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5G Wireless Mobile Network Deployment and Healthcare Service Delivery in Selected Federal Teaching Hospitals (FTHs) in North Eastern Nigeria

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Abstract

This study investigated the impact of 5G wireless mobile network deployment on healthcare service delivery efficiency in selected Federal Teaching Hospitals (FTHs) in North Eastern Nigeria, specifically FTH Gombe and FTH Azare. The study adopted a cross-sectional survey research design, and data were collected from 261 valid responses from healthcare professionals using a structured questionnaire. Data were analyzed using descriptive statistics, Spearman correlation, and multiple linear regression. Findings revealed a moderate level of awareness and integration of 5G technology among healthcare professionals, while adoption of 5G-enabled healthcare systems remains relatively low. Correlation results indicated significant positive relationships between 5G awareness/integration, enabled healthcare technology, and healthcare service delivery efficiency ($p < 0.01$). Regression analysis showed that 5G awareness/integration significantly influences service delivery efficiency ($\beta = 0.171$, $p < 0.001$), while enabled healthcare technology exerts a stronger effect ($\beta = 0.719$, $p < 0.001$). The model explained 73.7% of the variation in healthcare service delivery efficiency ($R^2 = 0.737$). The study concludes that 5G deployment enhances healthcare service delivery efficiency by improving speed, accessibility, cost effectiveness, and quality of care. However, limited adoption and integration constrain full realization of its benefits. The study recommends improved infrastructure, capacity building, and policy support to enhance 5G-enabled healthcare implementation in Nigeria.

Keywords: *5G technology, Healthcare delivery, Service efficiency, Digital health, Nigeria*

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Background to the Study

Globally, the integration of 5G technology into healthcare systems has demonstrated considerable potential in addressing challenges related to accessibility, timeliness and quality of care. In developed countries, 5G-enabled healthcare solutions have facilitated real-time communication between healthcare providers and patients, improved remote diagnosis and treatment and strengthened healthcare delivery in underserved and geographically isolated communities (Bakare et al., 2021). Furthermore, the technology has enhanced clinical decision-making through rapid data exchange and seamless connectivity among medical devices and healthcare information systems, thereby improving healthcare service efficiency and effectiveness (Kofi et al., 2024).

The healthcare sector is undergoing a rapid digital transformation driven by advances in information and communication technologies. Among these innovations, fifth-generation (5G) wireless mobile network technology has emerged as a critical enabler of modern healthcare systems due to its high-speed data transmission, ultra-low latency, enhanced reliability, and ability to support massive device connectivity (Eze & Olatunji, 2024). These capabilities have created new opportunities for improving healthcare service delivery through applications such as telemedicine, remote patient monitoring, artificial intelligence (AI)-assisted diagnostics, robotic surgery, and the Internet of Medical Things (IoMT) (Jain, 2024). As a result, healthcare institutions across the world are increasingly leveraging 5G technology to improve operational efficiency, patient outcomes, and access to quality healthcare services. Recognizing the transformative potential of digital technologies, Nigeria has embarked on a national digital transformation agenda aimed at accelerating socio-economic development through enhanced connectivity and technological innovation. The implementation of the National Digital Economy Policy and Strategy (NDEPS) and the launch of commercial 5G services by the Nigerian Communications Commission (NCC) in 2022 marked significant milestones in the country's digital evolution (Philip-Kpae et al., 2023). Healthcare has been identified as one of the strategic sectors expected to benefit from 5G deployment because of its capacity to improve healthcare accessibility, reduce service delivery bottlenecks, and strengthen healthcare system resilience. Despite these developments, healthcare institutions in many parts of Nigeria continue to face significant challenges, including inadequate infrastructure, shortage of healthcare personnel, limited access to advanced technologies, and inefficiencies in service delivery. These challenges often result in delays in diagnosis and treatment, increased healthcare costs, restricted access to specialist services, and poor patient outcomes. The deployment of 5G technology offers a promising opportunity to address these challenges through the adoption of digital health solutions capable of enhancing healthcare delivery efficiency and expanding access to quality healthcare services.

