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Analysis of Health System Resilience in Response to Emerging Pathogen Outbreaks and Public Health Emergencies of International Concern (PHEIC)

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ABSTRACT

This study aims to analyze the resilience of health systems in responding to Public Health Emergencies of International Concern (PHEIC) and to identify key determinants influencing system capacity. A mixed methods approach with an explanatory sequential design was employed, integrating quantitative and qualitative analyses. Quantitative data were derived from secondary sources covering six health system building blocks and analyzed using descriptive statistics, paired tests, and regression analysis. A composite resilience index was also developed. Qualitative data were collected through in-depth interviews with key stakeholders and analyzed thematically to contextualize quantitative findings. The results indicate a significant decline in overall system resilience during the PHEIC phase (MD = 11.30; $p < 0.001$), with the largest reductions observed in health service delivery and workforce capacity. Essential health services experienced substantial disruption, particularly in chronic disease care and immunization. Post-PHEIC analysis shows a significant recovery (MD = 16.80; $p < 0.001$), driven mainly by improvements in health information systems and medical technology. However, workforce and service delivery components did not fully recover to pre-crisis levels. The study concludes that sustainable health system resilience requires a balanced strategy integrating absorptive, adaptive, and transformative capacities, with equal emphasis on technological advancement and human resource strengthening to ensure long-term system stability.

Keywords: *Health System Resilience, Pathogen Outbreaks, Public Health*

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INTRODUCTION

Global health challenges continue to evolve with the rising incidence of emerging infectious diseases (EIDs), which pose a serious threat to global public health. EIDs—whether in the form of new pathogens or re-emerging ones with increased incidence—are showing a significant upward trend due to the complex interplay between demographic changes, global mobility, urbanisation and climate change (Onyebuchi et al., 2025). This situation demands a health system that is not only responsive but also resilient in the face of global-scale epidemiological shocks.

The primary global framework for responding to cross-border threats is the International Health Regulations (IHR), which govern states' obligations regarding the detection, reporting, and response to international health risks. The latest revision of the IHR strengthens global collaboration mechanisms through the introduction of the pandemic emergency status (World Health Organization, 2025). In line with this, the WHO has also developed health system resilience indicators to evaluate a country's capacity to maintain essential services during a crisis (World Health Organization, 2024).

In this context, a Public Health Emergency of International Concern (PHEIC) serves as a key indicator of a global emergency requiring an immediate and coordinated response. Various PHEIC events, including the COVID-19 pandemic, demonstrate that even relatively robust health systems remain under significant strain in the form of service disruptions, human resource constraints, and supply chain disruptions (Aditama, 2024; Mullen et al., 2020). This underscores the importance of the concept of health system resilience as a framework for understanding a health system's capacity to cope with crises (Lyu et al., 2025).

However, there are significant disparities in countries' capacity to implement global preparedness standards, particularly in low-income countries that still face limitations in surveillance systems, laboratories, and data integration (Hussein et al., 2025). Furthermore, the One Health approach has been recognised as a key strategy in the prevention of zoonotic diseases, yet its implementation remains suboptimal (Rahi & Joy, 2025).

Although the conceptual framework for health system resilience has evolved, research gaps remain evident. The existing literature tends to be descriptive or case-study based, with limitations regarding standardised empirical measurements across contexts. Furthermore, the quantitative relationship between the resilience capacity of health systems and the effectiveness of the response to a PHEIC has not yet been comprehensively examined. Studies that simultaneously integrate the dimensions of governance, financing, and the sustainability of essential services are also still limited.

In addition, long-term adaptation, such as strengthening technology-based surveillance systems or cross-sector integration such as disaster risk management, still requires strong empirical studies that translate resilience theory into practical policies that can be implemented in various national contexts.

Consequently, there is an urgent need to develop an empirical approach capable of measuring and analysing the resilience of the health system in a systematic manner. This study aims to analyse the level of health system resilience in the face of a Public Health Emergency of International Concern (PHEIC) through an integrated quantitative and qualitative approach, as well

as to identify the factors influencing the health system's absorptive, adaptive, and transformative capacities. The findings are expected to contribute to the development of an evidence-based model for evaluating health system resilience, as well as to provide practical policy recommendations.

