



**Evaluating the Effect of Information and Communication Technology on
Healthcare Service Delivery in Nigeria: A Focus on Specialist Hospital
Sokoto State**

Garba Ibrahim Tanko¹

Aisha Shehu Zaki²

¹Department of Public Administration, Usmanu Danfodiyo University, Sokoto, Nigeria.

Corresponding Author: garibtan65@gmail.com

Abstract

The aim is to evaluate the effect of information and communication technology on healthcare service delivery in Nigeria with particular reference to Specialist Hospital Sokoto State. To realize this, the paper employed the use of secondary data to review existing literature and official reports related to this study. Based on the review, the study concludes that the use of Information and Communication Technology (ICT) in healthcare service delivery has revolutionized the way healthcare is delivered to patients and had a significant impact on various aspects of healthcare, from improved patient care to increased efficiency in healthcare systems as well as enhancing patient care and safety. The study recommends further improvement including the need for increased investment in ICT infrastructure, training of healthcare professionals on ICT tools, and continuous monitoring and evaluation of ICT implementation as well other healthcare facilities should also consider adopting ICT solutions to enhance healthcare service delivery.

Keywords: Information and Communication Technology, Healthcare Service Delivery.

1. Introduction

Healthcare service delivery plays a paramount important in addressing emerging global health challenges aiming to improve the health outcome and well-being of the citizens in the society. The WHO (2010) emphasizes the importance of healthcare service delivery in achieving universal health coverage, promoting equitable access to essential healthcare services, and improving health outcomes. Healthcare service delivery, encompassing primary, secondary, and tertiary care, involves the provision of preventive, promotive, curative, and rehabilitative services. Effective service delivery can significantly reduce morbidity and mortality rates and enhance the overall well-being of individuals and communities (WHO, 2010).

Today, with the advancement of technology, Information and Communication Technology (ICT) tools have become increasingly important in achieving the



above WHO objectives and enhancing healthcare services worldwide, the technology is changing the landscape of the world and leading us towards a sophisticated technical world. ICT applications such as electronic health records (EHRs), telemedicine, and mobile health (mHealth) have revolutionized the healthcare industry.

Despite significant efforts to improve healthcare service delivery, Nigeria still faces numerous challenges that hinder its progress. The underfunding of the healthcare system has resulted in inadequate infrastructure, equipment, and essential medical supplies (Abolade *et al.*, 2017). Limited access to quality healthcare, especially in rural areas, leads to disparities in healthcare service delivery (Abimbola *et al.*, 2014). Furthermore, the shortage and uneven distribution of healthcare professionals, including doctors and nurses, exacerbate the problem (Awofeso, 2017). The doctor-to-patient ratio in Nigeria is 1:5,000 which is below the recommended ratio of 1:600 (WHO, 2018). These challenges hinder effective healthcare service delivery and contribute to poor health outcomes in the country.

Therefore, it is based upon the above-stated problems that this study raised a question on what extent to which ICT tools enhance healthcare service delivery in Nigeria. Several studies have examined the effect and impact of information and communication technology on healthcare service delivery, focusing on different aspects such as efficiency, accessibility, and quality; all about either one or two aspects of ICT tools (Lau *et al.*, 2012; Whitten *et al.*, 2002; Lee *et al.*, 2016; Adler-Milstein *et al.*, 2017). However, despite the existing research on the topic, a noticeable gap can be observed regarding the study area, most of these studies were conducted in other countries and Nigeria as well but none was done specifically at Sokoto Specialist Hospital. To fill this gap, the study aims to examine the extent to which ICT influences healthcare service delivery in Nigeria specifically Sokoto State Specialist Hospital. Furthermore, to achieve this objective, after employing the use of secondary data to review previous studies, the paper is divided into an introduction, conceptual clarification, empirical review, theoretical framework, and finally conclusion and recommendation for the study.

