AG EDITOR

REVIEW

Artificial Intelligence in Nigeria Healthcare: A Review of State, Challenges and Opportunities

La inteligencia artificial en la sanidad de Nigeria: análisis de la situación actual, retos y oportunidades

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ABSTRACT

Objective: to examine the current stage of Artificial Intelligence (AI) adoption in Nigeria's healthcare system, identify the progress made, the persistent challenges and potential opportunities.
Method: a narrative review of literature from 2013 to 2025 was conducted using PubMed, Google Scholar, Researchgate and African Journals Online. Studies focusing on AI applications in healthcare settings within were selected.
Results: findings revealed AI applications in diagnostics, telemedicine, public health surveillance, and hospital administration. However, infrastructure gaps, limited digital literacy, and weak regulatory frameworks hinder widespread adoption. Opportunities exist in expanding rural access, predictive diagnostics, hospital efficiency, and health research.
Conclusion: by addressing existing barriers through strategic investments, policy reforms, and cross sector collaborations, Nigeria has the potential to harness AI to drive transformative improvements in healthcare delivery. This review serves as a call to action for stakeholders across government, academia, industry, and healthcare to work collectively toward an AI driven, patient centered healthcare future in Nigeria.

Keywords: Artificial Intelligence; Healthcare Innovation; AI in Healthcare; Nigeria Health System; Digital Health; Predictive Analytics.

RESUMEN

Objetivo: examinar la etapa actual de adopción de la inteligencia artificial (IA) en el sistema sanitario de Nigeria, identificar los avances logrados, los retos persistentes y las oportunidades potenciales.
Método: se llevó a cabo una revisión narrativa de la literatura entre 2013 y 2025 utilizando PubMed, Google Scholar, Researchgate y African Journals Online. Se seleccionaron estudios centrados en las aplicaciones de la IA en entornos sanitarios.
Resultados: los hallazgos revelaron aplicaciones de la IA en el diagnóstico, la telemedicina, la vigilancia de la salud pública y la administración hospitalaria. Sin embargo, las deficiencias en las infraestructuras, los limitados conocimientos digitales y la debilidad de los marcos normativos dificultan su adopción generalizada. Existen oportunidades para ampliar el acceso en las zonas rurales, el diagnóstico predictivo, la eficiencia hospitalaria y la investigación sanitaria.
Conclusión: al abordar las barreras existentes mediante inversiones estratégicas, reformas políticas y colaboraciones intersectoriales, Nigeria tiene el potencial de aprovechar la IA para impulsar mejoras

transformadoras en la prestación de asistencia sanitaria. Esta revisión sirve como llamada a la acción para que las partes interesadas del gobierno, el mundo académico, la industria y la asistencia sanitaria trabajen colectivamente hacia un futuro sanitario impulsado por la IA y centrado en el paciente en Nigeria.

Palabras clave: Inteligencia Artificial; Innovación Sanitaria; IA en la Asistencia Sanitaria; Sistema Sanitario de Nigeria; Salud Digital; Análisis Predictivo.

INTRODUCTION

Over the years, the emergence of Artificial Intelligence (AI) in all areas of life has been transformative, reshaping industries, enhancing efficiency, and revolutionizing the way humans interact with technology and make decisions. Its applications are widely spread across fields such as healthcare, manufacturing, education, agriculture, telecommunication development, global marketing, and many more.[1,2,3] Since the end of the COVID19 pandemic, the use of AI in the healthcare system has increased rapidly, as it demonstrated its efficiency in combating the pandemic.[4,5] Despite the adoption of AI in healthcare systems across advanced and well developed countries, Nigeria, the giant of Africa[6] and the economic hub of West Africa still struggles to fully adopt AI and harness its potential due to challenges such as high rate of infectious disease, growing of noncommunicable diseases, inadequate knowledge of AI, infrastructural deficiencies, limited access to data, and fraud.[7,8,9] As AI continues to revolutionize the global healthcare landscape by enhancing diagnostic accuracy, improving treatment efficiency, advancing drug development and discovery, predicting diseases, optimizing medication dosages, enhancing population health management, establishing guidelines, providing virtual health assistants, supporting mental health care, improving patient education, optimizing hospital management, and influencing patient physician trust, while also reducing diagnostic and therapeutic errors, time, and costs. [10,11,12,3,7,13,14] Nigeria remains on the periphery of these advancements, necessitating a deeper exploration of its barriers and opportunities. The purpose of this study is to determine the main obstacles to AI adoption in Nigeria's healthcare system and investigate prospective avenues for AIdriven healthcare advancement.

