

Research Article

Digital Health Adoption and Performance of Healthcare Services in Akure Metropolis, Ondo State, Nigeria

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Abstract

This study assessed digital health adoption and performance of healthcare services in Akure Metropolis, Ondo State, Nigeria, where there is an acute underutilization of the accessible technological tools. A survey research method was employed, enabling the collection of pertinent data from healthcare workers and patients attending the State Specialist Hospital, Akure, the largest healthcare facility in Akure metropolis, through questionnaire administration. The data was analysed using both descriptive and inferential statistics. The formulated hypotheses were tested with the use of test statistics, while Pearson product-moment correlation and factor analysis were used to test the level of relationship between the variables. The results identify the moderate application of SMS-based medication reminders and health education, as 63.5 per cent of the respondents stated that the cost of implementing and maintaining digital health technologies has a serious influence on the capacity of hospitals to provide quality care. Also, 63.0 per cent of the sampled population admitted that government policies and regulations are important in determining the reception of digital health. The research indicates low use of integrated Hospital Information Systems (HIS) and Laboratory Information Management Systems (LIMS) as well as automated billing, with 44.5 per cent of the respondents disagreeing with the statement that the training of healthcare professionals has a positive effect on service delivery. The regression model indicates that the two most significant independent contributors of digital health adoption are operation effectiveness and infrastructure readiness, and that operation effectiveness operated significantly and positively ($\beta = 0.757$, $p = 0.000$). Conversely, policy, cost, and user readiness variables exerted a rather low effect, indicating that the development of digital health adoption rates should be directed to the improvement of operating systems, infrastructure, and the removal of organisational constraints. The study revealed that the healthcare system in Akure is technologically evolving, yet demonstrably capable of realising sizeable performance gains, where even limited digital tools are embedded.

Keywords

Digital Health, Healthcare, Health Performance, Healthcare Services, Technology, Health Adoption, Nigeria

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1. Introduction

1.1. Background to the Study

Digital health is defined by the World Health Organization (WHO) as the field of knowledge and practice associated with the development and use of digital technologies to improve health. It encompasses a wide range of tools, such as telemedicine, mobile health, and health information systems, aimed at enhancing healthcare access, quality, and efficiency [1]. Over the past few decades, digital health has come to represent a fundamental change to the way people around the world access their healthcare. Digital health technologies offer numerous opportunities to facilitate prevention, early diagnosis of life-threatening diseases, and management of chronic conditions outside of traditional health care settings. Digital devices have the potential to improve our ability to diagnose accurately, treat diseases and enhance the delivery of healthcare for individual patients, as well as empower patients to have more control over, and make better-informed decisions about their health [2]. The adoption of digital health in Nigeria is more promising in urban centers where it is being viewed as a game-changing technology aimed at resolving some issues involved in offering efficient and effective healthcare services. If embraced fully, it could enhance both delivery and outcomes of care. For example, mobile Health (m-Health) applications have been developed to cater for critical health issues like maternal care, reproductive age group and chronic illnesses [3]. With these technologies, patients can receive reminders about medication adherence, appointment scheduling, and information on various health topics with the aid of manual platforms which would reduce reliance on healthcare workers for routine follow ups. These innovations augment patient care quality through enhanced patient engagement, reducing healthcare costs, and promoting preventive health measures [3].

Digital literacy plays a crucial role in healthcare as digital literacy allows both patients and healthcare specialists to communicate with digital health technologies, such as telemedicine systems, electronic health records, and health apps. It has been established that those with advanced digital literacy have better odds of using digital health tools, making them healthier. For instance, El Benny et al., 2021 found that patients with better digital literacy were more likely to use telemedicine effectively and access accurate health information online. Such results support the value of digital literacy in the delivery of patient care and especially in underserved communities with potentially sparse healthcare facilities [4].

Another direction pointed out by the speed of the changes occurring in the field of technology is continued instruction in digital literacy. Innovation evolves so that people need to upgrade their digital expertise over and over to become current. Caroline et al., 2024 emphasize that digital literacy is not a static skill but rather a lifelong learning process, where

individuals must adapt to new technologies and digital environments to participate fully in society [5].

The present study assessed the level of digital health adoption in Akure Metropolis of Ondo State, Nigeria and its impact on the performance of healthcare services in the study area.

1.2. Statement of the Problem

Similar to any emerging technologies, implementation of digital health in healthcare system has been limited by a number of contextual and systemic drivers. The issues related to insufficient digital infrastructure, unreliable internet connectivity, and inability to find human resources are mainly acute in the low-resource context [6]. In most under resourced settings, these contextual aspects, including deficient infrastructure, skill base, funds, and socio-cultural constraints are major threats to efficient implementation and utilization of digital health technologies. Indicatively, Electronic Management Records (EMRs) and telemedicine cannot be implemented effectively because of poor power and internet connectivity attributed to the defective digital infrastructure. Additionally, most healthcare practitioners lack technical knowledge, resulting in an excessive volume of available technology being unused [7]. There has been a continued state of inefficiencies in healthcare delivery services in Akure, Ondo State such as delays in the offering of services to the patients, limited accessibility to the electronic health records of the patients, reliance on paper-based outdated system which experiences numerous errors and culminate into low quality service delivery. Thus, the study assessed digital health adoption and performance of healthcare services in Akure Metropolis of Ondo State, Nigeria.