Although substantial evidence exists regarding the benefits of 5G technology in healthcare systems across developed economies, empirical studies examining its adoption and impact within the Nigerian healthcare context remain limited. Existing research has primarily focused on telecommunications infrastructure and general digital transformation, with relatively little attention given to healthcare applications. Moreover, few studies have investigated the

awareness, adoption, and utilization of 5G-enabled healthcare services among frontline healthcare professionals who are directly involved in healthcare delivery and technology implementation. The need for empirical investigation is further reinforced by concerns regarding low awareness of emerging digital technologies, inadequate integration of digital solutions into hospital operations, and infrastructural limitations that hinder the effective deployment of advanced healthcare technologies (Ogbonnaya et al., 2022). Although recent studies have highlighted the potential of 5G technology to support telemedicine, real-time diagnostics, remote consultations, and IoMT-enabled healthcare services (Musa & Yakubu, 2023). Therefore, this study examines the deployment of 5G wireless mobile network technology and its impact on healthcare service delivery efficiency in selected Federal Teaching Hospitals (FTHs) in North Eastern Nigeria.

Conceptual Literature Review

Concept of 5G Wireless Mobile Network Deployment

Fifth Generation (5G) wireless mobile network technology represents the latest advancement in telecommunications infrastructure, characterized by ultra-high data transmission speeds, ultra-low latency, enhanced network reliability, and massive device connectivity (Jain, 2024; Kofi et al., 2024). Unlike previous generations of mobile communication systems, 5G is specifically designed to support emerging technologies such as artificial intelligence (AI), cloud computing, big data analytics, machine learning, and the Internet of Things (IoT), thereby enabling digital transformation across various sectors (Philip-Kpae et al., 2023; International Telecommunication Union [ITU], 2024).

In healthcare, 5G deployment refers to the establishment and utilization of 5G-enabled infrastructure to facilitate healthcare operations, communication, diagnostics, and patient care services. According to Eze and Olatunji (2024), the high bandwidth and low latency characteristics of 5G make it possible to support real-time healthcare applications such as telemedicine, remote surgery, electronic health records, and continuous patient monitoring. Similarly, Musa and Yakubu (2023) argue that 5G deployment provides healthcare institutions with the technological foundation necessary to improve healthcare accessibility, responsiveness, and service quality.

5G Network Awareness, Adoption, and Integration

5G network awareness refers to the degree of knowledge and understanding that healthcare professionals possess regarding the existence, capabilities, benefits, and potential applications of 5G technology in healthcare delivery (Adepoju, 2023). Awareness is considered a critical determinant of technology acceptance because individuals are more likely to adopt innovations that they perceive as useful and beneficial to their work performance (Davis, 1989; Alhassan & Kwarteng, 2022). Adoption refers to the decision by healthcare institutions and healthcare professionals to utilize 5G-enabled systems and applications within healthcare operations. Technology adoption may involve the use of telemedicine platforms, remote monitoring systems, electronic health records, and digital communication tools supported by 5G infrastructure (Bakare et al., 2021; Ogbonnaya et al., 2022). According to Rogers'

Diffusion of Innovation Theory, adoption occurs when users perceive an innovation as advantageous, compatible with existing practices, and easy to use (Rogers, 2003). Integration refers to the incorporation of 5G technologies into healthcare workflows, clinical processes, communication systems, and organizational operations. Effective integration ensures that healthcare institutions maximize the benefits derived from technological investments by embedding digital solutions into routine healthcare delivery processes (Kumar et al., 2024). Studies by Eze and Olatunji (2024) indicate that successful integration of advanced communication technologies significantly improves healthcare efficiency and institutional performance.