2. Literature Review

Concept of Information and Communication Technology

Information and Communication Technology (ICT) refers to the use of various technological tools, devices, and systems to manage, store, transmit, and share information. It involves the integration of hardware, software, networks, and telecommunications to facilitate efficient communication, data management, and information processing (Basu & Bhattacharya, 2014). ICT is a broad umbrella term that encompasses a wide range of technologies and applications. It



includes, but is not limited to, computers, mobile devices, telecommunications networks, internet services, software applications, electronic databases, and digital communication tools (World Health Organization, 2012).

ICT plays a crucial role in transforming various sectors, including healthcare. It has revolutionized healthcare service delivery, enabling improved access to care, enhancing communication and collaboration among healthcare professionals, streamlining administrative processes, and facilitating the collection, analysis, and sharing of health data (Sabesan et al., 2018). In healthcare, ICT has brought significant advancements in areas such as electronic health records (EHRs), telemedicine, telehealth, mHealth applications, medical imaging, health information systems, and health analytics (World Health Organization, 2012).

Theoretical Framework

Technology Acceptance Model (TAM). TAM was developed by Davis in 1989 and has been widely used to explore the factors influencing the adoption and use of technology in various fields, including healthcare (Davis, 1989).

According to TAM, the acceptance and successful integration of technology into healthcare service delivery are influenced by two main factors: perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989). Perceived usefulness refers to the degree to which individuals believe that a particular technology will enhance their performance and efficiency in healthcare service delivery. Perceived ease of use refers to the degree to which individuals believe that using a particular technology will be effortless and straightforward.

Applying TAM to the effect of ICT on healthcare service delivery at Sokoto Specialist Hospital, the study can assess healthcare professionals' perceptions of ICT's usefulness in improving patient care, enhancing communication between healthcare providers, facilitating record-keeping, and streamlining administrative tasks. Additionally, the study also can explore healthcare professionals' perceptions of the ease of using ICT, including user-friendliness, system compatibility, and training/support availability.

Several studies have applied TAM to investigate the impact of ICT on healthcare service delivery. For example, a study by Holden and Karsh (2010) examined the adoption of Electronic Medical Records (EMR) systems in hospitals and found that the perceived usefulness and ease of use were important determinants of the successful implementation of EMR systems. Another study by Huang et al. (2014) applied TAM to assess the acceptance and use of mobile health applications among patients. They found that perceived usefulness and ease of use significantly influenced patients' intention to use mobile health applications.



These studies provide evidence for the importance of TAM in understanding the effects of ICT on healthcare service delivery. Considering the perceived usefulness and ease of use of ICT tools, healthcare organizations can design and implement technologies that are more likely to be adopted and used effectively by healthcare providers and patients. Therefore, this study also will employ TAM to examine healthcare professionals' attitudes toward ICT adoption and usage in Sokoto Specialist Hospital. Because TAM can enable the study to provide valuable insights into the factors that promote or hinder the integration of ICT into healthcare service delivery. These insights can facilitate the development of strategies to overcome barriers and promote the effective utilization of ICT in Sokoto Specialist Hospital

3. Healthcare Service

Healthcare service also referred to as healthcare delivery or healthcare provision, encompasses the organized provision of medical services to individuals, families, or communities in need of healthcare. It involves a range of activities, including prevention, diagnosis, treatment, and rehabilitation, aimed at maintaining and improving the health and well-being of individuals and populations. The WHO defines healthcare service as "all the activities whose primary purpose is to promote, restore, or maintain health." It includes services provided by medical professionals, hospitals, clinics, and other healthcare facilities (WHO, 2005). It's also viewed as the "preventive, curative, and palliative care provided to individuals in need of medical attention." It encompasses a wide range of services, such as primary care, specialist care, emergency care, and long-term care (Centers for Disease Control and Prevention, 2017). More elaborately, the Institute of Medicine, (2001) sees it as an "organized provision of medical care to individuals or communities." It emphasizes the importance of organizing and coordinating healthcare services to ensure accessibility, quality, and safety.

