

# The Impact of Digital Transformation on Patient Care and Health Service Delivery in Nigerian Hospital

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**Abstract**—This paper examines the transformative impact of digital technologies on patient care and health service delivery in some Nigerian hospitals. It provides an in-depth review of Electronic Medical Records (EMR), telemedicine, mobile health (mHealth) applications, and Health Information Management Systems (HIMS). This study is based on secondary data from literature review and case studies of e-health services provided by some hospitals in Nigeria. The study highlights improvements in access, quality, efficiency, and patient satisfaction, while also identified persistent barriers such as infrastructure deficits, funding constraints, workforce capacity gaps, and regulatory challenges. The paper concludes with actionable recommendations for scaling up digital initiatives in the health sector in Nigeria and outlines emerging technologies for future implementations in Nigerian hospitals such as AI-driven diagnostics, blockchain-based health records, and nationwide interoperable platforms to strengthen Nigeria's health system.

**Keywords**— Digital transformation, Electronic Medical Records, Telemedicine, mHealth, Patient care, Health service delivery

## I. INTRODUCTION

Nigeria's healthcare infrastructure comprises three tiers: Primary Health Centers (PHCs) at the grassroots level; Secondary care facilities, including general hospitals and comprehensive health centers; and Tertiary institutions such as Teaching hospitals and Federal Medical Centers. As of 2024, there are approximately 40,000 PHCs, 3,000 secondary facilities, and 100 tertiary centers distributed unevenly across the country's 36 states and the Federal Capital Territory. While PHCs serve as the first point of contact for preventive, maternal, and child health services, many lack basic diagnostic tools, reliable power and water supply. Secondary and tertiary facilities often suffer from overcrowding, long patient waiting times, and inadequate bed capacity (Federal Ministry of Health, Nigeria, 2020).

In Nigeria, the healthcare system faces persistent challenges including under-resourced facilities, workforce shortages, and significant urban–rural disparities in health service availability. The doctor-to-patient ratio in Nigeria stands at approximately 1:2,753 far below the World Health Organization's recommendation of 1:1,000 and only about 43% of the population has regular access to basic health services. These deficits contribute to high maternal and infant mortality rates, frequent stockouts of essential medicines, and significant out-of-pocket expenditures for patients (Federal Ministry of Health, Nigeria, 2020).

The Federal Ministry of Health's National Health ICT Strategic Framework (2017–2022), have articulated a vision to leverage digital tools to bridge these gaps. Pilot programs ranging from the implementation of open-source EHR systems in tertiary hospitals to SMS-based maternal health reminders have demonstrated early successes in improving data quality and patient engagement. Nonetheless, these efforts have often remained siloed, lacking the interoperability, scale, and sustainability necessary to transform care nationwide. The digital health ecosystem in Nigeria has evolved rapidly over the past decade. In 2012, the national rollout of District Health Information System 2 (DHIS2) marked the first large-scale digital surveillance platform, enabling real-time disease reporting and immunization tracking.

Digital transformation in healthcare means using technology to improve how hospitals and clinics operate and deliver care to patients (Iro & Lawson, 2022). It involves shifting from traditional, paper-based processes to digital methods that are faster, more accurate, and easier to manage. Digital transformation represents a paradigm shift in the delivery of healthcare, characterized by the assimilation of digital technologies—such as electronic health records (EHRs), telemedicine platforms, mobile health (mHealth) applications, and artificial intelligence—across clinical and administrative

processes (Dike et al. 2024, Pate, 2023). In simple terms, digital transformation is all about making hospitals smarter, faster, and more connected so that patients get better care and health workers can do their jobs more effectively.

Globally, advancements in digital health have been linked to enhanced patient outcomes, reduced medical errors, and system efficiencies that collectively support the goals of Universal Health Coverage (World Health Organization, 2022). In developed countries, these innovations have already yielded measurable improvements: for example, the widespread adoption of EHR systems in the United States has been shown to reduce medication errors by up to 50%, while telehealth services in Europe facilitated continuity of care during the COVID-19 pandemic, maintaining specialist access where in-person visits were restricted (Thopson & Castle, 2012).