1.3. Research Questions

This study answered the following research questions:

- 1) What are the technological tools available for digital health services in the study area?
- 2) What are the factors influencing the adoption of digital health services in the study area?

1.4. Objectives of the Study

The main objective of the study is to assess the effect of digital health adoption on the performance of healthcare services in a selected healthcare facility in Akure metropolis, Ondo State Nigeria. While the specific objectives are to:

- 1) investigate the technological tools available for digital health services in the study area; and
- 2) assess the factors influencing the adoption of digital health services in the study area

This research focused on digital health adoption and its

implication on the performance of healthcare delivery in Akure metropolis. The study variables include technological tools available for digital health services and factors influencing the adoption of digital health in the study area. The respondents were selected from the largest public healthcare provider available within Akure metropolis.

2. Literature Review

2.1. Conceptual Review of Literatures

2.1.1. Concept of Perception in Digital Health

The perception of digital health encompasses the attitudes, beliefs, and experiences of various stakeholders, patients, healthcare professionals, and the general public toward the integration of digital technologies in healthcare. Recent studies indicate that patients generally hold positive views toward digital health technologies. For instance, a study found that 79.8% of patients were satisfied with their digital health monitoring experiences, with 86.2% finding device usage comfortable and 78.1% expressing satisfaction with health education and feedback provided through these technologies [8]. Additionally, 87.2% of patients believed that technology has improved healthcare, and 80.3% stated that health technologies have enhanced ease of access to care [8].

Healthcare professionals' views on digital health are nuanced. A qualitative study exploring their lived experiences revealed that digital health competence is linked to the ability to provide patient-centric care through digital channels, effectively use technology and digital health systems, and interact with patients via digital means [9]. Some professionals reported sufficient competence, while others perceived a lack of skills in specific areas [9]. Another study highlighted that primary care physicians held mostly positive views on adopting digital health, noting improvements in patient empowerment and collaborative care. However, concerns were raised about potential erosion of trust, hindrance in knowledge acquisition, and reduced humanistic interaction [10]. The general public also perceives digital health positively. A survey reported that 56% of respondents felt technology enhances the quality of care, while only 8% believed it diminishes it [11]. Factors influencing the willingness to use mobile health applications include digital literacy and online habits related to sharing personal information. Interestingly, concerns about personal privacy had a weaker impact on the willingness to use these applications [12].

2.1.2. Concept of Innovation in Healthcare

Innovation in healthcare is a broad and multifaceted concept that encompasses the development and implementation of new ideas, processes, technologies, and models aimed at improving healthcare delivery, efficiency, quality, and patient outcomes [13]. Innovation is also applied to the model of

healthcare delivery. As an example, patient-centered care has turned out to be a healthcare innovation in every healthcare system in the world, with the patient being an active party in deciding on healthcare provision. One of the studies carried out by Finkelstein, 2019 emphasizes that following patient-centered care models, patients are more likely to receive a personalized approach to care and become more active in managing their health [14]. Improved health results, such as increased patient satisfaction, compliance with treatment regimens and decreased readmission rates have been associated with this approach. Based on patient-centered innovations, empathy, communication, and shared decision-making are crucial, which is an essential element of the care quality improvement.

2.2. Theoretical Review

The Technology Acceptance Model (TAM), developed by Fred Davis in 1989, is a robust and widely utilized theoretical framework designed to explain and predict users' acceptance of technology. TAM posits that two primary factors Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) significantly determine an individual's intention to use a new technology [15]. Perceived Usefulness means to what extent an individual feels that utilization of certain technology will improve his/her job performance.

This may apply to the healthcare sector as well, dealing with whether healthcare professionals feel that digital health technology tools, including Electronic Health Records (EHRs) or telemedicine platforms, would augment efficiency, accuracy and quality of patient care [16]. Perceived Ease of Use on the other hand explains the extent to which one feels that he/she will not experience any hard work when using the technology. In the context of healthcare providers and patients in Akure, in case digital health technologies are seen as convenient and easy to integrate with the current workflow, there are higher chances that they will be adopted.

Aljarboa and Miah, 2021 compared the integrated model, namely TAM combined with Task- Technology Fit (TTF) theory, to the acceptance of Clinical Decision Support Systems (CDSS) among such general practitioners in Saudi Arabia [17]. The paper concluded that the combination of such variables as performance expectancy, facilitating conditions, effort expectancy, the fit of technological device and task, and task characteristics were influential in defining the CDSS acceptance. Alharbi et al., 2020 have explored the role of technology acceptance by conducting a scoping study [18]. They sought to understand how technology acceptance is interpreted and the extent to which it is measured in mobile health (mHealth) studies. The study established that TAM is mostly applied in the determination of mHealth application acceptability whereby PU and PEOU are some of the factors that have significant impacts in determining intentions of mHealth application adoption by consumers. The review did not miss the importance of including some more constructs

within the consideration such as trust and privacy concerns, to make it explain the results of the mHealth application.