DEVELOPMENT

Applications Of AI In Healthcare

The application of AI in healthcare is still in its early stages compared to its full potential, as researchers and scientists continue to develop and uncover new discoveries and insights into its use in areas that are currently facing limitations. Nonetheless, we will briefly discuss its applications in healthcare. The applications of AI in healthcare are as follows:

Diagnostic Assistance

Medical diagnostics involves evaluating health conditions by analyzing symptoms, medical history, and test results to determine the cause of an illness and guide treatment. Traditional diagnostic methods, such as imaging (X-Rays, MRIs, CT scans), blood tests, and biopsies, help healthcare providers make accurate diagnoses and monitor disease progression. With the recent AI revolution, medical diagnostics is being transformed by enhancing prediction accuracy, speed, and efficiency. AI algorithms can analyze vast amounts of patient data, including 2D/3D medical imaging, biosignals (ECG, EEG, EMG, EHR), vital signs, demographic details, and laboratory test results. AI powered tools assist in detecting diseases earlier and more accurately, improving decision making and treatment planning. By automating and optimizing diagnostic processes, AI minimizes human error, accelerates diagnosis, and ultimately enhances patient outcomes[15,16]

Predictive Analytics

Prediction involves estimating potential outcomes for various phenomena. AI powered predictive models are playing an increasingly significant role in early disease detection. By leveraging machine learning techniques, these models analyze imaging data, genetic information, and electronic health records (EHRs) to identify individuals at risk for conditions such as diabetes, cancer, and heart disease.[17] This proactive approach enables early intervention, improving patient outcomes and reducing the burden on healthcare systems. For example, a hospital uses a machine learning model that analyzes patient EHRs and genetic data to predict the likelihood of developing Type 2 diabetes. The model identifies individuals at high risk based on factors like family history, blood sugar levels, and lifestyle choices. By flagging these patients early, doctors can recommend lifestyle changes, medications, and regular screenings, potentially preventing the onset of diabetes and improving long-term health outcomes.

Personalized medicine

Personalized medicine, also known as precision medicine, is a healthcare strategy that customizes medical treatment based on the unique characteristics of each individual such as their genetics, lifestyle, and environmental factors.[18] Artificial Intelligence (AI) is driving significant progress in personalized medicine by offering powerful tools to process and interpret large, complex datasets leading to more precise diagnoses, tailored treatment strategies, and improved predictive capabilities for individual patients. AI models, particularly those using machine learning (ML) and deep learning, can identify patterns in data that would be difficult for humans to discern. In personalized medicine, these AI systems analyze data from various sources, including genomic sequencing, electronic health records (EHRs), medical imaging, and biomarkers, to make predictions about disease risks and recommend personalized treatment options.

Drug Discovery and Development

The traditional drug discovery and development process, from target identification to Phase 1 clinical trials and eventual FDA approval, followed by Phase 4 studies, can take several years and incur unsustainable costs. There is an urgent need to accelerate this process while reducing expenses. AI powered technologies offer a promising solution by enhancing drug discovery and development, potentially lowering attrition rates, shortening timelines, and cutting costs. AI driven drug discovery and screening, combined with laboratory automation, can optimize drug design, chemical synthesis, screening, and biological testing, improving efficiency in the design make test analyze cycle. Additionally, in the clinical trial phase, AI can assist physicians in analyzing patients' genomic data to identify targeted treatments, leading to increased drug efficacy, reduced adverse effects, expanded treatment options, and improved patient outcomes.[19]

Remote Monitoring and Telemedicine

AI is transforming remote monitoring and telemedicine by enabling realtime, datadriven healthcare solutions that improve patient management outside traditional clinical settings. Through wearable devices, smart sensors, and AIpowered applications, healthcare providers can continuously monitor patients' vital signs, detect anomalies, and intervene early when necessary. This enhances chronic disease management, reduces hospital visits, and improves patient outcomes. For instance, an AI powered smartwatch can continuously track a patient's heart rate and notify healthcare providers if signs of atrial fibrillation (AFib) are detected, allowing for timely medical intervention and reducing the risk of stroke.