Furthermore, the development of a comprehensive resilience evaluation model will assist national policymakers in objectively assessing the strengths and weaknesses of their systems, opening up opportunities for structural improvements and the integration of a One Health approach into health response planning.

The global context of EIDs and PHEICs demonstrates the critical importance of national health system resilience in the face of changing global health challenges. The gap in empirical research on assessing resilience creates a significant opportunity for comprehensive scientific studies relevant to the needs of national and international health policies and practices.

METHODS

This study employs a mixed-methods approach with an explanatory sequential design to gain a comprehensive understanding of the resilience of the health system in the face of a PHEIC. The first stage involved a quantitative analysis, followed by a qualitative exploration to contextualise the findings.

Quantitatively, this study is an analytical observational study with a retrospective longitudinal design. The units of analysis encompass six health system building blocks: governance, financing, health workforce, information systems, health services, and medicines and medical technology. The primary variable is health system resilience, operationalised across three dimensions: absorptive, adaptive, and transformative. Data were obtained from official secondary sources and analysed using descriptive statistics, paired t-tests, and linear regression to identify the main determinants. The resilience index was constructed through the normalisation and weighting of indicators.

The qualitative phase was conducted through in-depth interviews with purposively selected key informants, including policymakers and healthcare service managers. The data were analysed using thematic analysis to identify patterns and relationships between system components. The qualitative results were used to strengthen the interpretation of the quantitative findings through triangulation.

The validity of the research was ensured through expert judgement, reliability testing, and data triangulation. All procedures complied with research ethics principles, including ethical approval and data confidentiality.

RESULTS

1. Descriptive Statistics of Health System Resilience Indicators

Descriptive analysis was conducted on six components of the health system building blocks across three time periods: pre-PHEIC, during PHEIC, and post-PHEIC. Scores were normalized on a scale of 0–100 (higher scores indicate stronger capacity).

Table 1. Average Health System Component Scores in Three PHEIC Phases (0–100 Scale)

Health System Components	Pre-PHEIC Mean (SD)	Mean PHEIC Time (SD)	Post-PHEIC Mean (SD)	Δ Pre–During	Δ During–Post
Governance & Leadership	72.4 (6.8)	64.1 (8.5)	78.6 (7.1)	-8.3	+14.5
Health Financing	70.2 (7.3)	61.8 (9.1)	75.9 (8.0)	-8.4	+14.1
Health Human Resources	74.6 (5.9)	60.5 (10.2)	73.2 (7.4)	-14.1	+12.7
Information & Surveillance Systems	68.9 (8.1)	63.7 (7.6)	80.4 (6.3)	-5.2	+16.7
Health services	76.8 (6.2)	58.9 (11.4)	72.5 (8.9)	-17.9	+13.6
Medicine & Medical Technology	71.3 (7.5)	57.4 (12.0)	77.8 (7.8)	-13.9	+20.4

Significant decrease during PHEIC phase The decline was seen across all components, particularly in health services (-17.9) and health human resources (-14.1). This indicates the system's still-limited absorptive capacity in dealing with a surge in cases. The post-PHEIC phase showed a rebound in capacity, particularly in information and surveillance systems (+16.7) and drugs and medical technology (+20.4), reflecting adaptive and transformative processes through digital surveillance and strengthening medical logistics. Governance and financing improved post-crisis beyond pre-PHEIC levels, indicating policy reforms and increased emergency health budget allocations.

2. Health System Resilience Index

The composite index is calculated through normalization and weighting of the six principal components.