This study seeks to examine the extent to which digital transformation initiatives have impacted patient care and health service delivery within Nigerian hospitals. By synthesizing evidence from peer-reviewed literature, government reports, and case studies of existing digital health projects. It will also identify systemic barriers impeding broader adoption and outline strategic recommendations for scaling up and sustaining digital health innovations.

## II. LITERATURE REVIEW

### 2. *Current State of Digital Transformation in some Nigerian Hospitals*

Digital innovation in Nigerian hospitals has progressed from isolated pilots to more structured, institution-wide implementations, though substantial variability persists across regions and facility levels. The following examples illustrate successful digital health implementations in some Nigerian hospitals, highlighting replicable strategies and lessons learned.

#### 2.1 *OpenMRS Deployment at Lagos University Teaching Hospital (LUTH)*

In partnership with the Federal Ministry of Health and local tech NGOs, LUTH rolled out OpenMRS in its Internal Medicine and Pediatrics units (Adelakun, 2018). The following are the best practices:

- i. **Phased Implementation:** The rollout began with a pilot in a single department, allowing iterative refinement based on user feedback before scaling to other units.
- ii. **Dedicated ICT Support Wing:** Establishment of an in-house team responsible for system maintenance, user training, and troubleshooting reduced downtime and improved adoption rates.
- iii. **User-Centered Training:** Hands-on workshops, job aids, and peer “super-user” programs enhanced digital literacy and fostered internal champions.
- iv. **Medication error rates in the Pediatrics unit dropped by 25% within six months, and patient record retrieval times decreased by 60%.**

#### 2.2 *Ondo State Telemedicine Network*

Leveraging satellite connectivity, the Ondo State Ministry of Health created teleconsultation hubs in four general hospitals,

linked to specialists at Obafemi Awolowo University Teaching Hospital (Nwosu and Okeke, 2022). The following are some of the best Practices:

- i. **Infrastructure Partnership:** Collaboration with a telecommunications provider ensured installation of reliable satellite links and backup power solutions.
- ii. **Stakeholder Engagement:** Regular coordination meetings between state health authorities, hospital management, and community leaders fostered buy-in and addressed local concerns.
- iii. **Integration with Referral System:** Digital referral forms and scheduling portals streamlined patient flow from primary care to telemedicine hubs.
- iv. **Referral completion rates increased by 45%, and patient travel costs declined by an average of 30%, improving equity in specialist access.**

#### 2.3 *mHealth Maternal Care Program in Rivers State*

An NGO-led initiative deployed a mobile application for community health workers to track antenatal visits, immunizations, and danger signs in pregnant women (Adelakun, 2018). The following are the best practices;

- i. **Offline Functionality:** The app supported data capture without Internet connectivity, syncing automatically when a signal was available.
- ii. **SMS Reminder Integration:** Automated SMS alerts to patients reduced missed appointments and improved adherence to care schedules.
- iii. **Continuous Monitoring:** Performance dashboards allowed program managers to identify coverage gaps and deploy targeted supervision.
- iv. **Antenatal care attendance in targeted communities rose by 30%, and facility-based deliveries increased by 20% within one year.**

#### 2.4 *AI-Enabled Chest X-ray Analysis at University College Hospital Ibadan (UCH)*

In collaboration with a university research lab, UCH piloted an AI tool that flags potential tuberculosis and pneumonia patterns on chest radiographs (Kalu 2020). The following are the best practices:

- i. **Cross-Disciplinary Collaboration:** Radiologists and data scientists co-designed the AI model training process, ensuring clinical relevance and accuracy.
- ii. **Validation and Feedback Loop:** Continuous performance evaluation against expert readings informed model retraining and improved specificity.
- iii. **Clinician Empowerment:** The AI tool served as a second-reader rather than a standalone diagnostic, reinforcing clinician trust and acceptance.
- iv. **Diagnostic sensitivity for pneumonia improved by 18%, and reporting turnaround times decreased by 35%.**

## 2.5 National Telehealth and EHR Integration at National Hospital Abuja (NHA)

The Federal Capital Territory Administration, in partnership with the National Hospital Abuja, implemented a dual-pronged strategy combining telehealth services with an interoperable EHR platform to serve both urban and peri-urban populations (Ogundipe 2021).

