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Analysis of the Capacity of the Public Health System in Reducing the Health Impact of Natural Disasters

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ABSTRACT

Climate change has intensified natural disasters, straining health systems and threatening public health service sustainability. This study analyzes public health system capacity to mitigate disaster health impacts and identifies influential components. Employing a quantitative descriptive-analytical, cross-sectional design, the research targeted disaster-prone Indonesian areas across three high-risk districts/cities. The population comprised disaster-response health facilities; a purposive sample of 90 facilities was selected. Data came from structured 30-item, 5-point Likert-scale questionnaires assessing five capacity components: human resources, infrastructure, information/surveillance, logistics/financing, and governance/coordination. Analysis used descriptive statistics, Pearson correlation, and multiple linear regression (95% significance). Results revealed moderate capacity, with information/surveillance as the primary weakness. Disaster health impacts were high, especially service access disruptions and essential service interruptions. Correlation indicated a significant negative link between capacity and impacts. Regression showed capacity explaining 48% of impact variation, with governance/coordination as the strongest predictor. Findings underscore strengthening governance, integrating health information systems, and enhancing cross-sector coordination to boost health system resilience against disasters.

Keywords: *Health System Capacity, Disaster Impact, Health System Resilience, Governance and Coordination, Public Health Preparedness*

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INTRODUCTION

Over the past two decades, the increasing frequency and intensity of natural disasters has become one of the main challenges for the global health system. Climate change, environmental degradation, and unplanned urbanisation have increased communities' vulnerability to various types of disasters such as floods, storms, droughts, and landslides. Global reports from the World Meteorological Organisation and various international agencies show that climate-related disasters have increased significantly since 2000 and have had serious consequences for public health, in the form of increased mortality, morbidity, and disruption to health care systems (Carrington, 2025).

The health impacts of disasters are not limited to physical injuries or immediate deaths, but also include disruptions to essential health services, increased risks of communicable and non-communicable diseases, and mental health disorders among affected populations. Disruptions to health infrastructure, limited health personnel, and interrupted medical supply chains can prevent basic health services from functioning optimally during and after a disaster. These conditions indicate that the capacity of the health system is a determining factor in the level of health impact caused by disasters (Ministry of Health, 2026).

Natural disasters such as floods, earthquakes, tsunamis, and tropical cyclones are becoming more frequent and intense worldwide, primarily due to anthropogenic climate change, which is exacerbating both the frequency and scale of damage (WHO, 2023). The health impacts of these disasters are multifaceted, including acute traumatic injuries, infectious disease outbreaks due to contaminated water and poor sanitation, treatment disruptions for patients with chronic diseases such as diabetes or hypertension, and long-term mental health burdens such as PTSD and depression that can strain health systems for years (Walden University, 2025; Aerts et al., 2023; Balikcioglu et al., 2023).

According to WHO projections, between 2030 and 2050, climate change alone is predicted to cause an additional 250,000 deaths per year from undernutrition, malaria, diarrhea, and heat stress, while mortality rates from extreme weather events are 15 times higher in vulnerable countries than in developed regions (WHO, 2023). Public health systems have key capacities to mitigate these impacts through integrated Disaster Risk Reduction (DRR) strategies, including strengthening the surge capacity of health facilities, early surveillance systems for outbreak detection, interagency coordination, and building community resilience (Sharma et al., 2024; Kelman, 2014; PAHO, 2019).

However, many public health systems still face structural weaknesses such as limited disaster-resilient infrastructure, shortages of trained health workers, and a lack of real-time data integration, as evidenced by the 2024 Mumbai floods or the 2023 Turkey-Syria earthquake (Sharma et al., 2024; Balikcioglu et al., 2023). In the Asia-Pacific, a region with high disaster risk, public health capacity is often out of balance with risk exposure, leading to cascading risks such as the collapse of primary care that exacerbates secondary mortality (SEI, 2022; Smith et al., 2025).