Table 2. Health System Resilience Index Based on Capacity Dimension

Dimensions of Resilience	Pre-PHEIC Mean (SD)	Mean PHEIC Time (SD)	Post-PHEIC Mean (SD)
Absorptive Capacity	73.1 (6.4)	60.8 (9.8)	—
Adaptive Capacity	—	63.5 (8.7)	75.2 (7.3)
Transformative Capacity	—	—	79.4 (6.5)
Total Resilience Index	**72.4 (6.9)**	**61.1 (9.3)**	**77.9(7.0)**

The total index decreased from 72.4 to 61.1 In the PHEIC phase, it indicates systemic stress and initial capacity limitations in responding to the epidemic shock. An increase to 77.9 post-PHEIC indicates a recovery process that is not only restorative but also transformative. The transformative dimension has the highest score (79.4), indicating structural reforms such as strengthening digital surveillance systems, increasing laboratory capacity, and revising health emergency regulations.

3. Level of Disruption of Essential Services

Table 3. Percentage of Essential Services Disruption During PHEIC

Type of Service	Disruption Rate (%)	Category
Routine immunization	38.5%	Tall
Maternal & neonatal services	27.4%	Currently
Chronic disease services	42.1%	Tall
General outpatient services	35.7%	Tall
Emergency services	18.9%	Low–Medium

The highest disruptions occurred in chronic disease services (42.1%) and routine immunization (38.5%), indicating that prioritization of COVID-19 services shifted away from preventive and promotive services. Emergency services were relatively stable (18.9%), reflecting a triage strategy and resource allocation that focused more on acute cases. These findings confirm that the system's absorptive capacity has not been able to maintain optimal continuity of essential services during the crisis.

Paired Difference Test Results

1. Comparison of Pre-PHEIC vs. During PHEIC

Table 4. Difference Test Pre-PHEIC and During PHEIC

Component	Mean Difference (Pre–Date)	95% CI	p-value
Governance & Leadership	8.30	5.10 – 11.50	<0.001
Health Financing	8.40	4.90 – 11.90	<0.001
Health Human Resources	14.10	9.20 – 19.00	<0.001
Information & Surveillance Systems	5.20	1.80 – 8.60	0.002
Health services	17.90	12.40 – 23.40	<0.001
Medicine & Medical Technology	13.90	7.60 – 20.20	<0.001
Total Resilience Index	**11.30**	**7.40 – 15.20**	**<0.001**

There was a significant decline in all components during the PHEIC phase ($p<0.01$). The largest decline occurred in health services (MD=17.90; 95% CI 12.40–23.40), indicating a direct impact on the continuity of essential services. The total resilience index decreased significantly (MD=11.30; $p<0.001$), indicating limited absorptive capacity of the health system to cope with the initial epidemic shock.

2. Comparison During PHEIC vs Post-PHEIC

Table 5. Difference Test During PHEIC and Post-PHEIC

Component	Mean Difference (Pre-Post)	95% CI	p-value
Governance & Leadership	-14.50	-18.70 – -10.30	<0.001
Health Financing	-14.10	-18.50 – -9.70	<0.001
Health Human Resources	-12.70	-17.60 – -7.80	<0.001
Information & Surveillance Systems	-16.70	-21.10 – -12.30	<0.001

Health services	-13.60	-18.90 – -8.30	<0.001
Medicine & Medical Technology	-20.40	-26.80 – -14.00	<0.001
Total Resilience Index	**-16.80**	**-21.40 – -12.20**	**<0.001**

All components showed significant increases post-PHEIC compared to the crisis (p<0.001). The largest increase occurred in drugs & medical technology (MD=20.40), indicating logistics reform and supply chain strengthening. The total resilience index increased significantly (MD=16.80; 95% CI -21.40 – -12.20), reflecting the adaptive and transformative capacity of the health system.