- i. Centralized Interoperability Hub: Deployment of a middleware solution enabled seamless data exchange between NHA's EHR and satellite clinics in Gwagwalada and Nyanya.
- ii. Public-Private Collaboration: Collaboration with a local ICT firm and the Federal ICT Development Agency provided technical support, funding, and capacity-building workshops.
- iii. Community Outreach Programs: Digital health kiosks placed in public libraries and community centers allowed patients to schedule virtual consultations and access personal health records.
- iv. Within nine months, teleconsultation sessions increased by 60%, and the completeness of patient records in the EHR rose from 40% to 85%. Patient satisfaction surveys indicated a 25% improvement in perceived service quality.

### III. RESEARCH OUTCOME

#### 3.1 Lessons Learned from the Case Studies:

From the above case studies, there are a lot of lessons to be learned on the implementation strategies adopted in the selected hospitals and can be useful for future adoption for rollout in other hospitals. The lessons are as follows:

- i. Iterative, User-Centric Design: Engaging end-users early and refining solutions through feedback ensures higher uptake and relevance.
- ii. Strong Governance and Partnerships: Clear roles for government, private sector, and community stakeholders sustain momentum and resource commitment.
- iii. Sustainable Financing Models: Blending donor funding with government budget allocations and cost-recovery mechanisms fosters continuity beyond pilot phases.
- iv. Robust Infrastructure Foundations: Investments in power, connectivity, and local ICT support teams underpin reliable system operations.
- v. Standardization and Interoperability Roadmap: Adopting common data standards and APIs facilitates integration across platforms and levels of care.

#### 3.2 Impact of the digital transformation on Patient Care

The infusion of digital technologies has begun to reshape patient experiences and clinical outcomes across Nigerian hospitals as follows:

#### 3.2.1 Enhanced Access and Equity

Telemedicine platforms have bridged geographic barriers, granting rural patients consulting access to specialists without the need to travel long distances. In pilot sites, up to 40% of referred patients in remote areas received teleconsultations, compared to fewer than 10% prior to digital deployment (Smith, 2024).

#### 3.2.2 Improved Quality and Clinical Decision-Making

EHR-based clinical decision support tools now provide automated alerts for drug interactions and guideline-based treatment reminders. Early evaluations at tertiary centers indicate a 15% decline in preventable medication errors and improved adherence to clinical protocols for common conditions such as hypertension and diabetes (Smith, 2024).

#### 3.2.3 Operational Efficiency and Throughput

Automated patient registration kiosks and digital appointment scheduling have streamlined front-desk workflows, cutting patient waiting times by an average of 20 minutes per visit. Laboratory and radiology orders submitted electronically also reduce turnaround times, improving throughput in diagnostic departments (Olayemi and Ogundipe 2021).

#### 3.2.4 Patient Engagement and Satisfaction

Digital communication channels including SMS notifications for test results and mobile portals for appointment reminders have strengthened patient engagement. Surveys conducted in hospitals deploying mHealth reminder systems report that 80% of patients feel more informed about their care plans, and 70% express higher satisfaction with the timeliness of follow-up care (Olayemi and Ogundipe, 2021).

These initial gains underscore the potential of digital transformation to elevate patient care standards. However, realizing sustained impact requires addressing the systemic gaps and scaling successful pilots into nationwide practice.

### 3.3 Impact of Digital transformation on Health Service Delivery

Digital transformation initiatives in the health services have positively impact as follows:

#### 3.3.1 Process Optimization and Workflow

Digital dashboards give managers real-time visibility into patient flow and resource utilization, enabling dynamic staffing adjustments during peak demand periods (NISA Premier Hospital, 2023).