Healthcare Service Delivery Efficiency

Healthcare service delivery efficiency refers to the ability of healthcare institutions to provide quality healthcare services in a timely, accessible, cost-effective, and resource-efficient manner (World Bank, 2023). It reflects the extent to which healthcare organizations achieve desired healthcare outcomes while minimizing waste of time, financial resources, and human effort (World Health Organization [WHO], 2024). Healthcare service delivery efficiency is increasingly recognized as a critical performance indicator because healthcare systems worldwide are facing rising patient demands, limited resources, and increasing operational complexities (OECD, 2023). Efficient healthcare systems are characterized by prompt diagnosis and treatment, effective communication, improved patient outcomes, reduced waiting times, and optimal utilization of healthcare resources (WHO, 2024). Technological innovation has emerged as a major driver of healthcare efficiency. Digital healthcare solutions improve information sharing, streamline administrative procedures, facilitate clinical decision-making, and enhance collaboration among healthcare professionals (Kofi et al., 2024; Jain, 2024).

Speed of Healthcare Service Delivery

Speed of healthcare service delivery refers to the promptness with which healthcare services are provided to patients from the point of entry to the completion of treatment (WHO, 2024). Timely healthcare delivery is essential for improving patient outcomes, reducing mortality rates, and enhancing patient satisfaction. The deployment of 5G technology has the potential to significantly improve healthcare service speed by facilitating rapid data transmission, real-time communication, and immediate access to patient information (Eze & Olatunji, 2024). Telemedicine consultations, cloud-based healthcare systems, and remote diagnostic platforms supported by 5G networks reduce delays in diagnosis and treatment processes (Kumar et al., 2024). According to Philip-Kpae et al. (2023), hospitals that utilize advanced digital communication systems experience shorter patient waiting times and faster service delivery.

Cost Efficiency in Healthcare Delivery

Cost efficiency refers to the ability of healthcare institutions to provide healthcare services while minimizing operational costs and maximizing resource utilization (World Bank, 2023).

Cost-efficient healthcare systems seek to achieve better health outcomes with available financial and human resources. 5G-enabled healthcare technologies contribute to cost efficiency by reducing unnecessary hospital visits, minimizing travel expenses, facilitating remote consultations, and improving resource allocation (Musa & Yakubu, 2023). Telemedicine and remote monitoring systems reduce healthcare expenditure for both patients and healthcare institutions by enabling healthcare services to be delivered virtually (Eze & Olatunji, 2024). Recent studies have shown that digital healthcare technologies supported by 5G can significantly lower operational costs while improving healthcare accessibility and quality (Kumar et al., 2024).

Accessibility of Healthcare Services

Accessibility refers to the ease with which individuals can obtain healthcare services when needed regardless of geographical location, socio-economic status, or physical limitations (WHO, 2024). Healthcare accessibility remains a major challenge in many developing countries, particularly in rural and underserved communities. 5G technology has the potential to enhance healthcare accessibility through telemedicine, mobile health applications, and remote healthcare delivery systems (Bakare et al., 2021). By enabling real-time communication between patients and healthcare providers, 5G networks reduce geographical barriers to healthcare access and facilitate the delivery of specialist services to remote communities (Kofi et al., 2024). According to Adepoju (2023), the adoption of 5G-enabled healthcare systems can substantially improve healthcare coverage and reduce disparities in access to healthcare services.

Quality of Healthcare Services

Quality of healthcare services refers to the degree to which healthcare interventions improve desired health outcomes and conform to established professional standards (WHO, 2024). High-quality healthcare is characterized by effectiveness, safety, patient-centeredness, timeliness, efficiency, and equity. The integration of 5G technology enhances healthcare quality by supporting real-time data exchange, improving diagnostic accuracy, facilitating continuous patient monitoring, and strengthening collaboration among healthcare professionals (Jain, 2024). Advanced healthcare technologies supported by 5G enable healthcare providers to access patient information more efficiently and make informed clinical decisions (Kumar et al., 2024). Studies by Eze and Olatunji (2024) found that hospitals utilizing advanced digital health systems reported improved patient outcomes and higher levels of service quality.

