

Hospital Disaster Management as a Strategic Component of the National Emergency Response System: A Narrative Review

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ABSTRACT

Hospitals constitute a critical pillar of national emergency response systems, particularly in disaster-prone regions. Beyond their clinical function, hospitals act as coordination hubs for medical response, triage, logistics, and intersectoral collaboration. This narrative review critically examines the strategic role of hospitals in disaster management across preparedness, mitigation, response, and recovery phases. Evidence from international guidelines, peer-reviewed studies, and Indonesian experiences indicates that structured hospital disaster management significantly improves operational resilience, continuity of essential services, and patient outcomes. Strengthening hospital disaster preparedness through standardized planning, regular simulations, and incident command systems is essential for enhancing health system resilience and reducing disaster-related morbidity and mortality.

Keyword : disaster response; emergency preparedness; health system resilience; hospital disaster management; incident command system;

Introduction

Disasters pose a major threat to public health systems worldwide, causing sudden surges in morbidity, mortality, and healthcare demand. Between 2000 and 2022, over 10,000 disaster events were recorded globally, resulting in more than 1.5 million deaths¹. Hospitals

are at the forefront of disaster response, serving as critical infrastructure for emergency care, triage, and resource coordination. However, during emergencies, hospitals must maintain operations despite potential infrastructure damage, supply chain disruptions, and personnel shortages. Consequently, hospital disaster management encompassing mitigation, preparedness, response, and recovery has become a key component of national emergency systems².

Evidence indicates that hospitals with structured disaster plans and trained personnel achieve better operational performance and clinical outcomes during mass casualty incidents. A systematic review found that regular disaster drills and multidisciplinary planning committees significantly reduced mortality rates and improved patient throughput. Nevertheless, despite increasing disaster frequency and policy attention, substantial variability in hospital disaster preparedness and its integration into national emergency systems remains underexplored. Most existing research originates from high-income countries, while low- and middle-income countries (LMICs) which experience over 70% of disaster-related deaths remain underrepresented. In Southeast Asia, fewer than 40% of provincial hospitals have functional disaster committees, and only 25% conduct annual drills³.

This gap is particularly critical in disaster-prone countries such as Indonesia, situated on the Pacific Ring of Fire. The 2004 Indian Ocean tsunami killed over 160,000 people in Aceh and destroyed dozens of health facilities. The 2018 Lombok and Central Sulawesi earthquakes caused widespread hospital damage, severely hampering response efforts. Despite national policies such as the Hospital Disaster Preparedness Index and SPAB certification, implementation remains inconsistent⁴. Therefore, this study aims to analyze the current state of hospital disaster preparedness in selected disaster-prone regions of Indonesia and its integration into the national emergency response framework, addressing a critical gap in LMIC disaster research.

Material and Methods

This study employed a narrative review approach to synthesize and critically examine existing literature on hospital disaster management as a strategic component of national emergency response systems. A comprehensive literature search was conducted across several electronic databases, including PubMed, Scopus, ScienceDirect, and Google Scholar, to identify relevant publications from 2015 to 2025. The search strategy utilized combinations of keywords such as “hospital disaster management,” “emergency

preparedness,” “incident command system,” “health system resilience,” “disaster response,” and “hospital safety index,” with Boolean operators (AND, OR) applied to refine the results. In addition, manual searches were performed by screening the reference lists of selected articles to ensure the inclusion of relevant studies not captured in the initial search.

Eligible studies included peer-reviewed journal articles, international guidelines, and official reports that addressed hospital disaster management across one or more phases of disaster management, namely preparedness, mitigation, response, and recovery. Only publications written in English and those with clear relevance to hospital settings were included. Articles were excluded if they were not directly related to hospital-based disaster management, lacked methodological clarity, were duplicates, or represented non-scientific opinion pieces without supporting evidence. The study selection process was conducted in two stages, beginning with title and abstract screening, followed by full-text assessment to confirm eligibility based on predefined inclusion and exclusion criteria.

Data from the selected studies were extracted and organized into thematic categories reflecting key aspects of hospital disaster management, including preparedness strategies, risk mitigation measures, emergency response systems such as the Incident Command System, and recovery processes aimed at restoring healthcare services and improving system resilience. A thematic synthesis approach was applied to identify patterns, consistencies, and variations across the literature, enabling a comprehensive understanding of the strategic role of hospitals within disaster management frameworks. Although this study did not perform a formal quality appraisal due to its narrative design, priority was given to high-quality sources, including peer-reviewed publications and reports from recognized international organizations such as the World Health Organization and the United Nations Office for Disaster Risk Reduction. As this study was based solely on previously published data and did not involve human or animal subjects, ethical approval was not required.

Results and Discussion

Hospitals serve a strategic role within national emergency response systems by functioning as both healthcare providers and coordination hubs during disasters. Beyond delivering acute medical care, hospitals are responsible for implementing triage systems, managing surge capacity, coordinating referrals, and supporting interagency collaboration. Effective hospital disaster management ensures continuity of essential services even under conditions of extreme operational stress^{1,5}.