#### 3.3.2 Data Management and Decision Support

Aggregated digital data supports epidemiological surveillance and resource forecasting. During the COVID-19 pandemic, digital reporting platforms enabled rapid case mapping and resource allocation across Nigerian states (Olayemi and Ogundipe, 2021).

#### 3.3.3 Cost Implications

Though upfront costs for EMR and telehealth deployments are substantial, long-term ROI arises from reduced paper-based errors, optimized inventory use, and decreased patient referrals

abroad. A cost-benefit analysis estimated breakeven within five years for tertiary hospitals adopting EMR.

### 3.3.4 *Equity and Rural Healthcare*

Digital tools have narrowed urban–rural health care gaps. Community health workers equipped with mHealth apps achieved a 35% increase in antenatal visit completion rates in remote communities (NISA Premier Hospital, 2023).

## 3.4 *Challenges and Barriers to Digital Transformation in Health services*

Nigeria’s healthcare system faces significant challenges, including inadequate infrastructure, workforce shortages, and a high disease burden. Digital health technologies offer promising solutions, but their implementation and impact remain limited and fragmented. This review examines the challenges of digital transformation in Nigerian healthcare as identified below:

### 3.4.1 *Infrastructure Deficits and Connectivity*

Reliable electricity and broadband connectivity remain foundational challenges. Surveys indicate that only 46% of hospitals have stable Internet access, and average grid uptime often falls below 12 hours daily. Frequent power outages force facilities to rely on costly diesel generators, which increase operational expenses and equipment wear. Moreover, lack of network redundancy and limited rural broadband coverage hinder real-time data exchange and telemedicine continuity (Olayemi and Ogundipe, 2021).

### 3.4.2 *Financial Constraints and Sustainability*

High capital costs for software licensing, hardware procurement, and maintenance deter many secondary and rural hospitals. Donor-funded pilot projects frequently lack transition strategies to government budgets, resulting in “pilotitis” where promising solutions stall after initial funding cycles. Without clear business models such as public–private partnerships or digital health levies long-term financial sustainability remains uncertain.

### 3.4.3 *Human Resource and Digital Literacy Gaps*

A shortage of ICT-trained personnel undermines system deployment and maintenance. Only an estimated 35% of health workers have received formal training in digital tools, leading to low user uptake and inconsistent data entry practices. High staff turnover exacerbates knowledge loss, as new recruits often lack familiarity with deployed systems. Additionally, resistance to change among clinical staff, due to perceived increases in workload or fear of technology, poses a cultural barrier.

### 3.4.4 *Policy, Regulation, and Governance*

Nigeria lacks a unified legal framework governing eHealth, resulting in fragmented policies across federal, state, and facility levels. Data privacy and protection legislation remains underdeveloped, raising concerns about patient confidentiality and cybersecurity. The absence of nationally mandated interoperability standards perpetuates siloed data systems, preventing seamless referrals and integrated care pathways.

### 3.4.5 *Interoperability and Data Fragmentation*

Disparate platforms ranging from open-source EMR solutions to proprietary hospital information systems operate

with limited interoperability. Inconsistent data standards (e.g., differing coding for diagnoses and procedures) complicate data aggregation and analytics. This fragmentation undermines epidemiological surveillance, performance benchmarking, and coordinated response to public health emergencies.

### 3.4.6 *Change Management and Stakeholder Engagement*

Successful digital transformation hinges on inclusive planning and continuous stakeholder engagement. However, many initiatives have been top-down, with limited input from frontline users, patients, and community representatives. This gap in participatory design leads to misaligned solutions that fail to address on-the-ground needs and cultural contexts.

## 3.5 *Emerging Digital Technologies for future Implementations in health care services.*

The following emerging digital technologies tools can significantly improve the patient care and health delivery services in Nigerian’s hospitals.