5G-Enabled Healthcare Technologies

5G-enabled healthcare technologies refer to digital healthcare applications, devices, and systems that rely on 5G network capabilities for effective operation (Musa & Yakubu, 2023). Examples include telemedicine platforms, remote diagnostic systems, wearable health monitoring devices, robotic-assisted healthcare technologies, smart ambulances, and Internet of Medical Things (IoMT) applications (Jain, 2024). These technologies leverage the speed, reliability, and connectivity of 5G networks to facilitate efficient healthcare delivery.

Telemedicine enables virtual consultations, while remote diagnostic systems support the transmission of medical images and patient information in real time (Bakare et al., 2021). Similarly, IoMT devices continuously collect and transmit patient health data, allowing healthcare professionals to monitor patients remotely and respond promptly to emergencies (Kofi et al., 2024).

Operational Efficiency Among Healthcare Professionals

Operational efficiency among healthcare professionals refers to the ability of healthcare workers to perform clinical and administrative tasks effectively while minimizing time, effort, and resource wastage (OECD, 2023). Operational efficiency is reflected in improved productivity, effective communication, faster decision-making, and enhanced workflow management. The deployment of 5G-enabled healthcare technologies enhances operational efficiency by facilitating real-time information sharing, automating routine tasks, improving interdepartmental communication, and supporting data-driven clinical decisions (Musa & Yakubu, 2023). According to Kofi et al. (2024), healthcare professionals who utilize advanced digital technologies experience improved workflow coordination and greater productivity.

Empirical Literature

Ibanga et al., (2024) conducted a survey with Nigerian telecom experts (N=38) to evaluate the impact, deployment strategies, and challenges of 5G technology. The study revealed that 5G significantly improves network speed (mean=3.72), reduces latency (4.05), and drives economic growth (3.69). Key strategies for successful deployment include regulatory support (4.04), infrastructure investment (3.72), and network slicing (3.88). Major challenges identified include skill shortages (4.10), cybersecurity risks (3.98), and bureaucratic delays (3.93). The authors recommend greater collaboration among government, industry stakeholders, and international partners to overcome barriers and optimize 5G's potential in Nigeria.

Pahalson et al., (2023) assessed the opportunities and challenges of deploying 5G technology in Nigeria, focusing on its impact on sectors such as security, healthcare, agriculture, energy, and transportation. Using secondary data and discourse analysis, the study emphasized the transformative potential of 5G in improving broadband access, enabling the Internet of Things (IoT), and supporting smart infrastructure. The findings highlighted how 5G could enhance public safety, remote healthcare, and agricultural productivity. However, challenges such as inadequate power supply, low spectrum availability, misinformation, and infrastructural deficits were identified. The study concluded that successful 5G deployment in Nigeria requires strong public-private partnerships, improved infrastructure, policy reforms, and public sensitization. Philip-Kpae et al. (2023) explored the economic opportunities presented by 5G deployment in key sectors of Nigeria, including healthcare, education, agriculture, and transportation. Using a quantitative research approach, the study surveyed 385 employees from MTN, Airtel, Globacom, and 9Mobile in Nigeria's South-South region. Data were analyzed through descriptive statistics and structural equation modeling (AMOS software). The study found that 5G offers significant potential to enhance productivity,

connectivity, and innovation in the selected sectors through high-speed data transmission, low latency, and greater capacity. The study concluded that successful 5G deployment could modernize critical industries and drive national development but emphasized the need for infrastructure investment, policy support, and stakeholder collaboration.

Ogbonnaya et al., (2022) investigated strategies for deploying and managing 5G networks in Nigeria, focusing on reducing costs and supporting efficient rollout. They used data forecasting and cost analysis to evaluate infrastructure deployment models and projected subscriber growth under normal, optimistic, and pessimistic scenarios. The study revealed that infrastructure sharing could significantly reduce costs. Subscriber growth was forecasted to be 171.52%, 163.35%, and 155.19% over a ten-year period under the different scenarios. The study emphasized that successful 5G rollout depends on effective infrastructure sharing and planning.