In Indonesia, Recent institutional disaster simulations have illustrated the operational

value of ICS-based hospital preparedness. In 2025, multiple healthcare facilities conducted integrated disaster simulations to evaluate readiness for hazards such as fires, earthquakes, and extreme weather. For example, disaster response simulations at Eka Candrarini Hospital in Surabaya aimed to assess the effectiveness of the Incident Command System (ICS) and the preparedness of healthcare personnel to manage mass casualty situations. Similar exercises conducted at RSUD Wonosari during National Disaster Preparedness Day focused on evaluating evacuation routes, triage capacity, and interdepartmental coordination.

Real-world disaster events further highlight the strategic importance of hospitals. The major flooding incident in Mataram in 2025 required hospitals to establish emergency command posts and maintain essential services for more than ten days under disrupted operational conditions. This experience underscored the need for resilient logistics, communication systems, and disaster triage mechanisms to ensure uninterrupted patient care during prolonged emergencies ⁵.

Hospital Disaster Management Across Disaster Phases Preparedness

Preparedness is the cornerstone of hospital disaster management and involves the development of a Hospital Disaster Plan (HDP), formation of disaster response teams, routine training, and regular simulation exercises. Preparedness activities also include ensuring adequate medical supplies, establishing communication protocols, and integrating hospital plans with local and national emergency systems ^{1,6}.

The World Health Organization's Hospital Safety Index (HSI) provides a standardized tool for assessing hospital preparedness across three domains: structural safety, non-structural safety, and emergency and disaster management capacity ^{7,8}. Studies conducted in accredited hospitals in Indonesia demonstrate that facilities with higher HSI scores exhibit greater readiness to respond effectively to disasters ^{4,6}.

Mitigation and Risk Reduction

Mitigation focuses on reducing disaster risks through structural and non-structural interventions. Structural mitigation includes constructing earthquake-resistant buildings and protecting critical infrastructure such as power supplies and water systems. Non-structural measures involve securing medical equipment, maintaining clear evacuation routes, and implementing fire safety systems⁹. Effective mitigation strategies reduce the likelihood of hospital service disruption during disasters and enhance the safety of patients and healthcare workers. Incorporating risk assessments into hospital planning processes is essential for

identifying vulnerabilities and prioritizing mitigation efforts ¹⁰.

Response

The response phase requires rapid mobilization of hospital resources to manage sudden increases in patient volume. The Incident Command System (ICS) is widely recommended as a standardized management framework to coordinate decision-making, communication, and resource allocation during emergencies ¹¹. ICS implementation enables hospitals to minimize chaos, clarify leadership roles, and ensure coordinated action across clinical and non-clinical units. Evidence from mass casualty incidents and large-scale emergencies indicates that hospitals utilizing ICS demonstrate improved operational efficiency and patient outcomes^{12,13}.

Recovery involves restoring hospital services to normal or improved levels following a disaster. This phase includes infrastructure repair, staff rehabilitation, psychological support, and evaluation of disaster response performance. Lessons learned during recovery should inform updates to disaster plans, training programs, and mitigation strategies to strengthen future preparedness¹. The strategic roles of hospitals across disaster management phases are summarized in **Table 1**.

Table 1. Hospital Roles Across Disaster Management Phases

Disaster Phase	Primary Hospital Roles	Key Activities
Preparedness	Planning & Training	Disaster plans, simulations, stockpiling, staff training
Mitigation	Risk Reduction	Structural safety, evacuation planning, equipment securing
Response	Emergency Care & Coordination	Triage, surge management, incident command
Recovery	Service Restoration	Rehabilitation, evaluation, system improvement

Challenges and Strategies for Capacity Strengthening

Despite increasing awareness, hospitals face multiple challenges in implementing effective disaster management systems. Common barriers include limited infrastructure, insufficient training, lack of leadership commitment, and inadequate coordination with external agencies ^{2,14}. Studies have also identified disparities in preparedness levels among healthcare workers, with nursing staff often reporting lower preparedness compared to managerial personnel ⁷.

Strategies to strengthen hospital disaster capacity include continuous education and simulation-based training, leadership engagement, integration of disaster management into hospital accreditation standards, and investment in resilient infrastructure and communication systems^{2,15,16}. Strengthening intersectoral collaboration between hospitals, emergency services, and disaster management agencies is also essential to ensure coordinated national responses.

Conclusion

Hospitals are indispensable components of national emergency response systems, playing a critical role in disaster preparedness, response, and recovery. Effective hospital disaster management ensures continuity of essential healthcare services, protects patients and healthcare workers, and reduces disaster-related morbidity and mortality. Strengthening hospital preparedness through structured planning, regular training, implementation of incident command systems, and continuous evaluation is vital to enhancing health system resilience. As disaster risks continue to increase, sustained investment in hospital disaster management is essential to safeguarding public health and strengthening national emergency response capacity.

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