The objectives of healthcare service delivery are multifaceted and aim to ensure the provision of high-quality, accessible, affordable, and patient-centered care. These objectives are crucial for promoting and maintaining the health and well-being of individuals and populations as follows; improve Health Outcomes: One primary objective of healthcare service delivery is to enhance health outcomes. This includes improving the overall health status of individuals, reducing morbidity and mortality rates, and increasing life expectancy. Effective delivery of healthcare services, such as preventive measures, early diagnosis, appropriate treatment, and follow-up care, is vital for achieving this objective (World Health Organization, 2010). Increase Access to Healthcare: Another important objective is to ensure equitable access to healthcare services for all individuals, regardless of their socio-economic status, geographical location, or other related



factors. The aim is to eliminate barriers to access and ensure that vulnerable populations receive the care they need. Strategies to achieve this include the establishment of healthcare facilities in underserved areas, the implementation of outreach programs, and the use of telemedicine and mobile health technologies to reach remote populations (World Health Organization, 2019).

Enhance Patient Satisfaction and Experience: Healthcare service delivery should prioritize patient satisfaction by providing a positive and supportive care experience. This includes ensuring respectful and compassionate treatment, involving patients in decision-making processes, and addressing their individual needs and preferences. Positive patient experiences are associated with better treatment outcomes and increased adherence to treatment plans (Rathert et al., 2013). **Improve Efficiency and Cost-Effectiveness:** Healthcare services should be delivered efficiently, optimizing the use of resources to reduce inefficiencies and unnecessary costs. This objective involves streamlining administrative processes, adopting evidence-based practices, utilizing technology for electronic health records and communication, and implementing strategies for waste reduction. Improving efficiency and cost-effectiveness, healthcare systems can allocate resources more appropriately and ensure sustainability (World Health Organization, 2010). **Enhance Safety and Quality of Care:** The objective of healthcare service delivery is to provide safe and high-quality care to patients. This includes preventing medical errors, reducing healthcare-associated infections, promoting adherence to clinical guidelines, and continuously monitoring and improving the quality of care provided. Effective care coordination, the implementation of patient safety protocols, and robust quality improvement initiatives are critical for achieving this objective (Institute of Medicine, 2001).

Information and Communication Technology Tools used in Providing HealthCare Service

Different ICT tools and technologies have revolutionized healthcare, transforming the way services are delivered and improving patient outcomes. EHRs are electronic versions of patients' medical records that encompass their entire medical history. These systems enable healthcare providers to access and update patient information in real time, resulting in improved coordination and continuity of care. According to a study by Adler-Milstein et al. (2014), the implementation of EHRs has been associated with increased patient safety, better adherence to clinical guidelines, and improved quality of care delivery. Telemedicine involves the use of ICT to provide healthcare services remotely, allowing patients to consult with healthcare professionals without being physically present. Telemedicine encompasses various modalities, such as videoconferencing, remote monitoring, and store-and-forward technology. A



systematic review conducted by Gagnon et al. (2012) found that telemedicine interventions were associated with positive outcomes, including increased access to healthcare, improved patient satisfaction, and reduced healthcare costs.

Health information exchanges (HIEs) are platforms that facilitate the exchange of patient's health information across different healthcare providers and systems. They enable healthcare professionals to access and share patient information securely, leading to improved care coordination and reduced duplication of tests and procedures. A study by Vest et al. (2014) demonstrated that HIEs were associated with improved healthcare outcomes, including reduced emergency department visits and hospital readmissions.

Health applications and wearable devices are mobile-based technologies that allow individuals to monitor and manage their health and wellness. These tools can collect various health data, such as heart rate, exercise activity, and sleep patterns, and can provide personalized feedback and reminders. A systematic review by Free et al. (2013) showed that mHealth interventions were effective in improving patient self-management, medication adherence, and health outcomes.