Factors that contribute to the implementation of remote healthcare technologies by healthcare professionals were explored in a study [19]. Sustainability was also considered as an important variable as part of the TAM construct to demonstrate why the variable is relevant in promoting and determining adoption of the remote healthcare technology. The findings indicated that the subjects in the study preferred the implementation of remote monitoring devices to perform telemedicine studies yet they were worried about privacy and security issues. The study revealed the need to expand the network coverage in the areas that are remote as well as the importance of the technological advancements and environmental sustainability in preconditioning the use of the remote monitoring instruments in telemedicine. Considering certain contextual factors and combining TAM with other theoretical frameworks, it would be possible to learn more about the factors that should be taken into consideration when defining the determinants of technology acceptance in a healthcare context.

2.3. Empirical Review of Literature

2.3.1. Influencing Factors of Digital Health Adoption

Khundkar et al., 2022 examined the monetary barriers to implementing such tools [20]. The study was conducted as a mixed-methods study involving interviewing healthcare providers and carrying out a survey among patients. It discovered that it was a major deterrent to patients and healthcare facilities due to its high patient and healthcare provider cost especially in the use of wearable devices, telemedicine consultations, and EHR systems.

The research highlighted the fact that the variation in financial barriers occurred both at the healthcare provider as well as patient level, i.e., an inability to make out-of-pocket payments, the need to pay to install new technological infrastructure, etc. The authors suggested development of policies that offered financial incentives, which could subsidize healthcare costs of the patient or the government, hence not affecting the budget of the healthcare agencies and the patient.

Digital health adoption is also influenced by the regulatory environment. Kushniruk et al., 2020 discussed the potential of government regulations and policies to promote or debar the adoption of digital health technologies [21]. Previous research data have revealed that such supportive policies, including those made available under the Health Information Technology and Economic and Clinical Health (HITECH) Act, contributed to fast-tracking the process of adopting electronic health records and other technologies as they introduced financial incentives to healthcare establishments. Nonetheless, there were found to be barriers of restrictive regulations imposed on data privacy and security. The authors advised that governments need to develop the possibility of maintaining policies that embrace the digital health setting, which touches

on privacy, data exchange norms, and finances health technology innovations.

Cultural attitudes toward technology and healthcare also influence digital health adoption. Rogers et al., 2020 explored how cultural beliefs impacted the acceptance of telemedicine in rural communities. Through qualitative interviews and surveys, they found that individuals in rural communities were often resistant to using telemedicine due to cultural attitudes favoring in-person healthcare visits. The study recommended that telemedicine programs be adapted to local cultural norms and values, integrating trust-building strategies and community outreach to foster acceptance [22].

2.3.2. Types of Technological Tools Available for Digital Health Services

The growth of wearable devices and their purpose in digital health was discussed in a recent study by Pereira et al., 2020 [23]. The authors did a systematic review on wearable health technologies such as fitness trackers and smart watches as well as biosensors, which have tremendously been improved over the last few years. They have been observed to increase physical activity, heart rate, and even sugar level which is very helpful to patients and caregivers. The research paper noted that there was increased popularity of such devices in handling chronic conditions including cardiovascular diseases and diabetes. Among the major discoveries was further integration of wearable devices to cloud-based systems and mobile applications, which enable real time data on sharing practices between patients and medical personnel. Pereira et al., 2022 advised that in future, wearable technology should be developed with the improvements of accuracy and battery life, and should be convenient to a wider range of users, including old-aged [23].

The third important study performed by [24] investigated the use of telemedicine to increase access to healthcare, especially in isolated and vulnerable areas. The authors applied the survey approach to evaluate the attitude of healthcare providers and patients to telemedicine. The research concluded that telemedicine channels particularly helped patients living in remote locations, where there is a shortage of medical institutions, since patients could get remote consultations through video conferences, telephone calls, or chat. Some of the challenges identified in the study included the digital divide in which some patients could not access reliable internet or digital devices, security and privacy of health data concerns. In the study conducted by [24], a recommendation was made to develop policies that will guarantee an equitable access to the telemedicine services, and that the healthcare organization should invest in the infrastructure to eliminate the digital divide.

3. Methodology

To achieve the study's objectives, a survey research method

was employed, enabling the collection of pertinent data from healthcare workers and patients attending the selected healthcare facility. The study is focused on Akure, Ondo State, with a population of approximately 774,000 based on the 2023 metro data. Akure is the capital city of Ondo State, located in the southwestern region of Nigeria. The city covers an area of approximately 331 square kilometers. The population density of Akure is about 2,338 persons per square kilometer, making it a significant urban center within Ondo State. The population growth in the city has been steady, contributing to its increasing importance as a hub for commerce, education, and healthcare in the region.

The population for this study includes healthcare workers and patients attending the selected government healthcare facility in Akure metropolis. The respondents were selected from State Specialist Hospital, Akure which is the largest public healthcare facility in the metropolis. In determining the sample size, purposive sampling which is a non-probability sampling technique was used. Under purposive sampling technique, the researchers select respondents who are relevant to the study and whose judgment is important to the study. The selected respondents were healthcare personnels such as doctors, nurses, pharmacist, and lab scientists in the healthcare facilities who though were staff also sought medical care from the facility (internal patients) and patients (external patients) aged 18 and above seeking medical attention in the facilities.

