Bunda Hospital has implemented an earthquake-resistant building design and a good drainage system. Evacuation routes are available complete with directions, and exercises are carried out periodically.

2. Structural Safety

Assessments of structural aspects show that most indicators are still in the medium category (B). Some elements such as structural detailing and resistance to non-earthquake hazards show good results.

Table 3. Structural Safety Index of Graha Bunda Hospital

Assessment Aspects	Dominant Categories	Average Presentation
Previous events and fixes	B	47–53%
Building and material integrity	B	53–60%
Resistance to other hazards	A	67%
Total Structural Safety Index	B	57%

Source: Primary Data, 2024

Based on observations, the hospital has a three-story building structure that is integrated, facilitating the evacuation process. The building uses earthquake-resistant materials, equipped with a natural lighting system and lightning repellent.

3. Nonstructural Safety

Nonstructural components are in category A with a safety index value of 86%. All vital hospital systems such as electricity, water, medical gas, HVAC, and medical devices are in good and safe condition.

Table 4. Summary of Nonstructural Safety of Graha Bunda Hospital

Component	Percentage	Category
Architectural security	87%	A
Infrastructure and access protection	80–93%	A
Electrical and communication systems	80–93%	A
Water, firefighting, sewage, etc	87–93%	A
Medical equipment and supplies	80–93%	A
Total Nonstructural Index	86%	A

Source: Primary Data, 2024

Graha Bunda Hospital has been equipped with smoke detectors and fire extinguishers spread throughout the area. Routine fire training is carried out and special teams are on standby for evacuation and rescue in case of emergency.

4. Emergency and Disaster Management

The disaster management of Graha Bunda Hospital received category A with an index of 86%. All aspects from planning, logistics, communication, to evacuation and recovery show high readiness.

Table 5. Emergency & Disaster Management Index of Graha Bunda Hospital

Assessment Components	Percentage	Category
Coordination and emergency response committees	80–93%	A
Emergency response and recovery plan	80–93%	A
Communication and information	87–93%	A
Human resources and logistics	80–93%	A
Patient service in emergency situations	87–100%	A
Total Emergency Management Index	86%	A

Source: Primary Data, 2024

The hospital has an emergency reporting system, alarm, and a trained response team. There is also a "code red" system to speed up evacuation and reporting.

5. Hospital Safety Index (HSI)

HSI is an overall score that reflects hospital readiness based on four main components. Based on the results of the assessment, Graha Bunda Hospital obtained a score of 73%, which is included in category A.

Table 6. HSI Recapitulation of Graha Bunda Hospital

Assessment Components	Score	Percentage	Category
Hazard	10	64%	B
Structural Safety	9	57%	B
Nonstructural Safety	13	86%	A
Emergency & Disaster Management	13	86%	A
HSI Overall Index	11,3	73%	A

Source: Primary Data, 2024

Although he has not used HSI directly, the informant stated that the hospital has carried out various safety improvement efforts. The future use of HSI is considered as a tool for further evaluation and planning.

Discussion

Graha Bunda General Hospital's Preparedness Level in Facing Disasters Based on Hospital Safety Index

Hazard Preparedness Level

The results of the study showed that the hazard preparedness index at Graha Bunda Hospital obtained a score of 64%, which was classified in category B. This indicates that hospitals still face a number of obstacles in maintaining optimal function during disasters. Although preparedness for geological, hydro-meteorological and technological hazards has been assessed well (category A), there are significant weaknesses in dealing with climatological, biological and social hazards.

Theoretically, these results are in line with the systemic approach to disaster risk management as described by (Yuandi, 2021), which emphasizes the importance of comprehensive multi-hazard identification and adaptive capacity building as a key component in the resilience of healthcare institutions. Unpreparedness for climatological threats such as extreme temperatures or extreme weather, as well as infectious disease outbreaks, indicates a weak integration between risk mapping and evidence-based emergency response planning.

The interpretation of the 64% score results also reflects the *indirect effect* of the limitations of the early monitoring system and the lack of optimal synergy between the disaster management information system and human resource training. Within the framework of organizational *capability theory*, this score shows that despite the basic resources available, the ability of hospitals to integrate, build, and reconfigure internal competencies to respond to changing threats is still not optimal.

Comparison with the results of previous research, such as studies by (Maulida et al., 2022) in Cilegon City, which showed a hazard preparedness value ranging between 0.67 and 0.85 (category A), underscoring the gap that still exists in hospitals operating in similar areas but have differences in structural capacity and contingency planning. This study underscores the importance of a not only reactive but also preventive and anticipatory approach in hospital preparedness systems, especially in the face of non-physical threats such as biological and social that are often overlooked in conventional assessments.

Structural Safety Level

The overall structural safety index was 57%, categorized as category B, indicating that hospitals have several obstacles in maintaining their functions in the event of a disaster. Although not critical, improvements are needed in some aspects to ensure optimal operation and full protection.

Several structural elements are ready (category A), such as system design, building condition, and roof integrity. However, there are aspects in category B that require attention, such as the interaction of non-structural elements with the structure and proximity of buildings that can trigger negative effects during earthquakes and fires.

Research by Wang et al. (2020) emphasizes that aspects of structural detailing, such as reinforcement of columns and beams, as well as the integrity of foundations, are critical in improving the structural safety of hospitals. The role of modern technology in improving the structural safety of hospitals, such as real-time monitoring of structures and the use of more durable building materials. The results of this study show similarities in the structural safety category, with the hospital safety index which is also in category B with a Hospital Safety Index of 0.64.