Bakare et al. (2021) reviewed 5G network implementation strategies in Nigeria, identifying key challenges and proposing suitable deployment approaches. Using qualitative methods based on secondary data, the study analyzed policy documents, global case studies, and academic sources. It found that Nigeria plans a phased 5G rollout, starting with Non-Standalone (NSA) systems and transitioning to Standalone (SA) networks by 2025. The main challenges include spectrum scarcity, regulatory issues, and infrastructure gaps. The study concluded that 5G has the potential to drive economic growth and innovation in Nigeria, but success will depend on supportive government policies, stakeholder collaboration, and investment in technology.

Methodology

Study Design

The study adopted a cross-sectional survey research design. This design was considered appropriate because it allows the collection of data at a single point in time from healthcare professionals regarding their perceptions of 5G awareness, adoption, integration, and its impact on healthcare service delivery efficiency. The design is suitable for examining relationships among variables and testing hypotheses using quantitative statistical techniques.

Study Area

This study was conducted in selected Federal Teaching Hospitals in North-Eastern Nigeria, specifically Federal Teaching Hospital Gombe and Federal Teaching Hospital Azare, Bauchi State. The North-East geopolitical zone comprises six states: Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe. The region is characterized by a mix of savannah and semi-arid ecological zones and continues to face developmental challenges, particularly in healthcare infrastructure, workforce distribution, and access to modern medical technologies.

Population of the Study

The population of the study comprised all clinical healthcare professionals working in the selected Federal Teaching Hospitals. These include doctors, nurses, pharmacists, laboratory

scientists, radiographers, physiotherapists, and other clinical staff involved in direct patient care. The total population was 3,411, distributed as follows:

i. Federal Teaching Hospital Azare = 1,663
ii. Federal Teaching Hospital Gombe = 1,748

Sample Size Determination

The sample size was determined using the Taro Yamane (1967) formula for finite populations:

$$N = \frac{N}{1 + N\,(e)^2}$$

Where n denotes the sample size, N represents the population size, and e is the level of precision.

Substituting the population size (N = 3,411) and precision level (e = 0.05):

$$N = \frac{3{,}411}{1 + 3{,}411\,(0.05)^2}$$

$$N = \frac{3{,}411}{1 + 3{,}411\,(0.0025)^2}$$

$$N = \frac{3{,}411}{1 + 1.9475}$$

$$N = \frac{779}{2.9475}$$

$$N \approx 358$$

Thus, the minimum sample size required was 358 respondents. However, due to non-response and incomplete questionnaires, only 261 valid responses were retrieved and used for final analysis.

Sampling Technique and Procedure

The study employed a stratified random sampling technique to ensure proportional representation of respondents across hospitals and professional categories. In the first stage, the population was stratified based on the two selected hospitals Federal Teaching Hospital Azare and Federal Teaching Hospital Gombe in the second stage, each hospital was further stratified into professional categories, including doctors, nurses, pharmacists, laboratory scientists, radiographers, physiotherapists, and other clinical staff. Proportional allocation was used to determine the number of respondents drawn from each hospital based on population size:

Azare: 1,663 / 3,411 ≈ 49% → 128 respondents
Gombe: 1,748 / 3,411 ≈ 51% → 133 respondents

Thereafter, simple random sampling was used within each stratum to select individual respondents. Staff lists obtained from the hospitals served as the sampling frame.

Instrument for Data Collection

Data were collected using a structured questionnaire designed by the researcher. The questionnaire was divided into two sections: Section A: Demographic characteristics of respondents (gender, age, educational qualification, and years of experience). Section B: Items measuring the study variables, namely: 5G Awareness and Integration, 5G-Enabled Healthcare Technologyand Healthcare Service Delivery Efficiency Healthcare Service Delivery Efficiency was measured using indicators such as speed of service delivery, accessibility, cost efficiency and quality of care. All items in Section B were measured using a 5-point Likert scale ranging from: 1 = Strongly Disagree to 5 = Strongly Agree.

