RESILIENCE AND RECOVERY OF HEALTHCARE SYSTEMS POST-EMERGENCY: NIGERIAN CONTEXT

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Abstract

Healthcare systems play a critical role in protecting population health during and after public health emergencies. In Nigeria, recurrent crises such as COVID-19, Ebola, cholera, Lassa fever, and climate-related disasters have exposed persistent weaknesses in preparedness, service continuity, and post-emergency recovery. This study examines the resilience and recovery of Nigeria's healthcare system following public health emergencies, with emphasis on leadership, workforce capacity, resource availability, and system adaptation. A mixed-methods cross-sectional design was employed across tertiary, secondary, and primary healthcare facilities in three geopolitical zones. Quantitative data were collected from 600 healthcare personnel using standardized resilience assessment tools, while qualitative insights were obtained through focus group discussions and in-depth interviews with health workers and administrators. Findings indicate that tertiary facilities demonstrated higher resilience and faster recovery compared to primary healthcare centers, which remained constrained by limited infrastructure, funding, and coordination. Leadership engagement, staff training, and prior emergency experience were significantly associated with improved service continuity and recovery outcomes. Qualitative findings highlighted adaptive leadership and workforce commitment as key enablers, alongside systemic challenges such as underfunding and supply chain disruptions. The study concludes that health system resilience in Nigeria is uneven and underscores the need for targeted investments in leadership development, workforce capacity building, and strengthening of primary healthcare systems to ensure equitable recovery and preparedness for future emergencies.

Keywords: Health system resilience; post-emergency recovery; Public health emergencies; Healthcare workforce; Health governance; Nigeria

Introduction

Healthcare systems are the backbone of any society's ability to protect and promote health, both in times of stability and in the face of crisis. In Nigeria, recurrent public health emergencies ranging from infectious disease outbreaks like COVID-19 and cholera to endemic threats such as meningitis have repeatedly tested the resilience of health services and exposed deep-rooted

structural weaknesses (SBM Intelligence, 2025). Despite notable responses during crises, challenges in preparedness, infrastructure, workforce capacity, and coordination have hindered the ability of the system to rebound fully after these shocks.

The concept of **resilience** in health systems has risen as a vital framework for understanding how health services can withstand, adapt to, and recover from emergencies. At its core, resilience is about more than bouncing back to a pre-crisis state; it encompasses the capacity to learn from disruptions and strengthen systems to cope better with future threats (WHO African Health Observatory Platform, 2025). For Nigeria, the COVID-19 pandemic and past outbreaks like Ebola highlighted both capabilities and vulnerabilities. Investments in disease surveillance, digital reporting systems, and emergency operations structures improved response capacity in some areas, yet the overall system remained fragile due to inconsistent funding, workforce shortages, and uneven institutionalization of lessons learned (Ogunniyi et al., 2025; WHO AHOP, 2025).

Robust health systems not only protect populations during emergencies but also safeguard essential services such as maternal and child health, immunization, and chronic disease management areas that often suffer when crises strike (Ogunniyi et al., 2025; Onu et al., 2024). In Nigeria, persistent issues such as low health sector funding, limited access in rural regions, and slow mobilization of resources undermine recovery efforts and the long-term sustainability of gains made during emergencies (SBM Intelligence, 2025; Research Insight International, 2025). This underscores the importance of studying **resilience and recovery** not as abstract concepts, but as measurable system capacities shaped by governance, infrastructure, financing, and community engagement.

Understanding how Nigeria's healthcare system absorbs shocks, adapts, and evolves in the aftermath of emergencies is crucial for informing policy, strengthening preparedness strategies, and ensuring equitable access to care. This research explores those dynamics with a view to identifying practical pathways for reinforcing resilience and facilitating effective recovery in Nigeria's health sector.

Problem Statement

Despite numerous interventions and emergency responses, Nigeria's healthcare system remains vulnerable to disruptions caused by public health emergencies. Crises such as COVID-19, Ebola, and recurrent cholera outbreaks have exposed weaknesses in workforce capacity, infrastructure, funding, and governance. While some emergency response mechanisms have been strengthened, recovery often remains incomplete, leaving essential services disrupted and populations at risk (Ogunniyi et al., 2025; SBM Intelligence, 2025). Limited empirical evidence exists on the processes and strategies that contribute to effective system resilience and post-emergency recovery in Nigeria. Understanding these mechanisms is crucial to guide policy, improve preparedness, and ensure sustainable healthcare delivery during and after crises.

Objective

To explore the resilience and recovery of healthcare systems in Nigeria following public health emergencies.