State of AI in the Nigeria healthcare system

AI has rapidly transform various industries, healthcare are no exception. The relationship between AI and healthcare has the potential to significantly change how medical services are provided, how diagnoses are conducted, and patient outcomes are improved. Nigeria, home to one of the world's most dynamic youth populations, represents over half of West Africa's 250 million inhabitants and stands as a significant economic force within Africa.[20] The country is a regional economic powerhouse with huge human and natural assets, but innovation is slow because of reasons ranging from lack of adequate knowledge of AI to infrastructure issues, and lack of access to data.[21] Nigeria ranks 138 globally and 20 in the region in the Oxford Insight Government AI Readiness lagging behind South Africa, Kenya and Ghana.[22] The adoption of AI presents both opportunities and challenges for Nigeria, a nation facing difficulties within its healthcare system.

The application of AI in Nigeria's healthcare sector is still in its early stages and continues to develop.[7] It is projected that the market for AI in Nigerian healthcare will grow from $0,01 billion in 2022 to $0,13 billion by 2030, with a compound annual growth rate (CAGR) of 46,22 %.[23] This growth will be driven by the increasing availability of AI driven solutions and increasing investment in the development of AI in healthcare from both public and private sectors. The integration of AI into healthcare is expected to enhance the quality of care available to Nigerians. Additionally, it will bring numerous advantages, including enhanced automation of laboratory processes, improved accuracy in diagnosis, tailored treatment plans, more efficient healthcare operations, proactive disease detection and prevention, advancements in drug discovery, and support for clinical research.[24] While the benefits of incorporating AI into medicine are significant, its adoption has primarily been seen in developed countries.

Several Nigerian healthcare institutions have begun to implement AI based solutions to improve healthcare delivery. The Lagos University Teaching Hospital has created an AI powered system for diagnosing breast cancer. The system analyses mammograms using machine learning algorithms to detect early signs of breast cancer. Oyo State has implemented the ADVISER framework, an AI driven vaccination intervention optimizer.[25] This project is the first time an AI enabled tool chain has been successfully implemented in Nigeria to optimise health interventions. Wellvis, a Nigerian startup, created an AI powered telemedicine platform. The platform allows patients to consult with healthcare providers remotely, increasing access to healthcare services, particularly in rural areas with inadequate healthcare infrastructure. There is XOLANI, a Nigeria AI and cloud solution

for clinical decision-making. This includes software such as DICOMX, a system to support image diagnosis and analysis as well as Xolani Air which allows users to take a picture of a patient's body part and possible health issues are detected with generated report. ARONE, a Nigerian drone delivery uses medical smart aerial logistics technology with AI and autonomous flight navigation software to run drones for the delivery of medical supplies between clinics, hospitals, laboratories, and health facilities. Pronov, located in Lagos is a provider of a telehealth platform that delivers clinical decision support. The company offers an AI based platform that provides electronic medical records, diagnostics testing, prescriptions, education, referrals, chronic disease management, and other services. 10mg, an AI powered logistics management system for the pharmaceutical ecosystem. The company's solution utilizes an AI algorithm based on the code tree model to match medical providers with financing partners to enable bulk medication purchases for pain management.

Nigeria has seen an uptick in investments from both the government and the private sector toward the development of AI based healthcare solutions. The Nigerian Communications Commission (NCC) has introduced a research grant program to promote the creation of innovative and pertinent technologies, including artificial intelligence (AI) in the healthcare sector. Additionally, the pressing healthcare challenges in the country, such as insufficient medical infrastructure, a shortage of healthcare providers, and a high disease burden, are becoming more pronounced.[23] The increasing availability of AI based solutions, as well as increased government and private sector investment in the advancement of artificial intelligence in healthcare, are projected to propel AI adoption in Nigeria in the coming years.

Despite the rapid advancement of AI technology in Nigeria's medical sector, key stakeholders are expressing concerns regarding its safety. The trust and acceptance of both patients and healthcare providers are essential for the successful implementation of AI in healthcare. Issues related to the ethical ramifications of AI, data misuse, privacy concerns, the potential disruption of the patient-physician relationship, inadequate infrastructure, and the lack of transparency in AI decision making may hinder the widespread adoption of AI driven healthcare solutions.[26] To build confidence, healthcare organizations and AI developers must focus on transparency, ensuring both patients and providers can easily understand the AI systems. However, a study examining the knowledge and attitudes of healthcare professionals in Nigeria found that a considerable majority (77 %) believe machine learning can enhance service delivery. In terms of possible applications of AI in Nigerian healthcare, 68,1 % agreed that AI is vital for healthcare services. Moreover, 66,7 % of respondents thought that incorporating AI in healthcare would enhance human intelligence, and 61,5 % believed it could create new job opportunities.[27]