Method of Data Collection and analysis

Data collection was conducted through personal administration of questionnaires to respondents in the selected hospitals. This approach improved response rate and allowed clarification of items where necessary. Respondents were given adequate time to complete the questionnaires, and follow-ups were made to ensure maximum retrieval. Data collected were coded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. The analysis was carried out in two stages: Descriptive statistics: Frequencies, percentages, means, and standard deviations were used to summarize respondents' demographic characteristics and describe the level of 5G awareness, adoption, integration, and use of 5G-enabled healthcare technologies. Inferential statistics: Spearman's Rank Correlation Coefficient was used to determine the relationship between 5G awareness/integration, 5G-enabled healthcare technology, and healthcare service delivery efficiency. Multiple Linear Regression Analysis was used to examine the extent to which 5G awareness/integration and 5G-enabled healthcare technology jointly and individually influence healthcare service delivery efficiency.

The regression model is specified as:

$$HSDE = \beta_0 + \beta_1 (5GAI) + \beta_2 (EHT) + \varepsilon$$

Where;
HSDE = Healthcare Service Delivery Efficiency, 5GAI = 5G Awareness and Integration, EHT = Enabled Healthcare Technology, β_0 = constant, β_1–β_2 = coefficients and ε = error term

Ethical Considerations

Ethical approval was obtained from the management of the selected hospitals prior to data collection. Participation in the study was voluntary and informed consent was obtained from all respondents. Confidentiality and anonymity of respondents were strictly maintained and data were used solely for academic purposes.

Results and Discussion

Demographic Characteristics of Respondents

The summary of demographic characteristics of the respondents, including gender, age, educational qualification, and years of experience are presented in Table 4.1 below. This is essential to provide background information on the sample and to understand the composition of respondents involved in the study.

Table 1: Demographic Characteristics of Respondents (N = 351)

Variable	Category	Frequency	Percentage (%)
Gender	Female	133	37.9
	Male	218	62.1
Age Bracket	20–29	87	24.8
	30–39	127	36.2
	40–49	77	21.9
	50–59	48	13.7
	Above 60	12	3.4
Educational Qualification	Diploma	29	8.3
	HND/BSc	126	35.9
	MBBS	70	19.9
	MSc	84	23.9
	PhD/Consultant	42	12.0
Years of Experience	< 5 years	97	27.6
	5–10 years	118	33.6
	11–15 years	81	23.1
	16–20 years	35	10.0
	Above 20 years	20	5.7

Source: Author's Computation Using SPSS Version 25.

The demographic distribution of respondents shows that males constitute the majority with 62.1%, while females account for 37.9%. This indicates a higher male representation among healthcare personnel in the selected hospitals. In terms of age distribution, the majority of respondents fall within the 30–39 years category (36.2%), followed by those aged 20–29 years (24.8%). This suggests that most respondents are relatively young and within active working age, which is relevant for understanding their exposure to and use of healthcare technologies. Regarding educational qualification, most respondents hold HND/BSc qualifications (35.9%), followed by MSc holders (23.9%) and MBBS holders (19.9%). This reflects a reasonably educated workforce capable of engaging with advanced healthcare technologies such as 5G-enabled systems. For years of experience, the highest proportion of respondents have 5–10 years of experience (33.6%), followed by those with less than 5 years (27.6%). This indicates that the study largely captures responses from moderately experienced healthcare professionals who are likely familiar with both traditional and emerging healthcare systems. The demographic profile suggests that the respondents are sufficiently diverse and experienced to provide reliable insights into the impact of 5G awareness and healthcare technologies on service delivery efficiency

Spearman Correlation Analysis

To examine the relationship among 5G Awareness/Integration, Enabled Healthcare Technology, and Healthcare Service Delivery Efficiency in the selected Federal Teaching Hospitals, Spearman's rank correlation coefficient was employed. This was considered appropriate due to the ordinal nature of the variables and the need to assess the strength and direction of association among the study constructs. The results are presented in Table 2 below.

Table 2: Spearman Correlation

Variables	5g Awareness Integration	Enabled Healthcare_Technology	Healthcare_Service delivary Efficiency
5g Awareness Integration	1.000		
Enabled Health care technology	.476**	1.000	
Healthcare Service delivery Efficiency	.714**	.843**	1.000

Note: Correlation is significant at the 0.01 level (2 -tailed).