Using the Yamane's Statistical Distribution reported by Yamane, 1967 [25].

$$n = \frac{N}{1 + N \cdot e^2}$$

where

n = required sample size

N = total population of the healthcare facility

e = margin of error (set to 0.05 or 5%)

Estimated weekly external patient population ($N = 550$, $e=0.05$):

Given $n = 550$ and $e = 0.05$

$$n = \frac{550}{1} + 550 (0.0025)^2$$

$$n = \frac{550}{1} + 1.375$$

$$n = 550/2.375$$

$$n = 231.58, n = 232$$

Estimated weekly internal patient (medical staff) population ($N = 54$, $e=0.05$):

Given $n = 54$ and $e = 0.05$

$$n = \frac{54}{1} + 54 (0.05)^2$$

$$n = \frac{54}{1} + 0.135$$

$$n = 54/0.135$$

$$n = 47.58, n = 48$$

$$\text{Total Sample Size} = 232 + 48 = 280$$

Method of data analysis includes both descriptive and inferential statistics. Frequency, mean and standard deviation were used to analyze the descriptive data. The formulated hypotheses were tested with the use of tests statistics while Pearson product moment correlation and factor analysis was used to test the level of relationship between the variables.

4. Results

Data were gathered with a structured questionnaire administered to both internal patients (hospital medical workers) and external patients (non-hospital workers) who access healthcare services in State Specialist Hospital, Akure. Of the 280 questionnaires administered, 206 were returned fully completed and usable, yielding a robust response rate of 73.6 per cent (Table 1). This high level of participation provides a solid foundation for analyzing respondent demographics, the range of technological tools currently available for digital health, the extent to which these tools are being adopted, the factors that facilitate or hinder adoption, and the resulting effects on healthcare-service performance.

Table 1. Response Rate.

Questionnaire Distributed	Total Valid Questionnaire Retrieved	Response Rate
280	206	73.6%

Source: Field Survey, 2025

4.1. Technological Tools Available for Digital Health Services

Before the impact of digital health can be assessed, it is necessary to establish the baseline of technological capacity that currently exists within local healthcare facilities. Therefore, the range and maturity of hardware, software, and connectivity solutions such as Hospital Information Systems, Electronic Medical Records, mobile-health apps, and telemedicine platforms presently deployed across public and

private providers in Akure was surveyed.

As shown on Table 2, respondents indicated a moderate availability of SMS or mobile notifications for medication reminders and health education, with a mean value of 2.66. Specifically, 25.4% strongly disagreed and 41.0% disagreed, suggesting that a considerable proportion did not agree with the presence of this tool. Nonetheless, 24.4% moderately agreed, 8.3% agreed, and only 1% strongly agreed, indicating that while the adoption is not widespread, there is moderate recognition of this tool's usage within the healthcare system.

Table 2. Technological Tools Available for Digital Health Services.

Technological tools available for digital health services	Strongly Disagree	Disagree	Mod. Agree	Agree	Strongly Agree	Mean	Std Dev.	Remark
SMS or mobile notifications are used for medication reminders and health education	25.4	41.0	24.4	8.3	1.0	2.66	5.19	Moderate
A hospital information system (his) is in place to integrate various digital health services and streamline hospital operations	41.7	39.3	9.7	5.8	3.4	1.90	1.02	Low
A laboratory information management system (LIMS) is available for digital tracking and processing of laboratory tests	38.0	46.8	9.8	5.4		1.82	0.82	Low
An automated billing system is available for generating and tracking patient invoices	37.6	51.0	6.9	3.5	1.0	1.79	0.80	Very Low
Telemedicine platforms are available for remote consultations between patients and healthcare providers	49.0	35.9	5.8	8.3	1.0	1.76	0.96	Very Low
Patients can access mobile health (mHealth) applications for appointment scheduling, reminders, and health information	42.4	48.3	2.4	6.8		1.74	0.81	Very Low
The hospital has an electronic process	49.3	37.1	5.9	7.8		1.72	0.89	Very Low
The hospital has a fully operational electronic medical records (EMR) system for managing patient health data	51.9	36.4	4.9	4.4	2.4	1.69	0.93	Very Low
Ai-driven tools are available for predictive analytics and early disease detection	61.0	29.3	2.9	4.9	2.0	1.58	0.91	Very Low
Grand Mean						1.85		Low

Source: Field Survey, 2025

Regarding the availability of a Hospital Information System (HIS) designed to integrate various digital health services and streamline hospital operations, respondents showed a low mean score of 1.90. A significant proportion of respondents (41.7%) strongly disagreed, and an additional 39.3% disagreed with its availability. Only a small percentage moderately agreed (9.7%), agreed (5.8%), and strongly agreed (3.4%), which highlights limited integration of hospital operations via HIS within the study area.