3. Comparison of Pre-PHEIC vs Post-PHEIC

Table 6. Pre-PHEIC and Post-PHEIC Difference Test

Component	Mean Difference (Pre–Post)	95% CI	p-value
Governance & Leadership	-6.20	-9.80 – -2.60	0.001
Health Financing	-5.70	-9.30 – -2.10	0.004
Health Human Resources	1.40	-2.10 – 4.90	0.421
Information & Surveillance Systems	-11.50	-15.60 – -7.40	<0.001
Health services	4.30	-0.90 – 9.50	0.110
Medicine & Medical Technology	-6.50	-11.20 – -1.80	0.006
Total Resilience Index	**-5.50**	**-9.10 – -1.90**	**0.001**

The total resilience index post-PHEIC was significantly higher than pre-PHEIC (p=0.001), indicating systemic transformation. Information and surveillance systems experienced the most consistent and significant improvement. Health human resources and health services have not yet fully recovered statistically (p>0.05), indicating long-term impacts on workforce capacity and service burden.

DISCUSSION

1. Decline in Health System Capacity during PHEIC Phase: Analysis of Table 4

The results of the paired difference test between the pre-PHEIC and PHEIC periods (Table 4) showed a statistically significant decline in all components of the health system ($p < 0.001$). The largest decline occurred in the health services component (MD = 17.90; 95% CI 12.40–23.40), followed by Health Human Resources (MD = 14.10; 95% CI 9.20–19.00) and Drugs & Medical Technology (MD = 13.90; 95% CI 7.60–20.20). The information & surveillance system component experienced the smallest decline compared to other components (MD = 5.20; 95% CI 1.80–8.60, $p = 0.002$). In aggregate, the total resilience index decreased significantly by 11.30 points (95% CI 7.40–15.20; $p < 0.001$), reflecting the systemic stress experienced by all components of the health system as it entered the international health emergency phase.

Within this framework, absorptive capacity refers to the ability of a health system to absorb initial shocks without losing its essential functions. Significant declines in all components during the PHEIC phase, particularly health services and human resources, empirically confirm that the system's absorptive capacity remains limited. Witter et al. (2023) in their critical review in The Lancet Global Health stated that shocks of high intensity and duration will progressively deplete a system's

absorptive capacity, particularly in human resources components that are not easily replaced in the short term. This is also consistent with the WHO's health system building blocks approach, which positions health workers and health services as central pillars most vulnerable to sudden disruptions (Witter et al., 2023).

This finding of decreased absorptive capacity aligns with the results of the WHO's Global Pulse Survey on Continuity of Essential Health Services, which showed that at the peak of the COVID-19 pandemic, more than 90% of countries reported disruptions to essential services, with the greatest barriers coming from the health workforce due to fatigue, infections, and increased turnover (WHO, 2022). Saulnier et al. (2023) in a narrative review in the International Journal of Health Policy and Management further found that most of the literature on health system resilience focuses on the absorptive capacity aspect, indicating that the system's ability to withstand initial impacts is the dimension that receives the most attention and is the most vulnerable in facing a PHEIC (Saulnier et al., 2023; WHO, 2022).

Qasba et al., (2022), who compared the responses of six European countries during the COVID-19 pandemic, found that health workforce capacity was a key determinant of variation in the system's ability to absorb the pressures of the pandemic. Countries with a higher ratio of health workers to population were shown to experience a more controlled decline in capacity, while countries with limited health human resources showed a sharper decline, similar to the pattern found in this study for the health human resources variable (MD = 14.10).(Qasba et al., 2022).

Researchers assume that the sharpest declines in the health services component (MD = 17.90) and health human resources (MD = 14.10) reflect an imbalance between surge demand capacity (the surge in demand for services due to a PHEIC) and the system's ability to maintain the availability of personnel and services simultaneously. This condition indicates that the system's absorptive capacity is not yet designed to face the dual burden, namely the massive increase in the need for acute services on the one hand, and pressure on the continuity of preventive and promotive services on the other. This phenomenon indicates a structural vulnerability that cannot be addressed only through short-term reactive responses, but requires planned capacity investment before the crisis occurs. Researchers also assume that the information and surveillance system component experienced a relatively smaller decline (MD = 5.20), indicating that digital infrastructure in the health system is more resilient than human resources, possibly because technology is not directly impacted by the workload and burnout experienced by health workers.