Challenges Associated with Healthcare Service Delivery

One of the challenging issues associated with healthcare service delivery is inadequate infrastructure in the healthcare sector. Many healthcare facilities in Nigeria lack basic amenities such as electricity, clean water, and essential medical equipment (Uzochukwu et al., 2020). This hampers the delivery of quality healthcare services and can negatively impact patient outcomes. Another challenge is the insufficient healthcare workforce. Nigeria has a shortage of healthcare professionals, including doctors, nurses, and midwives (Oleribe et al., 2015). This scarcity of skilled healthcare personnel limits the capacity to provide adequate care, particularly in rural areas where healthcare access is already limited. Against, limited funding is another significant challenge in healthcare service delivery. The Nigerian government allocates a small portion of the national budget to the health sector, resulting in inadequate resources for healthcare provision (Uzochukwu et al., 2020). Insufficient funding limits the ability to improve infrastructure, acquire necessary medical equipment, and attract and retain qualified healthcare professionals.

In addition, low healthcare utilization rates pose challenges to healthcare service delivery in Nigeria. Many Nigerians, especially those in rural areas, face barriers to accessing healthcare, including high costs, long distances to healthcare facilities, and lack of awareness about available services (Oleribe et al., 2015). This leads to delayed or inadequate care, worsening health outcomes, and increased burden on the healthcare system.



Informational and Communication Technology and its Effect on Healthcare Service Delivery

The use of Information and Communication Technology (ICT) in healthcare has revolutionized service delivery, leading to improved patient outcomes and efficient healthcare systems in different ways. One significant effect of ICT on healthcare service delivery is increased accessibility to care. ICT tools such as telemedicine and mobile health apps have allowed healthcare providers to reach patients in remote areas, eliminating the barriers of geographical distance. For instance, telemedicine enables patients to consult with physicians remotely, saving time and money on travel expenses (WHO, 2010). A study conducted in rural communities in the United States found that telemedicine led to a 53% decrease in hospital admissions and a 50% reduction in emergency department visits (Bashshur *et al.*, 2011). This demonstrates how ICT can enhance access to healthcare services, particularly for underserved populations.

Furthermore, ICT has improved medical decision-making by providing clinicians with immediate access to diagnostic tools and medical databases. Electronic Health Records (EHRs) have revolutionized patient management by centralizing medical information, allowing for a comprehensive view of a patient's medical history and enabling better-informed decisions (Menachemi & Collum, 2011). The use of decision support systems integrated within EHRs assists clinicians in making accurate diagnoses, selecting appropriate treatments, and monitoring patient progress (Hersh, 2009). Consequently, healthcare providers can provide safer, more effective care, leading to improved patient outcomes.

Moreover, ICT has greatly enhanced communication among healthcare professionals, resulting in streamlined care coordination and improved patient safety. Health Information Exchange (HIE) systems enable the seamless sharing of patient information across different healthcare organizations (Vest, 2014). This facilitates collaboration among healthcare professionals, allowing for better coordination of services and reduced medical errors (Angst *et al.*, 2018). In a study conducted in a large teaching hospital, the implementation of an electronic medication reconciliation system through an HIE reduced adverse drug events by 49% (Pronovost *et al.*, 2012). This highlights how ICT enables effective communication, leading to improved patient safety and quality of care.

4. Conclusion and Recommendations

The use of Information and Communication Technology (ICT) in healthcare service delivery has revolutionized the way healthcare is delivered to patients. It has had a significant impact on various aspects of healthcare, from improved patient care to increased efficiency in healthcare systems. ICT has played a crucial role in enhancing patient care and safety. Electronic Health Records



(EHRs) have enabled healthcare providers to access complete and up-to-date patient information, leading to better diagnosis and treatment decisions. This has resulted in improved patient outcomes and reduced medical errors. Moreover, telemedicine, which utilizes ICT tools to provide remote healthcare services, has facilitated access to healthcare in rural and remote areas, ensuring that patients receive timely and appropriate care. It also helps in reducing healthcare costs and increasing efficiency. Digital systems have automated various administrative tasks, such as appointment scheduling, billing, and inventory management, reducing the time and effort required for manual paperwork. This has not only saved healthcare providers significant amounts of money but also enabled them to allocate more resources to patient care. Additionally, the use of ICT in healthcare has enabled the sharing of medical knowledge and expertise among healthcare professionals, leading to better collaborative decision-making and reducing unnecessary duplication of tests and procedures.