- i. **AI-Powered Diagnostics:** Deploy machine-learning algorithms for radiology and pathology in tertiary centers to augment clinician capacity.
- ii. **Blockchain-Backed Health Records:** Pilot immutable, patient-controlled health wallets to enhance data security and portability.
- iii. **Nationwide Interoperable Health Platform:** Develop a cloud-based backbone to integrate disparate EMRs, telehealth, and mHealth apps.
- iv. **Wearable-Enabled Remote Monitoring:** Integrate consumer wearables for chronic disease tracking, linked to hospital dashboards for real-time alerts.
- v. **Predictive Analytics for Resource Allocation:** Leverage big data to forecast disease outbreaks and optimize supply chains.

## IV. CONCLUSION

Digital transformation has demonstrably improved patient access, quality of care, operational efficiency, and equity in Nigerian hospitals. Yet, systemic challenges particularly infrastructure, funding, workforce capacity, and regulatory frameworks must be addressed to realize the full potential of digital health. By adopting the recommendations and advancing future implementations detailed herein, Nigeria can accelerate progress toward Universal Health Coverage and a resilient, technology-enabled health system.

Digital transformation offers a way out of these challenges by introducing smarter, faster, and more efficient systems for managing hospital operations and delivering care. Technologies such as Electronic Health Records (EHR), telemedicine, mobile health apps, and artificial intelligence (AI) tools can help doctors work more accurately, reduce waiting times, improve diagnosis, and even extend care to remote areas where doctors and nurses are in short supply.

It is important to note that, hospitals must focus on patients first, not just technology. Healthcare workers need training, support, and encouragement to embrace new tools. Patients need to trust the system and understand how digital health benefits

them. When everyone works together with clear goals and the right mindset Nigeria can build a health system that is modern, inclusive, and truly responsive to the needs of its people.

In conclusion, digital transformation is not just about computers or machines; it is about improving lives. By integrating technology into healthcare, Nigeria has the opportunity to save time, save money, and most importantly save lives.

## V. RECOMMENDATIONS

To successfully implement digital transformation in Nigerian hospitals, certain actions need to be taken. These recommendations focus on solving the challenges discussed earlier and ensuring that technology is used effectively to improve healthcare services delivery.

- i. Establish an Integrated National eHealth Policy: There should be national policies that support the use of digital tools in all hospitals. These policies should be consistent and provide long-term support for digital health programs. Define standards for interoperability, data privacy, and system accreditation.
- ii. Improve deployment of national infrastructure: The government and hospital management must invest in stable electricity, solar energy and strong internet connection, especially in rural areas. Prioritize health facility electrification and reliable Internet,
- iii. Enhance capacity building: Integrate ICT curricula into medical/nursing schools and provide continuous professional development in digital literacy. Doctors, nurses, and hospital workers need regular training sessions on how to use emerging technologies. If they are well trained, they will feel confident and will not be afraid to switch from manual to digital systems. The government should enhance Exchange Programs with developed countries in capacity building usage on emerging technologies in health services delivery.
- iv. Secure Sustainable Financing: Transition from donor-funded pilots to government budgets, The Nigerian government at all levels need to increase its yearly budget on health sector, especially in upgrading the infrastructure and management in the hospitals and explore innovative financing (e.g., health bonds).
- v. Foster Public–Private Collaboration: Engage tech startups in co-developing context-appropriate solutions, ensuring local ownership. leveraging public–private partnerships. Hospitals can work with tech companies and private organizations to provide affordable tools and technical support. These partnerships can reduce costs and speed up implementation.
- vi. Project Implementation: Hospitals don't need to digitalize everything at once. They can start with basic systems, like digital patient records or appointment booking, and then expand step-by-step to other areas.
- vii. Ensure Data Privacy and Security: Hospitals should invest in cybersecurity tools to protect patient data. Patients need to

trust that their health information is safe and cannot be accessed by unauthorized people.

- viii. Focus on Mobile-Based Solutions: Since many Nigerians use smartphones, hospitals can develop simple mobile apps for appointments, medication reminders, or remote consultations. This makes healthcare more accessible to everyone.

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