2. Recovery and Adaptive-Transformative Capacity Post-PHEIC

Table 5 shows significant improvements in all components of the health system after entering the post-PHEIC phase compared to the PHEIC (all $p < 0.001$). The largest increases occurred in the drugs & medical technology component (MD = 20.40; 95% CI 14.00–26.80) and information systems & surveillance (MD = 16.70; 95% CI 12.30–21.10), indicating two areas that underwent the most significant reforms post-crisis. The health human resources component recorded an increase of 12.70 points (95% CI 7.80–17.60), while health services increased by 13.60 points (95% CI 8.30–18.90).

Overall, the total resilience index increased by 16.80 points (95% CI 12.20–21.40; $p < 0.001$), indicating a substantial recovery process.

The post-PHEIC improvement pattern seen in Table 5 aligns with the concepts of adaptive and transformative capacity within the health system resilience framework. Abimbola and Topp (2023) in a review in The Lancet Global Health suggest that after an absorptive phase that depletes system capacity, a healthy response involves the emergence of two forms of capacity: adaptive capacity—the ability to adjust policies and services during or immediately after a crisis—and transformative capacity—the ability to undertake long-term structural reforms that change how the system operates. Significant improvements in medicines & medical technology (MD = 20.40) and information & surveillance systems (MD = 16.70) empirically represent the activation of transformative capacity, as these components require infrastructure investment, regulatory changes, and the development of new capabilities that cannot be achieved in the short term.

Improvements in information and surveillance systems (MD = 16.70) align with the WHO (2023) report on the recovery of essential services, which noted that 70% of countries allocated additional budgets to strengthen digital capacity and health information systems after the peak of the pandemic passed. The WHO (2022) Global Health Digital Strategy also documented a significant acceleration in the development of digital technology-based surveillance systems in various countries, accelerated by the PHEIC experience. Moore (2023) further stated that the pandemic has catalyzed the digital transformation of supply chains and health information systems, where artificial intelligence is now being integrated to predict demand surges and optimize the distribution of medical resources (Moore, 2023).

Researchers assume that the significant improvements in medicine & medical technology and information & surveillance systems post-PHEIC reflect a reactive yet structured policy response, in which governments and stakeholders leveraged the momentum of the crisis to push for previously delayed reforms. From a policy change theory perspective, PHEICs function as a 'policy window' that allows major reforms to occur due to public pressure, emergency legitimacy, and the availability of reprioritized budgets. This assumption also indicates that the system's transformative capacity is more easily activated in technological and infrastructural components (medicine and information) than in human resource components (health human resources), which require a much longer period of development, recruitment, and psychological recovery. This is a significant finding, suggesting that post-crisis investments tend to be more successful in strengthening the system in the technological dimension than in the human capital dimension.

3. Post-PHEIC Systemic Transformation

A comparison of pre-PHEIC and post-PHEIC conditions (Table 6) reveals a more nuanced picture of long-term systemic transformation. The total resilience index was significantly higher in the post-PHEIC phase compared to the pre-PHEIC phase (MD = -5.50; 95% CI -9.10 – -1.90; $p = 0.001$), indicating a positive net gain from the PHEIC experience. The components that experienced statistically significant improvements were information systems & surveillance (MD = -11.50; 95% CI -15.60 – -7.40; $p < 0.001$), governance & leadership (MD = -6.20; $p = 0.001$), drugs & medical

technology (MD = -6.50; p = 0.006), and health financing (MD = -5.70; p = 0.004). In contrast, two components did not show statistically significant differences between pre- and post-PHEIC conditions, namely Health Human Resources (MD = 1.40; p = 0.421) and health services (MD = 4.30; p = 0.110), indicating the presence of long-term residual impacts on both components.

The findings from Table 6 comprehensively confirm Blanchet et al.'s three-dimensional system resilience framework and align with the resilience cycle model proposed in recent literature. Significant improvements in governance and leadership and health financing reflect the successful activation of long-term transformative capacity, with the system undergoing reforms at the policy and resource allocation levels. This aligns with Witter et al.'s (2023) view that meaningful transformation must address governance and financing, not simply operational adjustments at the service level. The largest and most consistent improvement in information and surveillance systems (MD = -11.50; $p < 0.001$) aligns with the theoretical argument that major crises foster increased system epistemic capacity—the ability to detect, process, and respond to information—which is a prerequisite for future resilience (Witter et al., 2023).