The presence of a Laboratory Information Management System (LIMS) for digital tracking and processing of laboratory tests also recorded a low mean score of 1.82. The ma-

jority (46.8%) disagreed and 38.0% strongly disagreed, reflecting limited availability. Approximately 9.8% moderately agreed, while only 5.4% agreed, with no respondents strongly agreeing. Thus, the data underscores a minimal implementation of digital tracking systems for laboratory tests.

The availability of automated billing systems for generating and tracking patient invoices received a very low mean score of 1.79. Over half (51.0%) of respondents disagreed, and another 37.6% strongly disagreed with its presence, while only a small fraction of respondents moderately agreed (6.9%), agreed (3.5%), or strongly agreed (1.0%). This suggests minimal usage or near absence of automated billing

systems in the study area.

Respondents' perception of the availability of telemedicine platforms for remote consultations between patients and healthcare providers was also very low, with a mean value of 1.76. A significant 49.0% strongly disagreed, followed by 35.9% who disagreed, suggesting telemedicine is largely unavailable. Only 5.8% moderately agreed, 8.3% agreed, and just 1.0% strongly agreed, reflecting limited adoption of remote consultation platforms. The accessibility of Mobile Health (mHealth) applications for appointment scheduling, reminders, and health information also showed a very low level, indicated by a mean of 1.74. A majority of respondents (48.3%) disagreed, and another substantial proportion (42.4%) strongly disagreed, implying minimal to no usage of mHealth apps for patient management. Only minor percentages moderately agreed (2.4%) and agreed (6.8%), further confirming low implementation.

For the existence of an electronic processing system within hospitals, the mean value was also very low at 1.72. Most respondents (49.3%) strongly disagreed, and 37.1% disagreed, whereas a small proportion moderately agreed (5.9%) or agreed (7.8%). This indicates limited presence of electronic processing systems within hospital operations. The availability of fully operational Electronic Medical Records (EMR) systems for managing patient health data also showed a very low mean score of 1.69. A large portion of respondents

(51.9%) strongly disagreed, followed closely by those who disagreed (36.4%). Very few respondents moderately agreed (4.9%), agreed (4.4%), or strongly agreed (2.4%), reflecting minimal adoption of EMR systems.

4.2. Factors Influencing the Adoption of Digital Health Services

As shown on Table 3, respondents strongly agreed that the cost of implementing and maintaining digital health technologies significantly influences a hospital's ability to deliver quality healthcare services, scoring a high mean of 3.64. Specifically, 63.5% collectively agreed (37.6% agreed, 25.9% strongly agreed), with only a small percentage (17.6%) expressing disagreement. This indicates that financial constraints related to technology implementation and maintenance strongly impact digital health adoption. The influence of government policies and regulations on the adoption of digital health solutions was similarly high, with a mean value of 3.60. A considerable 63.0% of respondents agreed (37.1% agreed, 25.9% strongly agreed), while those disagreeing accounted for a modest percentage (21.0%). This highlights that government policies and regulatory frameworks significantly shape the extent and effectiveness of digital health adoption within healthcare institutions.

Table 3. Factors influencing the adoption of digital health services.

Factors influencing the adoption of digital health services	Strongly Disagree	Disagree	Mod. Agree	Agree	Strongly Agree	Mean	Remark
The cost of implementing and maintaining digital health technologies influences the hospital's ability to provide quality services	7.8	9.8	19.0	37.6	25.9	3.64	High
Government policies and regulations on digital health strongly impact the hospital's adoption of digital health solutions	7.8	13.2	16.1	37.1	25.9	3.60	High
Patients' willingness to use digital health tools positively affects healthcare delivery and outcomes	16.5	18.0	16.0	43.0	6.5	3.05	Moderate
The availability of reliable internet connectivity positively influences the efficiency of digital health services in the hospital	21.7	30.6	12.8	27.8	7.2	2.68	Moderate
Resistance to technology adoption among some healthcare workers negatively affects the hospital's healthcare performance	21.4	37.4	8.2	24.7	8.2	2.61	Moderate
The hospital's ability to securely store and protect electronic health records enhances the overall performance of digital health systems	23.9	36.6	8.8	25.9	4.9	2.51	Low
Adequate training of healthcare professionals on digital health tools has led to better healthcare service delivery	27.5	44.5	7.1	16.5	4.4	2.26	Low
The availability of digital health tools has improved patient satisfaction with hospital services	30.7	45.4	12.7	9.3	2.0	2.06	Low
The use of modern electronic medical records (emr) systems has improved patient data management and retrieval and accuracy of	40.0	34.4	8.3	13.9	3.3	2.06	Low

Factors influencing the adoption of digital health services	Strongly Disagree	Disagree	Mod. Agree	Agree	Strongly Agree	Mean	Remark
diagnosis and treatment							

Source: Field Survey, 2025

Overall, respondents highlighted financial costs and government policies as primary high-impact factors influencing digital health adoption, with moderate recognition of patient willingness, internet connectivity, and worker resistance. Conversely, issues related to training, patient satisfaction, data security, and EMR system efficacy were perceived as having relatively low influence, highlighting key areas for strategic improvement to bolster digital health adoption in Akure Metropolis.