This analysis aims to evaluate the capacity of public health systems holistically—including organizational, human resource, technological, and policy dimensions—in mitigating the health impacts of natural disasters, using an evidence-based approach derived from global case studies and the WHO Health Emergency and Disaster Risk Management (Health EDRM) framework, thus

providing practical recommendations for strengthening resilience, particularly in developing countries like Indonesia that are prone to multi-hazards (Chan et al., 2020; Kelman, 2014; AIU, n.d.). Ultimately, this capacity building will not only save lives but also support the achievement of Sustainable Development Goal 3 (Good Health) and the Sendai Framework for Disaster Risk Reduction (UNDRR, 2025).

Climate change acts as a "risk multiplier" that exacerbates global public health vulnerabilities. Extreme temperatures, air pollution, and shifting disease patterns force health systems to adapt not only for emergency response but also for long-term planning. The World Health Organisation (WHO) emphasises the need for health systems that are capable of adapting and transforming to address climate challenges and maintain the sustainability of health services (WHO, 2025).

Within the framework of public health system theory, a system's ability to respond, absorb, recover, and adapt to disruptions is known as health system resilience. This concept encompasses several key components, such as competent health workers, disaster-resilient infrastructure, effective health information systems, adequate logistics and financing, and governance that ensures cross-sectoral coordination. Recent global studies have identified that a strong health system is not only able to withstand crises but also maintain essential services for vulnerable populations during and after disasters (Morris et al., 2025; Myhre et al., 2025).

Theoretically, the ability of a health system to cope with crises is explained through the concept of health system resilience. This theoretical framework emphasises that a resilient health system must have the ability to absorb, adapt, respond, and recover from external disturbances such as natural disasters without losing its essential service functions. Within the health system framework, this capacity is influenced by several key components, including health human resources, service infrastructure and facilities, health information and surveillance systems, logistics and financing systems, as well as institutional governance and coordination. The interaction between these components determines the extent to which the health system is able to maintain service continuity during a crisis situation.

Although the concept of health system resilience has been widely studied in international literature, most previous studies have focused more on emergency response or on a specific aspect of the health system, such as health worker preparedness or infrastructure resilience. Approaches that comprehensively assess health system capacity and its relationship to the health impacts of disasters are still relatively limited, especially in the context of developing countries. This limitation indicates an important research gap, namely the need for empirical analysis that integrates various components of the health system into a single analytical framework to understand how the capacity of the health system affects the level of health impacts resulting from disasters.

This limitation is also evident in Indonesia, where natural disasters such as floods, landslides, and extreme weather consistently disrupt formal health services. A number of health facilities in affected areas have reportedly experienced operational disruptions, forcing national health authorities to quickly mobilise resources to ensure service continuity (Ministry of Health, 2025). This situation illustrates how the unpreparedness of the system can exacerbate the health impact on the

community, especially for vulnerable groups such as children, the elderly, and those with comorbidities.

This research gap is increasingly relevant in the context of Indonesia, which is one of the countries with the highest disaster risk in the world. Data from the National Disaster Management Agency shows that thousands of natural disasters occur every year, with the dominant types being floods, landslides, and extreme weather. These disasters not only cause physical infrastructure damage but also significantly disrupt health services, especially at primary health care facilities, which serve as the front line of public health services. Several national reports indicate that many health facilities in disaster-affected areas experience operational disruptions, limited health personnel, and difficulties in the distribution of medicines and medical equipment.

In scientific and academic contexts, most previous studies have focused on emergency response or the direct impacts of disasters, such as physical infrastructure damage, while comprehensive studies assessing the overall capacity of health systems remain limited. A review of the literature and recent studies highlights the need for research that assesses preparedness, system adaptation, and integration between health policies and disaster risk mitigation (Dubas-Jakóbczyk et al., 2025; Gkouliaveras et al., 2025).

Furthermore, scientific literature emphasises that strengthening the resilience of health systems requires a cross-sectoral approach that includes climate planning, early warning system development, health worker training, and improved institutional coordination. This calls for adaptive, evidence-based policies that are able to integrate disaster risk mitigation with long-term health development targets (Myhre et al., 2025).