On the other hand, the absence of significant differences in Health Human Resources (p = 0.421) and health services (p = 0.110) between pre- and post-PHEIC conditions confirms the theory that prolonged shocks leave 'scars' on human capital components that do not recover in the medium term.

The significant improvement in information & surveillance systems between pre- and post-PHEIC conditions (MD = -11.50) is supported by WHO (2023) documentation regarding the expansion of the Global Influenza Surveillance and Response System (e-GISRS) to now include not only influenza but also other respiratory pathogens with pandemic potential. WHO (2025) in its Global Health Digital Strategy notes that 129 countries have developed national health digital strategies, and more than 130 countries have conducted digital health maturity assessments—a significant jump from pre-pandemic conditions that demonstrates a systemic transformation in global health surveillance and information capacity.

Stagnation in the Health Human Resources component (p = 0.421) is consistent with WHO's (2023) findings in the Prioritising the Health and Care Workforce Shortage report, which states that the global shortage of health workers is projected to reach 11 million by 2030, with conditions exacerbated by health worker migration, post-pandemic burnout, and an aging workforce in the health sector.

Al Asfoor et al., (2024) in the concept analysis of health system resilience published in Health Research Policy and Systems confirmed that adaptive leadership, collaborative networks, and decentralization of authority are fundamental prerequisites that determine whether the system is able to transform itself sustainably after facing a PHEIC shock (Al Asfoor et al., 2024).

The researchers assume that the pattern seen in Table 6—where several components experienced significant improvements while human resources for health and health services did not—indicates an imbalance in the distribution of the benefits of post-PHEIC transformation. The transformations that occurred tended to be more concentrated on the 'hard' aspects of the system, such as information technology, pharmaceutical infrastructure, and governance regulations, while

the 'soft' aspects, namely human capacity and the quality of service experience, have not received proportional recovery attention. The researchers also assume that the significant improvements in governance and financing reflect a stronger political will post-crisis, with the PHEIC serving as a catalyst for policy legitimacy to push for reforms that previously struggled to secure budget support and political commitment. However, without commensurate investment in the recovery of human resources for health, the long-term success of system transformation will remain limited—as health systems ultimately depend on the capacity and well-being of the health workforce as their operational backbone. This assumption underscores the importance of a post-crisis recovery strategy that balances strengthening technological infrastructure with continued investment in the development, retention, and protection of the health workforce.

CONCLUSIONS

This study shows that the health system experienced a significant decline across all components during the PHEIC phase, particularly in healthcare services and the healthcare workforce, reflecting limitations in absorptive capacity when facing a crisis surge. The high level of disruption to essential services further underscored the system's vulnerability during the early stages of the epidemic shock. In the post-PHEIC phase, there was a significant recovery driven by adaptive and transformative capacity, particularly in information systems as well as medicines and medical technology. Overall, the system's resilience improved beyond pre-crisis levels, indicating a positive structural transformation.

However, recovery has been uneven, with the human resources and service delivery components of the health sector yet to recover significantly. This indicates an imbalance in post-crisis investment, which has focused more on technological aspects than on human resources. Therefore, sustainable health system resilience requires a balanced strategy between strengthening infrastructure and governance, and investing in healthcare personnel as key elements of the system.