Furthermore, a factor analysis was conducted as shown on Tables 6, 7, and 8 regarding the factors influencing the adoption of digital health services in Akure Metropolis. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.738, indicating a good level of sampling adequacy suitable for factor analysis, as values above 0.70 are typically considered acceptable. Bartlett's Test of Sphericity resulted in a significant Chi-square value of 905.989, with degrees of freedom (df) of 36 and a p-value (Sig.) of 0.000. This statistically significant result indicates that the variables included are adequately correlated for factor analysis, affirming that the data is appropriate for Principal Component Analysis

(PCA).

Principal Component Analysis extracted three significant components with eigenvalues greater than 1. The first component accounted for 42.21% of the variance (eigenvalue = 3.799), the second component explained 23.57% (eigenvalue = 2.122), and the third component accounted for 11.42% (eigenvalue = 1.027). Collectively, these three components explained 77.20% of the total variance. This is considered robust, as cumulative variance explained above 60% generally indicates a strong explanatory model. The rotated component matrix using Varimax rotation identified three distinct factor groupings. The first component represents factors related to operational effectiveness and capacity-building within hospitals, accounting for substantial variance (35.68% after rotation). It included three items with high loadings: "The use of modern Electronic Medical Records (EMR) systems has improved patient data management and retrieval, and accuracy of diagnosis and treatment" (0.927), "The availability of digital health tools has improved patient satisfaction with hospital services" (0.920).

Table 4. KMO and Bartlett's Test.

KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.738
	Approx. Chi-Square		905.989
Bartlett's Test of Sphericity	Df		36
	Sig.		0.000

Table 5. Total Variance Explained.

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.799	42.213	42.213	3.799	42.213	42.213	3.212	35.684	35.684
2	2.122	23.574	65.787	2.122	23.574	65.787	2.087	23.187	58.871

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
3	1.027	11.415	77.202	1.027	11.415	77.202	1.650	18.331	77.202
4	0.704	7.826	85.028						
5	0.554	6.157	91.185						
6	0.275	3.058	94.243						
7	0.209	2.327	96.570						
8	0.161	1.794	98.364						
9	0.147	1.636	100.000						

Extraction Method: Principal Component Analysis.

Source: Field Survey, 2025

Table 6. Rotated Component Matrix.

Rotated Component Matrix			
	Component		
	1	2	3
The availability of reliable internet connectivity positively influences the efficiency of digital health services in the hospital	0.453		0.608
The use of modern electronic medical records (EMR) systems has improved patient data management and retrieval and accuracy of diagnosis and treatment	0.927		
Adequate training of healthcare professionals on digital health tools has led to better healthcare service delivery	0.879		
Resistance to technology adoption among some healthcare workers negatively affects the hospital's healthcare performance			0.901
The cost of implementing and maintaining digital health technologies influences the hospital's ability to provide quality services		0.868	
Government policies and regulations on digital health strongly impact the hospital's adoption of digital health solutions		0.919	
The availability of digital health tools has improved patient satisfaction with hospital services	0.920		
Patients' willingness to use digital health tools positively affects healthcare delivery and outcomes	0.362	0.640	
The hospital's ability to securely store and protect electronic health records enhances the overall performance of digital health systems	0.620		0.547

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.^a

a. Rotation converged in 5 iterations. Source: Field Survey, 2025

Table 7. Model Summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.850 ^a	0.723	0.718	0.44589

a. Predictors: (Constant), Infrastructure and Organizational Barriers1, Policy, Cost, and User Readiness1, Operational Effectiveness and Capacity Building

Table 8. ANOVA.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	87.208	3	29.069	146.210	.000 ^b
	Residual	33.402	168	0.199		
	Total	120.609	171			

a. Dependent Variable: Digital Health

a. Predictors: (Constant), Infrastructure and Organizational Barriers1, Policy, Cost, and User Readiness1, Operational Effectiveness and Capacity Building

Table 9. Coefficients.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.192	0.034		64.485	0.000
	Operational Effectiveness and Capacity Building	0.635	0.034	0.757	18.634	0.000
	Policy, Cost, and User Readiness1	0.041	0.034	0.049	1.195	0.234
	Infrastructure and Organizational Barriers1	0.323	0.034	0.385	9.486	0.000

a. Dependent Variable: Digital Health

Source: Field Survey, 2025

The second component accounted for 23.19% of the variance after rotation and highlighted external environmental factors impacting adoption. The highest loading factors were "Government policies and regulations on digital health strongly impact the hospital's adoption of digital health solutions" (0.919), and "The cost of implementing and maintaining digital health technologies influences the hospital's ability to provide quality services" (0.868). Additionally, "Patients' willingness to use digital health tools positively affects healthcare delivery and outcomes" also loaded moderately on this component (0.640). This component indicates that policy, financial considerations, and patient attitudes collectively shape digital health adoption significantly.

The third component explained 18.33% of the variance after rotation, emphasizing factors related to infrastructure

and resistance. It includes "Resistance to technology adoption among some healthcare workers negatively affects the hospital's healthcare performance" (0.901), and "The availability of reliable internet connectivity positively influences the efficiency of digital health services in the hospital" (0.608).