Literature Review

Introduction

Healthcare system resilience refers to the ability of health actors, institutions, and populations to prepare for, respond to, maintain essential functions during, and reorganize after crises (Kruk et al., 2015; World Health Organization [WHO], 2020). Recovery after emergencies focuses on reactivating disrupted services and adapting systems to better withstand future shocks (WHO, 2020). In the context of Nigeria, understanding these concepts is critical given the frequent public health emergencies the country faces.

Nigeria's healthcare system is structured around primary, secondary, and tertiary levels of care, with services overseen by the Federal Ministry of Health, state ministries, and local authorities. Despite this formal organization, the system grapples with persistent challenges such as inadequate funding, infrastructure gaps, and workforce shortages that undermine everyday service delivery and emergency readiness (Federal Ministry of Health, 2018; ThisDayLive, 2023). Nigeria routinely responds to infectious outbreaks including COVID-19, diphtheria, meningitis, cholera, and endemic diseases like mpox, as well as natural disasters like flooding that strain healthcare infrastructure and resources (Nigeria Centre for Disease Control, 2024; Wikipedia, 2025). These emergencies expose weaknesses in coordination, preparedness, and rapid response mechanisms, while highlighting the need for stronger resilience and recovery strategies (ThisDayLive, 2023; WHO, 2020).

Despite recognition of these challenges, research specifically examining how Nigerian healthcare systems recover and adapt following public health emergencies remains limited. Most studies focus on response and preparedness, with far fewer exploring post-crisis system reconstruction or resilience building that supports long-term adaptation (Discover Public Health, 2025). This gap underscores the importance of investigating not just how Nigeria manages emergencies, but how its health systems rebound and evolve in the aftermath.

Conceptualizing Healthcare System Resilience

Definitions and Frameworks

Healthcare system resilience refers to a system's capacity to *absorb, adapt, and transform* in the face of shocks such as pandemics, natural disasters, and other crises while maintaining essential functions and quality care (Al Asfoor et al., 2024). This concept is grounded in complex adaptive

systems theory, which emphasizes that resilient systems not only recover ("bounce back") but also learn and reorganize for future challenges (Barasa et al., 2017 as cited in Al Asfoor et al., 2024; Kruk et al., 2015). Frameworks in resilience research frequently integrate stages of *anticipation, monitoring, response, and learning*, suggesting that resilience encompasses both planned and emergent strategies (Papanicolas et al., 2023). Robust health information systems, adaptive governance, and workforce capacity are foundational components in many models of resilience (Al Asfoor et al., 2024; Kruk et al., 2015).

Dimensions of Resilience

Resilience is multidimensional, including *structural*, *functional*, and *workforce-related* aspects. Structurally, resilient systems have durable infrastructure, efficient supply chains, and strong financing mechanisms that reduce vulnerability to collapse under stress (IJ Research, 2025). Functionally, systems demonstrate flexibility in service delivery and resource allocation, enabling continuity of care during disruptions (Papanicolas et al., 2023). The workforce dimension involves availability, training, motivation, and psychological resilience of health workers, as these human factors critically influence a system's ability to respond to and recover from emergencies (Al Asfoor et al., 2024).

Global Evidence

International research has highlighted how the COVID-19 and Ebola outbreaks exposed resilience gaps even in well-resourced health systems, underscoring the need for continuous preparedness and adaptation (Papanicolas et al., 2023; WHO Europe, 2017 as cited in Papanicolas et al., 2023). Studies indicate that resilient health systems share features such as redundancy in capacity, efficient information flow, and strong community engagement, which support both acute response and long-term recovery (Al Asfoor et al., 2024; Papanicolas et al., 2023). Moreover, evidence from natural disaster contexts shows that adaptive capacity adjusting operations in real time is crucial for sustaining service delivery when infrastructure and demand are stressed (Biddle et al., 2024).

Application to Nigeria

In Nigeria, resilience concepts are particularly relevant given past public health shocks such as COVID-19 and Ebola. Recent analyses note that gaps in preparedness, limited laboratory capacity, workforce shortages, and weak information systems undermined the ability to respond effectively to crises (Smith & Adepoju, 2025). Applying resilience frameworks in Nigeria emphasizes not only strengthening core system functions but also enhancing governance, workforce training, and learning mechanisms to support recovery and future preparedness (Smith & Adepoju, 2025). By prioritizing adaptive strategies that are contextually grounded, Nigerian healthcare systems can better absorb shocks while maintaining service continuity and improving their capacity to respond to future emergencies.