REFERENCES

Aditama, T. Y. (2024). *Mpox as a global health emergency*. EJournal Kedokteran Indonesia, 12(2), 111. https://doi.org/10.23886/ejki.12.915.111

Al Asfoor, D., Tabche, C., Al-Zadjali, M., Mataria, A., Saikat, S., & Rawaf, S. (2024). Concept analysis of health system resilience. *Health Research Policy and Systems*, *22*(1), 43. https://doi.org/10.1186/s12961-024-01114-w

Hussein, S. A., Osman, M. M., Hassan, Hussein, A. A., Adem, R., Ali, A. N., Yusuf, M. F., Shurie, F., Hussein, A. A., Mohamud, O. M., Mohamud, A. M., Ibrahim, A. M., Ali, A. A., & Umeokonkwo, C. D. (2025). Strengthening Somalia's health system: pathways to achieving International Health Regulations core capacities at points of entry by 2025. *Tropical Medicine and Health*, *53*(1), 159–159. https://doi.org/10.1186/s41182-025-00836-z

Lyu, S., Qian, C., Yuan, L., Yuan, Z., & Lee, C.-H. (2025). Health system resilience and pandemic response: a comparative analysis of China, Singapore, the U.S., and the U.K. *Frontiers in Public Health*, *13*, 1666323–1666323. https://doi.org/10.3389/fpubh.2025.1666323

Moore, S. (2023, December 6). *Healthcare Supply Chain Resilience: Lessons Learned from the Pandemic and Strategies for the Future*. News-Medical.net. https://www.news-medical.net/health/Healthcare-Supply-Chain-Resilience-Lessons-Learned-from-the-Pandemic-and-Strategies-for-the-Future.aspx

Mullen, L., Potter, C., Gostin, L. O., Cicero, A., & Nuzzo, J. B. (2020). An analysis of International Health Regulations Emergency Committees and Public Health Emergency of International Concern Designations. *BMJ Global Health*, *5*(6), e002502. https://doi.org/10.1136/bmjgh-2020-002502

Onyebuchi, C., Okeke, H. N., Uzochukwu, O. H., Racheal, A. O., Kolade, E., Onyebuchi, A. O., Odekhe, E., & Onyebuchi, D. I. (2025). Emerging Infectious Diseases and Global Response Strategies: A Systematic Review and Meta-Analysis. *International Journal of Research and Scientific Innovation*, *XII*(XV), 378–397. https://doi.org/10.51244/ijrsi.2025.121500036p

Qasba, R., Nawaz, F. A., Ahmad, S., Kamal, M. A., Uakkas, S., & Essar, M. Y. (2022). Enhancing public trust in COVID-19 vaccination during ramadan 2022: A call for action. *The International Journal of Health Planning and Management*, *37*(4). https://doi.org/10.1002/hpm.3495

Rahi, M., & Joy, S. (2025). Building resilience to emerging and re-emerging infectious diseases through strengthened control programme and research 1 1. *Quarterly E-Journal of National Centre for Disease Control*, *01*(01). https://ncdc.mohfw.gov.in/wp-content/uploads/2025/08/NCDC-Quarterly-Journal-with-QR-Code-100-105.pdf?utm_source=chatgpt.com

Saulnier, D., Duchenko, A., Ottilie-Kovelman, S., Tediosi, F., & Blanchet, K. (2023). Re-evaluating our knowledge of health system resilience during COVID-19: lessons from the first two years of the pandemic. *Int J Health Policy Manag*, *12*(1), 6659. https://doi.org/10.34172/ijhpm.2022.6659

WHO. (2022, February 7). *Essential health services face continued disruption during COVID-19 pandemic*. Www.who.int. https://www.who.int/news/item/07-02-2022-essential-health-services-face-continued-disruption-during-covid-19-pandemic

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

World Health Organization. (2023, May 2). *New Survey Results Show Health Systems Starting to Recover from Pandemic*. Www.who.int. https://www.who.int/news/item/02-05-2023-new-survey-results-show-health-systems-starting-to-recover-from-pandemic

World Health Organization. (2024, March 25). *Health System Resilience Indicators: WHO Releases a New Package.* Who.int; World Health Organization: WHO. https://www.who.int/indonesia/id/news/detail/25-03-2024-health-system-resilience-indicators--who-releases-new-package

World Health Organization. (2025, September 19). *Amended International Health Regulations enter into force*. Who.int; World Health Organization: WHO. https://www.who.int/news/item/19-09-2025-amended-international-health-regulations-enter-into-force