Nonstructural Safety Level

The results of the analysis showed that hospitals were in category "A" with a percentage of nonstructural safety ranging from 80% to 94%. This shows high readiness in dealing with disasters and the ability to carry out functions optimally when a disaster occurs.

Each critical element evaluated scored excellently, from architectural security, infrastructure protection, critical systems, to equipment and inventory. Electrical systems, telecommunications, water supply, fire protection, waste management, fuel storage, medical gas systems, and HVAC systems all scored in the range of 80% to 94%.

Recent research confirms that nonstructural preparedness is critical in ensuring sustainable hospital operations during and after disasters. According to Dami et al. (2019), this readiness includes electrical systems, telecommunications, water supply, and fire protection, all of which must function properly to maintain the sustainability of hospital services.

Research by Krishnan et al. (2020) shows that critical systems such as HVAC, waste management, and fuel storage play an important role in maintaining the operational stability of hospitals during disasters. The safety and operation of medical and laboratory equipment is also very important in emergency situations, as shown by the research of Smith et al. (2021).

Comparisons with other studies show comparable results. Research conducted by Yenni et al. (2020) at Dr. Mohammad Hoesin Hospital found that the hospital's level of non-structural preparedness was at a high level with a Hospital Safety Index score of 0.84.

Emergency and Disaster Management Preparedness Level

Hospitals have very high preparedness in the face of emergencies and disasters, with an overall score of 86% in the Safety Index category, which includes sub-components with scores between 74%

and 99%. This readiness is reflected in the coordination of emergency and disaster management activities, such as coordination with hospital emergency/disaster committees (84%), preparedness programs to strengthen emergency response and recovery (94%), and coordination mechanisms with local emergency/disaster management agencies (96%).

The emergency response and recovery planning aspects also showed high readiness, with the emergency or disaster response plan obtaining a score of 90% and the hospital recovery plan with a score of 92%. Internal and external emergency communication achieved a score of 93%, while the aspects of human resources, logistics, finance, and patient care and support were all above 74%.

According to FEMA (2018), effective emergency management involves strong coordination between various departments and external agencies to ensure an integrated response. WHO (2019) states that a good emergency response plan should include all possible disaster scenarios and effective recovery strategies to ensure the continuity of medical services. In the study of Amaliah et al. (2021), the functional capacity of hospital X obtained an index value of 0.55 with the status of 'B', in contrast to the findings at Graha Bunda General Hospital which showed very high readiness with an overall score of 86%.

Overall Preparedness Level

Based on the analysis of the HSI Index table, the Hazard Preparedness Level (5.1) and the Structural Safety Index (5.2) are in category B with percentages of 57% and 64%. This shows that despite efforts to prepare hospitals for hazards and physical structures, there are still obstacles that hinder the maximum functionality of hospitals in disaster situations.

However, Non-Structural Preparedness (5.3) and Emergency Management (5.4) reached category A with a percentage of 86%, demonstrating excellent readiness in the non-structural and emergency management aspects. Overall, the HSI Index shows that hospitals are able to function optimally in the face of disasters, but there is still a need for improvement in terms of structural safety and preparedness to face hazards.

The HSI Index reflects a hospital's ability to deal with disasters by considering structural and non-structural aspects as well as emergency management. The theory underlying the HSI Index emphasizes the importance of integration between a strong physical infrastructure and an effective emergency management system to achieve optimal preparedness.

A comparison with the research of Kurniawan et al. (2023) which examined the Disaster Safe Hospital (RSAB) program at Kilisuci Hospital, Kediri City, showed slightly different results. The study found that there was a significant increase in employee capacity through training programs and disaster simulations, but Kilisuci Hospital still faces challenges in developing a documented preparedness plan that involves the surrounding community.

Proposed strategies to improve preparedness

To improve the preparedness of Graha Bunda General Hospital based on the HSI Index evaluation, especially from the level of preparedness to face hazards and structural preparedness, several strategies can be carried out:

1. Strengthen early detection and early warning systems against various types of hazards, such as earthquakes, floods, and epidemic threats. The implementation of advanced technologies such as sensors and integrated monitoring systems can speed up the response and allow for more timely evacuations.
2. Conduct an in-depth evaluation of the hospital's physical infrastructure, including strengthening the building structure, selecting building materials that are resistant to external pressures, and developing a continuous maintenance plan to ensure long-term safety.
3. Developing hospital emergency response capacity through investment in training of medical and non-medical staff in disaster management, routine disaster simulations, and evacuation exercises.
4. Improve communication and coordination between all parties involved in disaster management, including better implementation of information and communication technologies, as well as the establishment of cooperative networks with external parties such as local governments, health institutions, and volunteers.

Conclusion

These results show that Graha Bunda Hospital has generally met the disaster preparedness criteria as measured by the Hospital Safety Index, so that the purpose of the study to evaluate the hospital's overall readiness has been achieved. Graha Bunda General Hospital has an overall preparedness level of 73.3% (category A), which reflects good preparedness in general in dealing with disasters. Non-structural preparedness and emergency management were in category A with scores of 86% each, indicating excellent emergency management and support systems. However, hazard preparedness (64%) and structural safety (57%) are still in category B, so infrastructure improvements and risk mitigation strategies are needed to achieve more optimal readiness.

Hospital management is advised to immediately prepare a gradual structural improvement plan, strengthen the early warning system, and conduct periodic audits and simulations to ensure the effectiveness of the

mitigation strategies implemented. The focus on improvement also needs to be directed at increasing the capacity of human resources through structured and sustainable disaster training.

The study had limitations in the limited number of informants and the scope of the site covering only one hospital. Further research is suggested involving more hospitals and comparative analysis between disaster-prone areas to obtain a more comprehensive picture.

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