Source: Author's Computation Using SPSS Version 25.

The results presented in Table 2 reveal that there is a positive and statistically significant relationship among all the study variables at the 0.01 level of significance. Specifically, 5G Awareness/Integration has a moderate positive relationship with Enabled Healthcare Technology ($\rho = 0.476, p < 0.01$). This implies that an increase in awareness and integration of 5G technologies is associated with a corresponding increase in the adoption and utilization of healthcare technologies in the selected hospitals. Furthermore, Awareness/Integration shows a strong positive relationship with Healthcare Service Delivery Efficiency ($\rho = 0.714$, $p < 0.01$), indicating that improved awareness and integration of 5G technologies significantly enhance the efficiency of healthcare service delivery. In addition, Enabled Healthcare Technology exhibits a very strong positive relationship with Healthcare Service Delivery Efficiency ($\rho = 0.843$, $p < 0.01$). This suggests that the deployment and utilization of 5G-enabled healthcare technologies play a major role in improving the effectiveness, speed, and quality of healthcare services., the findings suggest that while awareness and integration facilitate technology adoption, the direct implementation of healthcare technologies has the strongest influence on healthcare service delivery efficiency in the selected hospitals.

Model Summary

Table 3 presents the model summary of the multiple regression analysis examining the effect of 5G Awareness/Integration and Enabled Healthcare Technology on Healthcare Service Delivery Efficiency in the selected Federal Teaching Hospitals.

Table 3: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error of Estimate	F-Statistic	df	Sig.
1	.858	.737	.735	.37632	487.369	(2, 348)	.000

Source: Author's Computation Using SPSS Version 25.

The result presented in Table 3 shows the overall explanatory power of the regression model. The correlation coefficient (R = 0.858) indicates a very strong positive relationship between the independent variables and healthcare service delivery efficiency. This suggests that improvements in 5G awareness/integration and enabled healthcare technology are strongly associated with improved healthcare service delivery efficiency in the selected hospitals. The coefficient of determination ($R^2 = 0.737$) reveals that approximately 73.7% of the variation in healthcare service delivery efficiency is jointly explained by 5G awareness/integration and enabled healthcare technology. This indicates that the independent variables possess substantial explanatory power in predicting healthcare service delivery efficiency, while the remaining 26.3% is explained by other factors outside the model. The adjusted R^2 value of 0.735 further confirms the robustness and predictive strength of the regression model after adjusting for the number of explanatory variables included in the analysis. The F-statistic value of 487.369 with a significance level of 0.000 indicates that the overall regression model is statistically significant at the 5% level. This implies that the explanatory variables jointly exert significant influence on healthcare service delivery efficiency in the selected Federal Teaching Hospitals. Consequently, the null hypothesis stating that 5G-related technologies have no significant effect on healthcare service delivery efficiency is rejected. The result therefore demonstrates that increased awareness, integration, and utilization of 5G-enabled healthcare technologies significantly improve healthcare service delivery efficiency.

Regression Coefficients

Table 4 presents the regression coefficients showing the individual contributions of 5G Awareness/Integration and Enabled Healthcare Technology to Healthcare Service Delivery Efficiency.

Table 4: Regression Coefficients

Variables	Coefficient (Beta)	Std. Error	t	Sig.	VIF
5G Awareness/Integration	0.171	0.046	3.957	0.000	2.477
Enabled Healthcare Technology	0.719	0.043	16.623	0.000	2.477
Constant	0.650	0.110	5.938	0.000	—

Source: Author's Computation Using SPSS Version 25.

The regression result in Table 4 reveals that 5G Awareness/Integration has a positive and statistically significant effect on healthcare service delivery efficiency. The standardized beta coefficient of 0.171 indicates that a unit increase in awareness and integration of 5G technologies leads to a corresponding increase in healthcare service delivery efficiency. The variable is statistically significant with a t-value of 3.957 and probability value of 0.000, which is less than the 0.05 level of significance. This implies that increased awareness and institutional integration of 5G technologies contribute significantly to improved healthcare delivery outcomes within the selected hospitals.