Challenges Hindering the adoption of AI in Nigeria's Healthcare System:
Limited Infrastructure
A fundamental challenge is the inadequate digital infrastructure in Nigerian healthcare facilities. Many hospitals and clinics still rely on paper based medical records, making it difficult to implement AI driven electronic health records (EHR) or predictive analytics. In addition, poor internet connectivity, unreliable electricity, and a lack of advanced computing resources further limit the adoption of AI technologies.[28] AI applications often require high performance computing and cloud storage, which are either unavailable or too expensive for many healthcare institutions. Without significant investment in digital infrastructure, AI adoption will remain limited to a few well-funded private hospitals or research institutions.

Lack of skilled workforce
AI and machine learning require expertise in programming, data science, and biomedical informatics. However, there is a severe shortage of skilled professionals in Nigeria who can develop, deploy, and manage AI solutions.[29,30,31] The educational system does not currently provide widespread training in AI for healthcare, and there are limited opportunities for professionals to gain hands on experience in AI driven healthcare research. Moreover, healthcare professionals, including doctors and nurses, often lack the digital literacy needed to integrate AI tools into their workflows effectively.

High cost of implementation
With Nigeria's government healthcare spending at just 4,6 % in 2017 far below the African (7,2 %) and global (10,3 %) averages,[32] public hospitals already struggle with basic resources, making AI adoption a significant challenge. Acquiring AI powered medical equipment, software, and necessary computing infrastructure is prohibitively high for most healthcare providers in Nigeria. AI models require significant investment in hardware (such as GPUs and cloud computing services) and software tools, which can be expensive. Additionally, maintaining AI systems requires continuous updates, data storage solutions, and cybersecurity measures, all of which add to the long-term financial burden. Public healthcare facilities, which serve the majority of Nigeria's population, often operate on limited budgets, making AI adoption financially unrealistic without significant external funding.

Data Privacy and Security

The adoption of AI in Nigeria's healthcare system is hindered by weak data protection frameworks, inconsistent enforcement of the Nigeria Data Protection Regulation (NDPR), and inadequate IT infrastructure, particularly in rural areas.[33] Many healthcare facilities lack secure networks, making patient data vulnerable to breaches and unauthorized access.[34] Additionally, implementing NDPR standards requires significant financial and human resources, which are often scarce.[35] Without clear regulations, robust cybersecurity measures, and proper enforcement, hospitals may be reluctant to adopt AI solutions that rely on largescale data collection.

Limited Data Availability and Quality

AI systems rely on large, high-quality datasets to train and improve their models. Unfortunately, healthcare data in Nigeria is often fragmented, inconsistent, and incomplete. Many hospitals do not have centralized digital records, and data collection practices vary widely across different institutions. Inaccurate, biased, or incomplete datasets can lead to unreliable AI predictions and reinforce existing disparities in healthcare delivery. Additionally, AI models trained on data from other countries may not generalize well to Nigeria's unique healthcare challenges, making locally relevant data even more critical. Establishing standardized data collection and management systems is essential for the effective implementation of AI.

Ethical Concerns

AI in healthcare raises several ethical questions, including bias in AI models, transparency in decisionmaking, and the role of human oversight. Many AI models are trained on datasets that may not adequately represent Nigeria's diverse population, leading to biased predictions and unequal healthcare outcomes. For example, an AI diagnostic tool trained on data from Western countries may fail to detect diseases common in Nigeria. Ethical considerations also extend to patient consent many patients may not fully understand how AI is used in their treatment. Ensuring fairness, transparency, and accountability in AI applications is essential to build trust among healthcare professionals and patients.

Limited Research and Development (R&D)

As of 2018, Nigeria's investment in research and development (R&D) remained low, accounting for just 0,22 % of its GDP, according to World Bank data. The advancement of AI in healthcare relies heavily on strong collaborations between academic institutions, hospitals, and technology firms. However, Nigeria's commitment to AI focused R&D remains limited, with only a few dedicated research centers and scarce funding opportunities for developing locally relevant AI solutions. Without substantial investment in research, Nigeria risks becoming a passive adopter of foreign AI technologies rather than a leading innovator in AI driven healthcare. To bridge this gap, increased funding, strategic international collaborations, and stronger industry partnerships are essential to drive AI research and innovation in the country's healthcare sector.