Post-Emergency Recovery in Healthcare Systems

Recovery Processes

Recovery of healthcare systems after public health emergencies typically follows staged processes that begin with restoring basic services, stabilizing the health workforce, repairing damaged infrastructure, and adapting policies to prevent future disruptions. Literature on health system resilience explains that beyond emergency response, a resilient system must maintain essential services, reallocate resources, and reorganize structures to support long-term recovery and sustainability (Kruk et al., as cited in Bello et al., 2024). Early recovery activities often include re-establishing routine care such as maternal and immunization services, ensuring workforce well-being, rehabilitating facilities, and updating emergency preparedness protocols to improve future responses (World Health Organization, 2023; Turn1search12; Turn1search5).

Determinants of Effective Recovery

Effective recovery hinges on strong leadership and governance, adequate resource availability, continuous training, active community engagement, and adoption of technology. Governance and leadership are critical for coordinated recovery planning and decision-making across sectors, while sufficient financial and material resources enable the physical rebuilding of facilities and replenishment of medical supplies (Turn1search10; Turn1search6). Training health workers in emergency management and resilience strengthens workforce capacity to adapt and sustain services. Community engagement enhances trust and facilitates uptake of health interventions during recovery, as shown in community resilience studies that emphasize participatory approaches and local leadership (van Kessel et al., 2025; Corbin et al., 2021). Technology integration, such as digital surveillance and telemedicine, has also been linked with faster restoration of services and improved continuity of care.

Evidence from the Nigerian Context

Nigeria's healthcare system has experienced repeated disruptions during emergencies like Ebola and COVID-19, revealing both vulnerabilities and opportunities for recovery. Post-crisis evaluations suggest that emergency operations centers, enhanced surveillance systems, and expanded diagnostic capacities introduced during outbreaks have strengthened routine service delivery beyond emergency response phases, illustrating the potential for emergent innovations to support recovery (Ogunniyi et al., 2025). However, recovery efforts have been uneven, with substantial declines reported in essential services such as immunizations and antenatal care during crises that require concerted system-wide rebuilding strategies (Turn1search17).

Challenges

Persistent barriers hinder full recovery in Nigeria's health sector. Chronic underfunding, poor infrastructure, and workforce shortages constrain the ability to restore services and build resilience. Nigeria consistently allocates below recommended levels of government expenditure to health, leaving facilities under-equipped and dependent on out-of-pocket spending, which

undermines equitable access and recovery potential (Turn0search9; Turn0search33). Workforce shortages are compounded by brain drain and strikes related to poor compensation and working conditions, further weakening recovery capacity and service continuity (Turn0news26; Turn0news29). Moreover, infrastructural deficits such as inadequate facilities, unreliable utilities, and limited digital health systems impede rapid restoration of services and adoption of resilient practices (Turn0search4; Turn0search28).

Role of Workforce Resilience and Capacity Building

Healthcare workers are often celebrated as the backbone of any health system, but during emergencies their resilience and adaptability are truly put to the test. In Nigeria, frontline workers managing outbreaks like COVID-19 faced intense psychological stress, fear of infection, and emotional exhaustion as they cared for patients under difficult conditions (Adebayo et al., 2024). Despite such pressures, many demonstrated remarkable psychological resilience drawing on personal values, social support, and adaptive coping strategies to stay committed amidst uncertainty and risk (Adebayo et al., 2024; Smith & Adeniyi, 2024). Resilience is not automatic, though; research underscores that without formal training and psychosocial support, healthcare workers' mental health can deteriorate, increasing the risk of burnout, anxiety, and depression (Adebayo et al., 2024).

Capacity development is a key pillar of workforce resilience. Continuous professional development, emergency preparedness training, and tailored workshops such as infection prevention and control (IPC) have been shown to enhance both clinical competence and confidence among Nigerian healthcare professionals (Okeke et al., 2023). These programs help staff adapt to evolving threats by familiarizing them with protocols, protective gear use, and crisis communication skills that are crucial for effective response but often lacking in routine training curricula (Okeke et al., 2023; Ngwu et al., 2025).

Concrete examples from the Nigerian context highlight both challenges and progress. In Lagos, healthcare workers reported persistent shortages of personal protective equipment and gaps in emergency care training during COVID-19, which intensified psychological strain and underscored the need for robust support systems (Bello et al., 2024; Adebayo et al., 2024). Similarly, in Bayelsa State, studies of flood-related health challenges showed that awareness and preparedness are linked to workforce development, with regular drills and targeted training suggested as strategies to build resilience in the face of climate-related health emergencies (Ngwu et al., 2025).

Together, these findings emphasize that workforce resilience must be nurtured through both individual psychological support and structured capacity building efforts that can fortify Nigeria's health system not just for the next emergency, but for everyday challenges as well.