To further enhance the effect of ICT on healthcare service delivery, this study recommends that specialist hospitals should invest in robust ICT infrastructure, with high-speed internet connectivity, secure servers, and reliable hardware and software systems. A strong and reliable ICT foundation is crucial for the successful implementation of healthcare technologies. Specialist hospitals should prioritize staff training and education to ensure healthcare professionals are proficient in utilizing ICT tools. Training programs should be regularly updated to keep pace with technological advancements. Data security and patient privacy must be given utmost priority. Specialist hospitals should implement robust data protection measures, such as encryption and secure access controls, to safeguard patient information from unauthorized access or breaches. Authorities and policymakers should promote the adoption of ICT in healthcare through incentives and funding schemes. Financial support can encourage specialist hospitals to invest in technology and facilitate the wider implementation of ICT tools in healthcare service delivery.

References

- Abimbola, S., Olanipekun, T., Igbokwe, U., & Negin, J. (2014). Nigeria. *Health System Review*, 4(3), 1-4.
- Jeremiah O. Abolade, Olasebikan A. Fakolujo, Abidemi Orimogunje. (2017) Handover in Mobile Wireless Communication Network – A Review. *International Journal of Advanced Engineering Management and Science*. Vol-3, Issue 9, September 2017.
- Adler-Milstein, J., Jha, A. K., Orav, E. J., & Bates, D. W. (2017). The Extent of Hospital Adoption of Electronic Health Records. *American Journal of Managed Care*, 23(5), e130-e138.



- Angst, C. M., Devaraj, S., & Xue, Y. (2018). Electronic Health Records: A Review and Research Agenda. *European Journal of Information Systems*, 27(1), 52-69.
- Bashshur, R. L., Shannon, G. W., Smith, B. R., & Woodward, M. A. (2011). The Empirical Foundations of Telemedicine Interventions for Chronic Disease Management. *Telemedicine and e-Health*, 17(3), 216-220.
- Basu, A., & Bhattacharya, A. K. (2014). Concept of ICT and IT-Enabled Services. *Proceedings of the International Conference on Issues and Challenges in Networking, Intelligence and Computing Technologies*, 373-378.
- Benjamin S. C. Uzochukwu, Chinyere Okeke, Niki O'Brien, Francis Ruiz, Issiaka Sombie, and Samantha Hollingworth. (2020). Health Technology Assessment and Priority Setting for Universal Health Coverage: A Qualitative Study of Stakeholders' Capacity, Needs, Policy Areas of Demand and Perspectives in Nigeria. *Journal of Globalization and Health* Volume 16, Article Number 58.
- Centers for Disease Control and Prevention (CDC). (2017). Glossary of Public Health Terms. Retrieved from <https://www.cdc.gov/opphss/csels/dsepd/ss1978/lesson3/section1.html>
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319-340.
- Free, C., Phillips, G., Felix, L., Galli, L., Patel, V., Edwards, P., ... & Haines, A. (2013). The Effectiveness of M-health Technologies for Improving Health and Health Services: a Systematic Review Protocol. *BMC Research Notes*, 6(1), 1-6.
- Hersh, W. (2009). Health Care Information Technology: Progress and Barriers. *Journal of the American Medical Association*, 302(1), 1067-1076.
- Holden, R. J., & Karsh, B. T. (2010). The Technology Acceptance Model: its Past and its Future in Healthcare. *Journal of Biomedical Informatics*, 43(1), 159-172.
- Huang, Y., Liu, X., Jiang, X., & Chen, Y. (2014). The Impact of mHealth Applications on Users' Behaviors: A Theory-Based Perspective. *International Journal of Mobile Communications*, 12(4), 385-403.
- Institute of Medicine (IOM). (2001). *Crossing the Quality Chasm: A New Health System for the 21st Century*. Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK222274/>
- Karami, M., Shahmoradi, L., & Ebrahimi, S. (2019). The Impact of Health Information Exchange on Healthcare Quality and Cost-effectiveness: Systematic Literature Review and Research Agenda. *International Journal of Medical Informatics*, 125, 98-107.