Similarly, Enabled Healthcare Technology demonstrates a strong positive and statistically significant effect on healthcare service delivery efficiency. The beta coefficient of 0.719

indicates that enabled healthcare technologies such as telemedicine, remote diagnostics, and IoT-based healthcare systems exert substantial influence on healthcare service delivery efficiency. The t-statistic of 16.623 and p-value of 0.000 confirm that the variable is highly significant. This finding suggests that increased deployment and utilization of 5G-enabled healthcare technologies significantly improve speed, accessibility, communication efficiency, and quality of healthcare services in the selected hospitals. The collinearity statistics further indicate the absence of multicollinearity problems among the explanatory variables. The VIF values of 2.477 for both variables are below the acceptable threshold of 10, indicating that the independent variables are not excessively correlated. This confirms the reliability and stability of the regression estimates generated by the model.

Summary, Conclusion and Recommendations

Summary of Findings

This study examined the impact of 5G wireless mobile network deployment on healthcare service delivery efficiency in selected Federal Teaching Hospitals in North-Eastern Nigeria (FTH Gombe and FTH Azare). The study specifically assessed 5G awareness, adoption, and integration among healthcare professionals and evaluated their effects on healthcare service delivery efficiency. Findings from the study revealed that healthcare professionals exhibit moderate awareness of 5G technology; however, the level of adoption and integration remains relatively limited. Correlation analysis indicated that all variables are positively and significantly related at the 0.01 level. Specifically, 5G awareness and integration demonstrated a moderate positive relationship with enabled healthcare technologies, while both constructs showed strong relationships with healthcare service delivery efficiency. Furthermore, regression analysis revealed that 5G awareness and integration significantly influence healthcare service delivery efficiency ($\beta = 0.171$, $p < .001$), while enabled healthcare technology exerts a stronger and more substantial effect ($\beta = 0.719$, $p < .001$). The model explained approximately 73.7% of the variance in healthcare service delivery efficiency ($R^2 = .737$), indicating strong explanatory power.

Conclusion

The study concludes that 5G wireless mobile network deployment is a significant determinant of healthcare service delivery efficiency in Federal Teaching Hospitals in North-Eastern Nigeria. While awareness and integration of 5G technologies are essential precursors to adoption, the actual implementation of 5G-enabled healthcare technologies has the most significant impact on healthcare service outcomes. The evidence further indicates that hospitals that adopt technologies such as telemedicine, remote diagnostics, IoT-based health monitoring, and real-time communication systems experience improved efficiency in service delivery. These improvements are reflected in reduced waiting times, enhanced accessibility, lower operational costs, and improved quality of care. However, the relatively moderate level of integration suggests that the healthcare sector in the study area is still in the early stages of digital transformation. Therefore, the full benefits of 5G in healthcare delivery can only be achieved through sustained investment in infrastructure, human capacity development, and institutional support.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. First, healthcare institutions should intensify efforts to improve 5G awareness among healthcare professionals through continuous training, seminars, and digital literacy programs. This will enhance readiness for adoption and effective utilization of emerging healthcare technologies.
2. Second, Federal Teaching Hospitals should prioritize the integration of 5G-enabled healthcare systems into routine clinical and administrative operations. Technologies such as telemedicine platforms, electronic health records, IoT-based monitoring systems, and AI-assisted diagnostics should be fully embedded into hospital workflows.
3. Third, government and hospital authorities should invest in modern ICT infrastructure to support reliable 5G connectivity and ensure seamless healthcare service delivery.
4. Fourth, policymakers should develop clear regulatory frameworks and implementation strategies that encourage the adoption of 5G technologies within the healthcare sector in Nigeria.
5. Fifth, collaboration between government agencies, healthcare institutions, and telecommunication companies should be strengthened to ensure sustainable deployment and maintenance of 5G-enabled healthcare systems.
6. Finally, adequate funding should be allocated to support digital health transformation initiatives, particularly in underserved regions such as North-Eastern Nigeria.

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