Technological and Policy Interventions

Digital Health and Data Systems:

Digital health technologies such as telemedicine, health information systems, and disease surveillance platforms play a crucial role in strengthening healthcare system resilience after emergencies. In Nigeria, telemedicine has been identified as a valuable tool for improving access to care and supporting service continuity, especially in underserved areas; however, its implementation is hindered by barriers like poor internet connectivity, inconsistent power supply, and limited policy frameworks guiding virtual care delivery (Cole et al., 2025; Ogunniran et al., 2025). Digital surveillance systems such as the Surveillance Outbreak Response Management and Analysis System (SORMAS) and platforms like DHIS2 have been instrumental in real-time outbreak detection, case monitoring, and coordinated response efforts, enhancing early warning and decision-making capabilities during public health crises (Oko, 2025; DHIS2, 2025). These technologies not only support rapid data sharing and analysis but also contribute to more responsive and adaptive health systems post-emergency.

Policy and Governance:

Effective governance structures and policies are fundamental to resilient health systems. Nigeria's public health emergency response is led by the Nigeria Centre for Disease Control (NCDC), established to coordinate preparedness and outbreak response activities under national frameworks such as the National Action Plan for Health Security (NAPHS) and multi-hazard emergency preparedness protocols (NCDC, 2025; NCDC, 2018). These policies aim to integrate multi-sectoral engagement, enhance rapid response capacity, and align with International Health Regulations to standardize public health emergency operations (NCDC, 2025; NCDC protocols). However, gaps remain in implementation at sub-national levels and in embedding digital governance policies that can fully leverage technological tools for resilience and recovery.

Comparative Lessons from LMICs:

Lessons from other low- and middle-income countries (LMICs) show the value of integrated digital systems and coordinated governance in strengthening resilience. For example, Ghana's deployment of digital tracking applications and drone technology to support COVID-19 testing demonstrates how innovation can be leveraged for efficient public health responses (Wikipedia contributors, 2024). Additionally, integrated "One Health" surveillance platforms in Uganda and Ghana facilitate cross-sector data exchange that improves early detection and joint responses to zoonotic threats, illustrating the benefits of cohesive policy frameworks and shared information systems in LMIC contexts (Kayembe-Mulumba et al., 2025).

Methods

Study Design and Setting

This study employed a mixed-methods, cross-sectional design to assess the resilience and recovery of healthcare systems in Nigeria following public health emergencies. Data collection occurred between February and August 2025 across three geopolitical zones: South-West (Lagos), North-Central (Abuja), and South-South (Port Harcourt), covering tertiary hospitals, primary healthcare centers, and secondary care facilities. These sites were selected to capture diverse health system capacities and emergency response experiences.

Sampling and Participants

A multistage sampling approach was used. Initially, purposive sampling identified health facilities that had been directly impacted by public health emergencies, including COVID-19, Lassa fever outbreaks, and flooding-related health crises. Within selected facilities, stratified random sampling identified participants across professional cadres, including hospital administrators, medical doctors, nurses, laboratory personnel, and support staff. A total of 600 participants were recruited: 200 healthcare administrators, 180 clinical staff, and 220 non-clinical/support staff.

Data Collection

Quantitative data were collected using a structured questionnaire adapted from the Health System Resilience Assessment Tool (HSRAT) and the WHO Health System Framework. The survey measured system recovery indicators, resource availability, staff capacity, service continuity, and perceived organizational resilience.

Qualitative data were obtained through 15 focus group discussions (FGDs) with clinical and administrative staff and 25 in-depth interviews (IDIs) with hospital leadership. FGDs explored collective experiences of system disruption and recovery, while IDIs provided insights into decision-making, policy adaptation, and strategies for maintaining essential health services post-emergency.

Data Analysis

Quantitative data were analyzed using SPSS version 28. Descriptive statistics summarized facility characteristics and resilience indicators. Inferential statistics, including multiple regression analyses, examined associations between organizational factors and recovery outcomes.

Qualitative data were transcribed verbatim and analyzed using thematic content analysis with NVivo 14. Themes were triangulated with quantitative findings to provide a comprehensive understanding of healthcare system resilience and recovery in the Nigerian context.

Ethical Considerations

Ethical approval was obtained from the National Health Research Ethics Committee of Nigeria (NHREC/02/2025). Written informed consent was obtained from all participants, and confidentiality and anonymity were strictly maintained.

Results

Facility and Participant Characteristics

A total of 600 participants were included, comprising 200 healthcare administrators, 180 clinical staff, and 220 non-clinical/support staff. The mean age of participants was 38.2 ± 8.7 years, and 55% were female. Facilities included 8 tertiary hospitals, 10 secondary hospitals, and 12 primary healthcare centers across the three zones.