To assess the influence of the factors on the adoption of digital health services in Akure Metropolis: [Tables 7, 8, and 9](#) presents the linear regression analysis. The regression analysis yielded a correlation coefficient (R) of 0.850, which indicates a very strong positive relationship between the identified factors (Operational Effectiveness and Capacity Building, Policy, Cost, and User Readiness, Infrastructure and Organizational Barriers) and the adoption of digital health services. The coefficient of determination (R Square) was 0.723, suggesting that 72.3% of the variation in the adoption of digital

health services can be explained by these three predictor components. The Adjusted R Square was slightly lower at 0.718, still affirming a robust model fit. The standard error of the estimate was 0.446, signifying a good level of accuracy in the predictions made by the regression model.

The analysis of variance (ANOVA) revealed the regression model was statistically significant, with an F-value of 146.210 ($df = 3, 168$) and a p-value of 0.000. This indicates strong evidence that the regression model is a good fit for predicting digital health adoption, and that at least one of the three factors significantly predict digital health service adoption in the hospitals. Examining the individual contributions of each factor reveals insightful findings. Operational Effectiveness and Capacity Building had a significant positive effect on digital health adoption ($\beta = 0.757$, $t = 18.634$, $p = 0.000$). This was the strongest predictor among the three factors, indicating that improvements in hospital operational efficiency, the effective use of EMR systems, availability of digital tools, and healthcare professional training substantially enhance digital health adoption.

Policy, Cost, and User Readiness had a relatively weak and statistically insignificant influence on digital health adoption ($\beta = 0.049$, $t = 1.195$, $p = 0.234$). This suggests that although government policies, cost considerations, and patient willingness are theoretically important, their impact within this specific context did not significantly predict the actual adoption of digital health services. Infrastructure and Organizational Barriers significantly and positively influenced digital health adoption ($\beta = 0.385$, $t = 9.486$, $p = 0.000$). While not as strong as the operational effectiveness component, infrastructure elements like reliable internet connectivity, the capacity to secure data, and addressing resistance from healthcare workers substantially predict digital health service adoption. Patient willingness registered a moderate effect (mean = 3.05).

5. Discussion

The empirical implications derived from the findings indicate that there is significant underutilization of technological tools available for digital health services in Akure Metropolis, which aligns with broader issues reported in similar healthcare contexts in developing countries. The moderate presence of SMS or mobile notifications for medication reminders and health education, as revealed in the study, parallels findings by [26] who noted the increasing but uneven adoption of SMS-based health reminders in Sub-Saharan Africa. Despite the widespread availability and relatively low cost of SMS technologies, implementation remains fragmented, primarily due to infrastructural limitations and inconsistent policy support [26].

The low availability of integrated Hospital Information Systems (HIS) has also been consistent with the past studies which have indicated major barriers regarding adoption of integrated Hospital Information System in Nigeria and other

developing regions. Akanbi et al., 2012 and Afolaranmi et al., 2021 support the fact that underutilization of HIS in Nigeria is caused by inadequacy of training, lack of infrastructures, and cost limitations [27, 28]. In addition, such constraints have a major negative impact on the possibility of introducing the concept of streamlined operations and better patient care delivery, thus limiting holistic digitization in healthcare services [27-29].

In the same vein, the low level of Laboratory Information Management Systems (LIMS) and automated billing corroborates the information about low levels of digitization of laboratory and administrative processes. In line with this, a study conducted by [29] stated that some healthcare facilities in Nigeria still placed their rely on the manual process of laboratory processing and billing because investment in digital infrastructure had not taken place. This deficit decreases the operational efficiency and raises the rates of mistakes in the process of financial management and finances diagnostics undermining the overall quality of care [28, 30]. Minimal adoption of telemedicine platform is linked with the previous findings in Nigeria where telemedicine programs were faced with major obstacles such as the lack of effective regulatory frameworks, poor internet connection, and slow patient and provider uptake [31, 32].

Importantly, [30] highlighted that it is established that although the potential of telemedicine is acknowledged, the actual implementation is yet to be achieved as in Akure Metropolis.

This principal component analysis illustrates how infrastructural barriers and internal resistance influence the efficiency and performance of digital health initiatives. Overall, the factor analysis clearly categorized factors influencing digital health adoption into three primary domains: internal operational effectiveness and training (Component 1), external policy and cost-related influences (Component 2), and infrastructural limitations and internal resistance (Component 3). These results highlight key areas for intervention and strategic planning in the improvement of digital health services adoption in healthcare institutions within Akure Metropolis. The examples provided by [33] also demonstrate that despite the undoubted potential of technology to change healthcare delivery, developing countries, such as Nigeria, lag far behind integrating such technologies into their healthcare systems because of their resource deficiencies, lack of technical expertise or deficiencies, and inappropriate policies.

The regression analysis demonstrates a strong predictive relationship between operational effectiveness, infrastructure readiness, and the adoption of digital health services. However, policy, cost, and user readiness factors did not significantly predict digital health adoption in the hospitals under study. Efforts to boost digital health adoption should primarily focus on enhancing operational effectiveness, improving infrastructure, and overcoming organizational barriers to digital technology integration.