Based on these conditions, research is needed that can empirically analyse the relationship between public health system capacity and the health impacts caused by natural disasters. This study attempts to fill the literature gap by developing an analysis that integrates various components of health system capacity into a single analytical model to assess their contribution to reducing the health impacts of disasters.

Scientifically, this research makes an important contribution to the development of health system resilience studies, particularly by providing empirical evidence on the role of various health system components in reducing the health impacts of disasters in developing countries. Practically, the findings of this study are expected to form the basis for the formulation of more adaptive and risk-based health system strengthening policies, thereby improving the preparedness and resilience of health systems in facing future disasters.

METHODS

This study uses a quantitative approach with a cross-sectional study design to analyse the relationship between public health system capacity and the health impact of natural disasters. This design was chosen because it allows simultaneous measurement of independent and dependent variables at a single point in time, enabling empirical analysis of the relationship between variables through an inferential statistical approach. The quantitative approach was used to produce objective

measurements of health system capacity indicators and the level of health impacts caused by disasters.

The study was conducted in disaster-prone areas in Indonesia that have a relatively high frequency of disasters based on national disaster reports and regional health data. The research area covered three districts/cities that historically often experienced hydrometeorological disasters such as floods and landslides. The unit of analysis in this study was health care facilities involved in health management during disasters, particularly primary health care facilities and referral health facilities that provided services to affected communities. Data collection for the study was carried out during the research period, which included the stages of instrument preparation, data collection, and statistical analysis.

The research population included all health care facilities located in the research area that had experience in responding to health services during disasters. The sample was determined using purposive sampling with the following inclusion criteria: health facilities that had been affected by disasters in the last five years, health workers or facility managers who had direct experience in handling disaster situations, and the availability of documented health service operational data. The sample size was calculated using the Slovin formula with a margin of error of 5%, resulting in a sample size of 90 health facilities consisting of primary health facilities and referral health facilities in the study area.

The independent variable in this study is the capacity of the public health system, which is operationalised into five main components, namely health human resources, health service facilities and infrastructure, health information and surveillance systems, health logistics and financing, and health system governance and coordination. The dependent variable is the health impact of natural disasters, which is measured through several key indicators, namely disruption to essential health services, an increase in the incidence of post-disaster diseases, and limited community access to health services.

Primary data was collected through a structured questionnaire developed based on the conceptual framework of health system resilience and indicators of health system preparedness in disaster situations. The research instrument consisted of 30 questions distributed proportionally across five components of health system capacity, with six items for each component. All questions used a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total score is then calculated to obtain the health system capacity index and the level of health impact due to disasters, which are further categorised into low, medium, and high levels based on the distribution of average values.

The validity of the instrument was tested in two stages, namely content validity and construct validity. Content validity was assessed by requesting evaluations from three experts with expertise in public health and disaster management to ensure the indicators were consistent with the theoretical concepts used. Next, construct validity was tested using Pearson Product Moment correlation analysis, with items deemed valid if the correlation coefficient value was greater than the r table value at a significance level of 5%. The reliability test of the instrument was conducted using Cronbach's Alpha method, with the criterion of an alpha value ≥ 0.70 indicating that the

instrument had good internal consistency. The test results showed that all items met the validity and reliability criteria with a Cronbach's Alpha value of 0.86, so the instrument was declared suitable for use in the study.

In addition to primary data, this study also utilised secondary data obtained from disaster reports, health facility operational reports, and regional health surveillance system data. Secondary data verification was carried out using document triangulation techniques by comparing data from several different institutional sources, checking the consistency of disaster timing and its impact on health services, and confirming with health facility managers to ensure the accuracy of the information used in the research analysis.

Data analysis was carried out in stages using statistical software. The first stage was descriptive analysis to describe the characteristics of health facilities and the level of health system capacity and the health impact of disasters through mean values, standard deviations, frequency distributions, and percentages. The second stage was Pearson's correlation analysis to test the relationship between health system capacity components and the level of health impact of disasters. Furthermore, to identify the contribution of each component of health system capacity to health impacts, multiple linear regression analysis was performed with a statistical significance level of 95% ($p < 0.05$). The regression model was used to estimate the simultaneous influence of the five components of health system capacity on the variation in health impacts occurring in the study area.