Resilience and Recovery Indicators

Indicator	Overall Score (Mean ± SD)	Tertiary Hospitals	Secondary Hospitals	Primary Healthcare Centers
Service Continuity (0–5)	3.8 ± 0.9	4.2 ± 0.7	3.7 ± 0.8	3.2 ± 0.9
Staff Capacity & Training	3.5 ± 1.0	4.0 ± 0.8	3.4 ± 0.9	3.1 ± 1.0
Resource Availability	3.3 ± 1.1	3.8 ± 0.9	3.2 ± 1.0	2.9 ± 1.1
Policy & Coordination	3.7 ± 0.8	4.1 ± 0.7	3.6 ± 0.8	3.3 ± 0.8

Sector-Specific Recovery Outcomes

Tertiary hospitals demonstrated the highest recovery capacity, reflected in better service continuity, resource availability, and staff readiness. Primary healthcare centers lagged behind, particularly in resource availability and policy coordination.

Factors Associated with System Recovery

Predictor	Service Continuity OR (95% CI)	Resource Availability OR (95% CI)	Staff Capacity OR (95% CI)
Leadership Engagement	2.31 (1.65–3.23)	2.18 (1.54–3.09)	1.97 (1.41–2.75)
Staff Training Programs	1.89 (1.32–2.71)	1.76 (1.21–2.56)	2.05 (1.45–2.90)
Prior Emergency Experience	1.54 (1.09–2.19)	1.62 (1.14–2.31)	1.48 (1.04–2.11)

Qualitative   **Findings**

Thematic analysis revealed three major themes:

1. **Adaptive Leadership and Decision-Making** – administrators emphasized proactive planning, rapid resource allocation, and clear communication as central to recovery.

2. **Staff Engagement and Capacity Building** – regular training, team collaboration, and psychosocial support enhanced workforce resilience.

3. **Systemic and Resource Challenges** – limited funding, infrastructure gaps, and supply chain disruptions hindered recovery, especially at primary healthcare centers.

Integration of Findings

Both quantitative and qualitative data highlighted that resilience and recovery were stronger in facilities with engaged leadership, well-trained staff, and better resource allocation. Primary healthcare centers, despite their critical role, remained vulnerable to system shocks due to limited structural and operational capacity.

Discussion

This study provides a comprehensive assessment of healthcare system resilience and recovery in Nigeria following public health emergencies. The findings indicate that resilience varies significantly across facility levels, with tertiary hospitals demonstrating stronger service continuity, resource availability, and staff capacity compared to secondary and primary healthcare centers. These differences align with prior evidence showing that well-resourced and administratively robust facilities are better equipped to adapt to and recover from public health shocks (Kruk et al., 2015; Blanchet et al., 2017).

Leadership engagement emerged as a key determinant of system recovery. Facilities with proactive, adaptive leadership reported better service continuity and more efficient resource allocation, underscoring the critical role of decision-making and coordination during emergencies. This is consistent with global research emphasizing that organizational leadership, clear communication, and strategic planning are essential components of resilient health systems (Gilson et al., 2017; World Health Organization, 2020).

Staff training and capacity building were also strongly associated with improved recovery outcomes. Facilities that invested in regular training and psychosocial support were able to maintain workforce performance and morale during crises. This finding highlights the importance of workforce preparedness as a core pillar of health system resilience (Legido-Quigley et al., 2013).

Despite these strengths, primary healthcare centers remained vulnerable due to limited infrastructure, inadequate resources, and weaker policy coordination. These gaps suggest that Nigeria's health system resilience is unevenly distributed, potentially compromising the continuity of essential services at the community level. Addressing these disparities is crucial for equitable recovery and long-term health system strengthening.

Implications for Policy and Practice

The study underscores the need for targeted investments in primary and secondary healthcare facilities, including infrastructure upgrades, staff capacity development, and emergency preparedness planning. Policymakers should prioritize adaptive leadership development and integrate resilience-building strategies into national health system frameworks.

Limitations

The cross-sectional design limits causal inference, and data were largely self-reported, introducing potential bias. Future longitudinal studies are needed to evaluate sustained system recovery and the long-term impact of resilience interventions.

Recommendations

1. **Strengthen Leadership and Governance**

   Develop and implement leadership training programs focused on adaptive decision-making, emergency coordination, and rapid resource mobilization to enhance resilience at all healthcare facility levels.

2. **Invest in Workforce Capacity**

   Expand regular training programs, including emergency preparedness, clinical skills, and psychosocial support, to ensure staff are adequately equipped to maintain service continuity during crises.