Studies in Brazil and India suggest that consumer enthusi-

asm alone rarely drives uptake without parallel clinician endorsement and workflow redesign [34, 35]. The Akure data confirm that while patients are increasingly open to apps and portals, systemic frictions—rather than sheer demand dominate adoption outcomes. Connectivity and staff resistance, both moderate (means = 2.68 and 2.61), echo the “dual-infrastructure” problem described by [36] bandwidth gaps and tacit opposition from frontline workers jointly erode perceived reliability, prompting reversion to paper. Similar dynamics were documented in Ugandan district hospitals where slow links amplified clinicians’ skepticism toward EMR pilots [37]. Our rotated component matrix clustered these two variables with data-security worries, forming an “Infrastructure and Organizational Barriers” factor that accounted for 18 % of explained variance empirically validating prior qualitative insights. The weakest influences which are training adequacy, patient-satisfaction gains and EMR efficacy (means ≈ 2.1) underscore a persistent capability gap [38]. argue that without continuous professional development and quick wins, users struggle to see value in EMRs, a pattern reproduced here: training loaded strongly (0.879) on the “Operational Effectiveness and Capacity-Building” component, and this component proved the single largest predictor of adoption in regression ($\beta = 0.76$, $p < 0.001$).

The implication is that human-capital investments yield outsized returns an insight echoed by [39], who found a 30 % jump in EMR utilization after structured upskilling in Chilean hospitals. Interestingly, despite high bivariate importance, the combined “Policy, Cost and User Readiness” component was not a significant predictor in the multivariate model ($\beta = 0.05$, $p = 0.23$). This divergence suggests that once operational capability and infrastructure are accounted for, macro-level policy and cost signals alone do not guarantee bedside-level uptake—supporting Rogers’ diffusion theory that perceived usefulness and ease of integration trump external mandates [40].

6. Conclusion and Recommendations

6.1. Conclusion

The following conclusions were drawn:

The study set out to determine how far Akure’s healthcare sector has progressed along the digital- health continuum and what that progress means for service delivery. The evidence shows a system that remains technologically evolving yet demonstrably capable of realizing sizeable performance gains where even limited digital tools are embedded. The first objective confirmed that basic SMS reminders are the most widely available technology, while core enterprise platforms Hospital Information Systems, Electronic Medical Records, telemedicine portals, AI-driven analytics are either rudimentary or absent in most facilities. Consequently, overall digital capacity in Akure is best characterized as “low-to-moderate.”

The second objective uncovered a hierarchical influence

structure. Cost pressures and the clarity of government policy are perceived as the strongest external determinants of adoption, yet multivariate analysis showed that internal operational readiness defined by adequate training, efficient EMR workflows and visible patient benefits exerts the single greatest effect. Infrastructure quality, especially bandwidth stability and data-security safeguard, forms the second-most powerful predictor. Together, operational readiness and infrastructure explain more than 70 percent of the variance in adoption levels, underscoring that digital transformation is primarily a hospital-level capability challenge rather than a policy declaration exercise alone.

6.2. Recommendations

- 1) For federal and state health authorities, the first priority is to close the financing gap that keeps basic enterprise platforms out of reach for most facilities. Earmarked digital-health grants, disbursed through a competitive matching-fund scheme, would incentivize hospitals to co-invest in certified electronic medical-record (EMR) modules, automated billing, and laboratory-information systems.
- 2) At the hospital-management level, digital transformation must be treated as a strategic change-management program rather than a one-off technology purchase.
- 3) Because training adequacy scored lowest among all adoption drivers, hospitals should shift from one-time vendor demos to tiered, competency-based training that culminates in internal certification and is tied to annual performance reviews.

Abbreviations

HIS	Hospital Information Systems
LIMS	Laboratory Information Management Systems
WHO	World Health Organization
EMRs	Electronic Management Records
TAM	Technology Acceptance Model
PU	Perceived Usefulness
PEOU	Perceived Ease of Use
EHRs	Electronic Health Records
TTF	Task- Technology Fit
CDSS	Clinical Decision Support Systems
HITECH	Health Information Technology and Economic and Clinical Health
SMS	Short Message Service
KMO	Kaiser- Meyer-Olkin
PCA	Principal Component Analysis

Author Contributions

Opeyemi Tawakalit Emmanuel-Ajayi: Conceptualiza-

tion, Data Curation, Formal Analysis, Writing – original draft
Olutoye Ade Aladejebi: Conceptualization, Methodology, Supervision, Writing – review & editing

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The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

All authors declare that they have no conflicts of interest.

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Biography



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With a strong foundation in the life sciences and management, she brings an interdisciplinary perspective to addressing challenges in healthcare delivery and innovation. Her research focuses on digital health technology and systems, particularly in the areas of technology adoption, healthcare service performance, and the integration of digital solutions to enhance patient care. She has developed strong analytical, organizational, and problem-solving skills through her academic work and participation in multidisciplinary projects. Passionate about advancing technology-driven healthcare solutions, Ms. Emmanuel-Ajayi is committed to contributing to initiatives that improve health systems, promote equitable access to care, and strengthen healthcare project delivery in resource-limited settings.



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