This study complied with research ethics principles by obtaining approval from the relevant institutional health research ethics committee prior to data collection. All respondents were given an explanation of the purpose and procedures of the study and were asked to provide written consent through an informed consent form before participating in the study. The identity of the respondents was kept confidential by using numerical codes on each questionnaire, and all data obtained was used exclusively for scientific research purposes.

RESULTS

The results of this study present the findings of descriptive and inferential analyses of the capacity of the public health system in disaster-prone areas and the resulting health impacts. The analysis covers the characteristics of health system units, the level of capacity in each main component, and the relationship between health system capacity and the health impacts of natural disasters. All results are presented in statistical tables to support empirical interpretation of the relationships between the variables studied.

Table 1. General Characteristics of Health System Units in the Study Area

Characteristics	n	
Type of Health Facility		
Primary Health Facility	58	64.4
Referral Facilities	32	35.6
Experience of Involvement in Disasters		
1–2 times	27	30

≥ 3 times	63	70
Ever Experienced Operational Disruption		
Yes	68	75.6
No	22	24.4

Most health system units (75.6%) have experienced operational disruptions due to natural disasters. The dominance of primary health facilities indicates that primary services are the most vulnerable sector to disasters, as well as the front line in public health response.

Table 2. Health System Capacity Levels Based on Key Components

Health System Capacity Components	Mean	SD	Category
Health Human Resources	3.21	0.62	Moderate
Facilities & Infrastructure	3.08	0.71	Moderate
Information Systems & Surveillance	2.89	0.66	Moderate–Low
Logistics & Financing	2.95	0.68	Medium
Governance & Coordination	3.34	0.59	Moderate–Good
Total System Capacity Score	**3.09**	**0.57**	**Moderate**

Note: Scale 1–5

Overall, the capacity of the public health system is in the **moderate** category, with the main weaknesses being in the health information and surveillance systems. This indicates that the health system's ability to respond to disasters is still reactive and not yet fully adaptive.

Table 3. Health Impacts of Natural Disasters

Health Impact Indicators	Mean	SD
Disruption of Essential Health Services	3.47	0.7
Increase in Post-Disaster Disease Cases	3.29	0.69
Limited Access to Health Services	3.56	0.7
Total Health Impact Score	**3.44**	**0.65**

Note: Scale 1–5 (high score = greater impact)

The relatively high average score indicates that natural disasters have a significant impact on the continuity of health services and public access to services. Disruption of access is the most dominant impact, reflecting problems with infrastructure and service distribution in the aftermath of disasters.

Table 4. Relationship between Health System Capacity and Health Impacts of Disasters

Health System Capacity Component	r	p-value
Human Resources	-0.46	0.001
Facilities & Infrastructure	-0.52	<0.001
Information Systems & Surveillance	-0.39	0.003

Logistics & Financing	-0.41	0.002
Governance & Coordination	-0.57	<0.001

There is a significant negative relationship between all components of health system capacity and the health impact of disasters ($p < 0.05$). This means that the higher the health system capacity, the lower the health impact. The governance and coordination components show the strongest correlation, confirming the important role of leadership and cross-sector coordination in mitigating the health impact of disasters.

Table 5. Linear Regression Analysis of Health System Capacity on Health Impacts

Independent Variables	β	SE	p-value
Human Resources	-0.24	0.07	0.002
Infrastructure	-0.31	0.08	<0.001
Information Systems	-0.18	0.06	0.004
Logistics & Financing	-0.21	0.07	0.003
Governance & Coordination	-0.36	0.09	<0.001
Model R^2		**0.48**	

The regression model shows that health system capacity simultaneously explains 48% of the variation in the health impact of disasters. Governance and coordination are the strongest predictors, followed by infrastructure resilience and human resource capacity. These findings reinforce the argument that health system strengthening must be carried out systematically, not partially.

DISCUSSION

1. Level of Health System Capacity Based on Key Components

The results of the study indicate that the capacity of the health system in the study area is moderate, with the lowest scores in the areas of health information systems and surveillance. These findings show that although structural components such as human resources and infrastructure are available to a certain extent, the system's ability to produce rapid and accurate health information is still limited. This situation can affect the speed of decision-making during a crisis.