Oppurtunities for AI in Nigeria Healthcare

AI holds significant potential to transform Nigeria's health sector by addressing challenges and enhancing service deliver. Its leverage can improve healthcare outcome in Nigeria in the following areas:

Improved Access to Healthcare

Nigeria faces a critical shortage of healthcare professionals, making it difficult to deliver quality care across the country, especially in rural and underserved areas. AI enabled health monitoring technologies, such as sensor based diagnostic tools and virtual consultations, can bridge this gap. For instance, wearable sensors can facilitate self-monitoring in patients with chronic conditions like heart failure. Moreover, the integration of AI with virtual reality can extend the availability of healthcare services around the clock.[36] Salway et al.[37] emphasized that the availability of health care 24hour a day can significantly increase accessibility, particularly in remote areas.

Early Disease Detection and Enhanced Diagnosis

AI supports early detection of diseases through predictive analytics and personalized medicine.[38,39] Machine learning algorithms can analyze patient data to identify at risk individuals and predict disease progression. This not only improves patient outcomes but also reduces the overall cost of care. For example, predictive analytics can be used to identify patients who are at risk of developing complications and predicts the likelihood of deterioration in the patient.[40] By intervening early, healthcare providers can improve patient outcomes and prevent critical conditions from developing.[41]

Enhance medical research and drug development

Machine learning algorithms are reducing drug discovery time, making the process faster, safe, and more

economical.[42] AI assists in discovering new compounds for diseases and identifying the applications of previously tested compounds. A notable example includes the identification of two drugs for treating the Ebola outbreak within a day, a process that would normally take months to years. In addiction, AI can aid in the development of new treatment, advancing medical research and innovation. Virtual screening techniques powered by AI allow researchers to assess vast datasets for drug target interactions.[43] This can greatly accelerate drug discovery, allowing researchers to identify potential drug candidates more quickly and at a lower cost.

Increased efficiency in hospital management

AI can streamline hospital operations by automating administrative tasks, reducing paperwork, and enhancing electronic health record (EHR) systems.[44] This will enable health care providers to manage care for a larger number of patients. In nursing for instance, it has been reported that the use of AI enabled tools increases productivity by 30-50 %.[45] Also its speed and efficiency in diagnosis, treatment and record keeping lead to reduced labor and treatment costs, ultimately improving the quality of healthcare services.[46] Electronic health record with AI technology simplify storing and managing patient data.

Economic growth and job creation

From an economic perspective, AI adoption in healthcare offers the potential to drive national development. It can drive the growth of techbased startups, research hubs, and innovations ecosystems focused on health solutions. This in turn promotes foreign investment and contributes to GDP growth. Importantly, it also creates employment opportunities. As the AI healthcare industry grows, demand for skilled professionals such as data scientists, AI engineers, bioinformaticians, and AI ethics consultants will rise, reducing unemployment among Nigerian youths. Training programs and university partnerships can help develop a local AI talent pipeline, ensuring Nigeria is not only a consumer of AI solutions but also a producer.

CONCLUSION

This review has highlighted the evolving role of Artificial Intelligence in Nigeria's healthcare system, exploring its current applications, state of adoption, and the critical challenges and opportunities it presents. While AI technologies are beginning to make an impact through diagnostic tools, predictive analytics, personalized medicine, and telemedicine platforms, adoption remains limited due to infrastructural gaps, a shortage of skilled professionals, high costs, fragmented data systems, and ethical concerns. Nonetheless, the opportunities are significant. AI can improve access to care, particularly in underserved regions, enable early disease detection, enhance hospital management, support drug discovery, and foster economic growth through innovation and job creation. The examples of emerging AI-powered solutions in Nigerian healthcare institutions and startups demonstrate that progress is possible. However, scaling these successes will require sustained investments in digital infrastructure, education, and research, as well as robust policies to ensure data privacy and build public trust. Moving forward, a collaborative effort among government, academia, the private sector, and healthcare providers is essential to harness AI's full potential and drive meaningful improvements in Nigeria's healthcare delivery.

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CONFLICT OF INTEREST
The authors declare that there was no conflict of interest

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