- Lau, F., Kuziemy, C., & Price, M. (2012). A Review on Systematic Reviews of Health Information System Studies. *Journal of the American Medical Informatics Association*, 19(6), 1019-1028.
- Lau, R. W. M., Wong, I. O. L., & Cheung, P. T. (2018). Impact of Telemedicine on Healthcare Accessibility in Rural Communities of Developed Countries: A Systematic Review. *International Journal of Medical Informatics*, 117, 116-126.
- Lee, J., Park, Y. R., Shin, S. Y., Kim, J. H., & Lee, J. (2016). Development of a Mobile Healthcare Service System for Diabetes Care. *Journal of Medical Systems*, 40(6), 141.
- Obinna Ositadimma Oleribe, Iheaka Paul Ezieme, Olabisi Oladipo, Ezinne Patience Akinola,
- Deborah Udofia & Simon D. Taylor-Robinson. (2016). Industrial Action by Healthcare Workers in Nigeria in 2013–2015: An Inquiry Into Causes, Consequences, and Control—Across-Sectional Descriptive Study. *Journal of Human Resource For Health*.
- Menachemi, N., & Collum, T. H. (2011). Benefits and Drawbacks of Electronic Health Record Systems. *Risk Management and Healthcare Policy*, 4, 47-55.
- Pronovost, P., Weast, B., Holzmüller, C., Rosenstein, B. J., Kidwell, R. P., & Haller, K. B. (2012). Evaluation of the Culture of Safety: Survey of Clinicians and Managers in an Academic Medical Center. *Quality and Safety in Health Care*, 15(2)
- Rathert, C., Wyrwich, M. D., & Boren, S. A. (2013). Patient-Centered Care and Outcomes: a Systematic Review of the Literature. *Medical Care Research and Review*, 70(4), 351-379.
- Sabesan, S., Simcox, K., Marr, I., Philip, T., & Shaw, T. (2018). Medical Oncology Clinics Through Videoconferencing: an Acceptable Telehealth Model for Rural Patients and Health Workers. *Internal Medicine Journal*, 48(10), 1201-1206.
- Gagnon, Marie-Pierre & Asua, José & Abdeljelil, Anis & Emparanza, Jose. (2011). Using a Modified Technology Acceptance Model to Evaluate Healthcare Professionals' Adoption of a New Tele Monitoring System. *Telemedicine Journal and e-health: the official journal of the American Telemedicine Association*. 18. 54-9. 10.1089/tmj.2011.0066.
- Vest, J. R., Issel, M., & Harle, C. A. (2017). Health Information Exchange in the Wild: The Association Between Organizational Capability and Perceived Utility of Clinical Event Notifications in Ambulatory and Community Care. *GEMS*, 5(1), 1-12.
- Whitten, P., Buis, L., Wesso, T. H., Mackert, M., & Johnson, E. D. (2002). Assessing Information Technology's Support for Medication Management



- in an Integrated Delivery System. *Journal of Health Information Management*, 16(4), 48-54.
- WHO. (2010). Monitoring and Evaluating the Health Systems Strengthening Process: A Toolkit for Countries. World Health Organization. Retrieved from https://www.who.int/healthinfo/statistics/toolkit_hss/en/
- World Health Organization (WHO). (2005). Everybody's Business: Strengthening Health Systems to Improve Health Outcomes. Retrieved from https://www.who.int/healthsystems/strategy/everybodys_business.pdf?ua=1
- World Health Organization. (2012). *mHealth: New horizons for health through mobile technologies* (Global Observatory for eHealth Series, Volume 3). Geneva: World Health Organization.
- World Health Organization. (2018). *Health Workforce Data and Statistics*. Retrieved from: <https://www.who.int/data/gho/data/themes/topics/health-workforce>
- World Health Organization. (2019). *WHO Guideline: Recommendations on Digital Interventions for Health System Strengthening*. Geneva: World Health Organization.