Within the framework of health system resilience, information systems serve as the primary mechanism enabling health systems to identify changes in risk early on and adjust their operational responses accordingly. Health systems with weak information capacity tend to respond to crises reactively due to limited real-time data to support strategic decision-making. This is in line with previous research findings which show that information system integration is an important prerequisite for health system resilience in the face of large-scale disruptions (Witter et al., 2023).

These findings are also consistent with research in several developing countries showing that limitations in health information systems are one of the main obstacles to disaster preparedness, even when other components are at a moderate level (Okyere et al., 2024). A similar pattern was also found in several Southeast Asian countries, such as the Philippines and Vietnam, where limitations in health data interoperability slowed down the coordination of post-disaster health responses.

Operationally, these results indicate that strengthening health system capacity requires not only investment in physical resources, but also in the development of integrated health information systems. The integration of epidemiological surveillance data, health facility data, and disaster early warning systems can improve the health system's ability to anticipate surges in health service needs during crises.

2. Health Impacts of Natural Disasters

The analysis shows that the health impact of disasters is relatively high, especially in terms of indicators of disruption to access to health services and disruption to essential health services. These findings indicate that operational disruptions to health facilities have direct consequences for the community's ability to obtain health services during and after a disaster.

From a health system perspective, disruption to one component of the system can have systemic effects on other components. Damage to infrastructure, limitations in medical logistics, or disruption to the mobility of health workers can lead to a decline in overall health service capacity. Previous studies have shown that health systems that lack operational adaptation mechanisms experience a significant decline in the provision of primary services during crisis situations (Behrens et al., 2022).

Research in Southeast Asia also shows a similar pattern. Studies on health responses to floods in Thailand and the Philippines show that disruption of access to primary health facilities is the most common health impact on affected communities (Luke et al., 2022). This condition shows that the level of health impact is not only related to the characteristics of the disaster, but also to the capacity of the health system to maintain basic services.

The operational implications of these findings are the need to develop more adaptive health service mechanisms during crisis situations, such as the provision of mobile health services, flexible emergency referral systems, and the strengthening of community-based health service networks to ensure that access to services remains available when formal health facilities are disrupted.

3. The Relationship between Health System Capacity and Health Impacts of Disasters

The results of the correlation analysis show a significant negative relationship between all components of health system capacity and the health impact of disasters. This relationship indicates that an increase in health system capacity contributes to a decrease in the level of health disruption experienced by the community.

The governance and coordination components show the strongest relationship with health impact. These findings indicate that effective cross-sectoral coordination plays an important role in optimising the use of available resources during a crisis. Health systems with strong institutional coordination tend to have a better ability to allocate resources quickly and reduce disruptions to health services (Witter et al., 2023).

These results are also in line with cross-country research showing that health systems with weak governance tend to experience fragmentation in their response despite having relatively adequate resources (Okyere et al., 2024). In the context of Southeast Asia, studies on health responses

to disasters in Indonesia, the Philippines, and Vietnam also show that coordination between the health sector, disaster management agencies, and local governments is an important factor in maintaining the continuity of health services during a crisis.

In terms of policy, these findings indicate that strengthening the resilience of health systems cannot only focus on increasing technical capacity, but also requires strengthening cross-sectoral coordination mechanisms. The development of emergency coordination protocols, the integration of disaster command systems, and the enhancement of leadership capacity in crisis management can increase the effectiveness of health responses to disasters.

4. Regression Analysis of Health System Capacity on Health Impact

The regression analysis results show that health system capacity simultaneously explains 48% of the variation in the health impact of disasters. Governance and coordination emerged as the strongest predictors, followed by infrastructure and human resources for health. These findings indicate that the managerial components of the health system have a relatively greater influence than the technical components in reducing the health impact of disasters.

These results support the view that health system resilience is the result of an interaction between technical capacity and institutional capacity. Health systems that are able to maintain service functions during a crisis usually have management mechanisms that enable rapid and efficient coordination of resources (Behrens et al., 2022). Other studies also show that investment in health system governance has a significant impact on reducing community health vulnerability to disasters (Luke et al., 2022).

However, the results also show that more than half of the variation in health impacts is not explained by the variables analysed in the model. This indicates that there are other external factors that also influence the health impacts of disasters. These factors may include the geographical characteristics of the region, the socio-economic vulnerability of the community, population density, the quality of transport infrastructure, and the effectiveness of the national disaster management system.

5. Research Limitations

This study has several limitations that need to be considered in interpreting the results. First, the cross-sectional study design limits the study's ability to identify longitudinal causal relationships between health system capacity and the health impacts of disasters. Second, the unit of analysis is limited to health care facilities, so it does not fully cover the social and environmental factors that influence the health impacts on the community. Third, several health impact indicators were measured based on respondents' perceptions through questionnaires, which could potentially be influenced by subjective bias.

Nevertheless, this study still provides important empirical contributions to understanding the relationship between health system capacity and the health impacts of disasters, particularly in the context of developing countries with high levels of disaster vulnerability.

CONCLUSIONS

This study concludes that the capacity of the public health system in disaster-prone areas is still at a moderate level, which is empirically insufficient to significantly reduce the health impact of natural disasters. The most crucial limitation was identified in the health information and surveillance system, which hinders the system's ability to respond quickly, data-driven, and adaptively to crisis situations.

The main findings of the study show that all components of health system capacity have a significant negative relationship with the health impacts of disasters, confirming that health impacts are not an inevitable consequence of natural disasters, but are greatly influenced by the quality and resilience of the underlying health system. Among all components, governance and cross-sectoral coordination emerged as the strongest determinants in reducing health impacts, followed by infrastructure resilience and human resource capacity for health.

The regression model confirmed that health system capacity simultaneously explained nearly half of the variation in post-disaster health impacts. These findings provide an important empirical contribution to the literature on health system resilience, emphasising that strengthening health systems is a high-leverage strategic intervention in mitigating health risks from disasters, even amid resource constraints.

Conceptually, this study reinforces the paradigm that strengthening the health system cannot be done partially or sectorally. , integration of information systems, and cross-sectoral coordination must be positioned as the core of health system resilience strategies, not merely as complements to emergency responses. Without transformation in these managerial and institutional governance aspects, increased investment in infrastructure and human resources risks producing suboptimal outcomes.

Thus, this study concludes that building a disaster-resilient health system requires a systemic, adaptive, and evidence-based approach that can turn disasters not only into sources of risk but also into learning opportunities to strengthen the capacity of the health system in a sustainable manner. These findings have important implications for the formulation of health and disaster management policies, particularly in developing countries facing escalating disaster risks due to climate change.

REFERENCES

Aerts, J. et al. (2023). Health impacts of extreme weather events: Cascading risks and adaptation. *International Journal of Disaster Risk Reduction*, PMC. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC10548486/

AIU (n.d.). The role of public health in disaster management. *Atlantic International University*. Available at: https://www.aiu.edu/mini_courses/the-role-of-public-health-in-disaster-management/

Balikcioglu, P. et al. (2023). The impact of natural disasters on healthcare and surgical services. *Surgery*, 174(3), 456–462. PMC. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC10406090/

Behrens, D. A., Rauner, M. S., & Sommersguter-Reichmann, M. (2022). Why resilience in health care systems is more than coping with disasters: Implications for health care policy. *Schmalenbach Journal of Business Research*, 74. https://doi.org/10.1007/s41471-022-00132-0

Carrington, D. (2025, March 19). More than 150 "unprecedented" climate disasters struck the world in 2024, says UN. *The Guardian*. https://www.theguardian.com/environment/2025/mar/19/unprecedented-climate-disasters-extreme-weather-un-report

Chan, E. et al. (2020). Health emergency and disaster risk management: Five years into implementation. *International Journal of Disaster Risk Reduction*, 46, 101496. PMC. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC7223383/

Dubas-Jakóbczyk, K., George, N. S., & Ndayishimiye, C. (2025). Health systems' adaptations to climate change: An umbrella review of global evidence protocol. *BMJ Open*, 15(10). https://doi.org/10.1136/bmjopen-2025-105492

Gkouliaveras, V., Kalogiannidis, S., Kalfas, D., & Kontsas, S. (2025). Effects of climate change on health and health systems: A systematic review of preparedness, resilience, and challenges. *International Journal of Environmental Research and Public Health*, 22(2), 232. https://doi.org/10.3390/ijerph22020232

Kelman, I. (2014). Integrating health into disaster risk reduction strategies. *PLoS Currents Disasters*, PMC. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC4167116/

Kemenkes. (2025, March 8). The Ministry of Health ensures that health services continue for flood victims. *Kemkes.go.id*. https://kemkes.go.id/id/kemenkes-pastikan-layanan-kesehatan-tetap-berjalan-bagi-korban-banjir

Kemenkes. (2026). Not only physical, the Ministry of Health restores the mental health of disaster victims. *Kemkes.go.id*. https://www.kemkes.go.id/id/tak-hanya-fisik-kemenkes-pulihkan-kesehatan-jiwa-korban-bencana

Luke, J., Franklin, R. C., Dyson, J., & Aitken, P. (2022). Building toward a disaster-resilient health system: A study of hospital resilience. *Disaster Medicine and Public Health Preparedness*, 17, 1–8. https://doi.org/10.1017/dmp.2022.204

Morris, K., Pasha, A., Li, X., & Qiao, S. (2025). Disaster preparedness of health systems in LMICs in the face of climate change: A systematic mapping review of vulnerabilities and response strategies. *BMC Public Health*, 26(217). https://doi.org/10.1186/s12889-025-25873-5

Myhre, S. L., Frønsdal, K. B., Ames, H. M. R., & Papadopoulou, E. (2025). A scoping review of climate-resilient health system strategies in low-resource settings. *Public Health*, 249, 106026. https://doi.org/10.1016/j.puhe.2025.106026

Okyere, D. O., Peri, K., Moore, M., & Lomazzi, M. (2024). Investing in health system resilience: A scoping review to identify strategies for enhancing preparedness and response capacity. *Population Medicine*, 6. https://doi.org/10.18332/popmed/183661

PAHO. (2019). Disaster risk reduction. *Pan American Health Organization/World Health Organization*. Available at: https://www.paho.org/en/health-emergencies/disaster-risk-reduction

SEI. (2022). Disaster risk reduction and health in the Asia-Pacific region. *Stockholm Environment Institute*. Available at: https://www.sei.org/wp-content/uploads/2022/01/disaster-risk-policy-asia-pacific-seibrief.pdf

Sharma, S. et al. (2024). Assessment of coping capacity of public health facilities during floods in Mumbai, India. *Frontiers in Public Health*, 12. PMC. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC11114514/

Smith, J. et al. (2025). A scoping review of health risks and outcomes from disasters. *Disaster Medicine and Public Health Preparedness*, 19. PMC. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC11987192/

UNDRR. (2025). Global Assessment Report (GAR) 2025. *United Nations Office for Disaster Risk Reduction*. Available at: https://www.undrr.org/gar/gar2025

Walden University. (2025). Six health impacts of natural disasters. *Walden University Online Master's Programs*. Available at: https://www.waldenu.edu/online-masters-programs/master-of-public-health/resource/six-health-impacts-of-natural-disasters

WHO. (2023). Climate change and health. *World Health Organization*. Available at: https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

WHO. (2025). WHO climate and health instruments support national action on resilience and sustainability. *Who.int*. https://www.who.int/indonesia/id/news/detail/23-05-2025-who-climate-and-health-tools-support-national-action-on-resilience-and-sustainability

Witter, S., Thomas, S., Topp, S. M., Barasa, E., Chopra, M., Cobos, D., Blanchet, K., Teddy, G., Atun, R., & Ager, A. (2023). Health system resilience: A critical review and reconceptualisation. *The Lancet Global Health*, 11(9), e1454–e1458. https://doi.org/10.1016/S2214-109X(23)00279-6