09.30.2025

JOURNAL OF

Health, Metabolism & Nutrition Studies (JHMNS) Vol. 9 No. 3

ROLE OF ARTIFICIAL INTELIGENCE IN MEDICAL DIAGNOSIS (A CASE OF STUDY OF BIRNIN KEBBI METROPOLIS)

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DOI Link: https://doi.org/10.70382/bejhmns.v9i3.017

Abstract

The advancement of Artificial Intelligence (AI) has greatly impacted multiple industries, including healthcare. This research examines the adoption, use, and effects of AI-powered technologies in medical diagnostics within healthcare facilities. Using a structured questionnaire distributed among healthcare professionals-ranging from medical doctors and radiologists to laboratory technologists and IT specialists—the study investigates levels of awareness, the extent of AI integration, perceived benefits, and challenges. The findings reveal that while awareness of AI is notably high (80%) among healthcare professionals, actual integration into diagnostic processes remains moderate, with most institutions reporting minimal to moderate usage. AI applications are predominantly found in radiology (70%) and laboratory diagnostics (40%), where tasks such as image analysis and pattern recognition benefit greatly from AI tools. The adoption of AI has led to improvements in diagnostic accuracy (65%) and workflow efficiency

Introduction

In healthcare, AI offers significant advancements in optimizing therapeutic interventions. Machine learning algorithms can analyze extensive patient data, such as medical records, treatment outcomes, and clinical guidelines, to develop personalized treatment plans (Novoa, R.A.,*et al.*,2017).

According to Kale.A.U., *et al* (2019), AI-driven decision support systems can assist healthcare providers in selecting optimal therapies tailored to individual patient characteristics. Additionally, AI can continuously track a patient's vital signs and physiological data, alerting

(70%), positively impacting patient outcomes. Despite these benefits, significant barriers persist, including concerns about data privacy and security (60%), high costs (55%), and inadequate training (50%). Nonetheless, the overall perception of AI is largely positive, with most respondents supporting its further adoption. The study concludes that institutions should make strategic investments in training healthcare professionals, upgrading technological infrastructure, and strengthening data security to fully realize the benefits of AI and overcome current hurdles.

Keywords: artificial intellegence, medicaldiagnostics, healthcare institutions, AI-powered technologies.

Medical staff to any anomalies or potential concerns, thereby enhancing patient safety and care quality. Another key area where AI shows substantial promise is in predictive healthcare applications (Kale.A.U., *et al* 2019).

AI can predict disease progression, patient outcomes, and potential complications using machine learning algorithms. By analyzing large datasets and identifying patterns, AI models can assess the risk of specific diseases, facilitating early intervention and preventive measures. Moreover, AI can help forecast the efficacy of different treatments, empowering healthcare professionals to make informed decisions about the best treatment plan for each patient (McKinney, S. M..2020).

Various benefits are offers in healthcare by AI, though it also presents challenges. A key concern is ensuring the ethical and responsible use of AI. Hence, safeguarding patient privacy and securing sensitive medical data are critical when implementing AI in healthcare settings (Margret **C .2024).**

AI algorithms depend on historical data that may contain biases or gaps, hence, require careful measures to address biases and ensure fairness. Healthcare professionals must also receive adequate training to use AI technologies effectively, ensuring these tools enhance rather than supplant existing expertise. Despite these challenges, AI's potential to revolutionize healthcare by improving patient care, enhancing diagnostic accuracy, and optimizing treatment plans (Topol, E. J. 2019).

It has the potential to save healthcare costs, cut down on medical mistakes and promote more individualized therapy. To successfully integrate AI in healthcare, however, academics, healthcare professionals, politicians, and technology developers must work together to overcome technological, ethical, and regulatory issues. (Novoa, R.A.,*et al.*,2017).

Artificial intelligence (AI) holds transformative potential not only for healthcare

but it has the potential to revolutionize other industries. Its ability to process vast datasets, identify patterns, and deliver accurate predictions has opened new possibilities in healthcare for diagnostics, treatment planning, and predictive analytics (Margret C.**2024**).. Therefore, AI has created new opportunities in medical diagnostics, treatment, and disease prediction

AI has the ability to optimize efficiency, deliver individualized treatment, and improve patient outcomes in healthcare systems. We shall examine the uses of AI in healthcare in this essay, paying particular attention to how it affects diagnosis, treatment, and prediction. (Margret C. **2024**).

Diagnosis is a fundamental part of healthcare, hence, its serves as a basis for choosing the best treatment. However, traditional diagnostic methods often depend on a doctor's individual judgment, which can be limited by factors such as fatigue, experience, and personal bias (Kale.A.U., *et al* 2019).

By using its capacity to evaluate vast amounts of medical data, such as electronic health records (EHRs), medical imaging, genetic data, and clinical literature AI has the potential to get beyond these constraints. On the basis of this data, machine learningalgorithmsmaybetrainedtodiscoverintricatepatternsandrecognizeillnesss ignsthat may not be visible to human diagnosticians. Healthcare practitioners may make diagnoses more quickly and accurately by merging clinical data with AI algorithms, which enables prompt action and better patient outcomes. (Novoa, R.A.,*et al.*,2017)**.**

AIMS OF THE RESEARCH

This research aims at determining medical diagnosis, providing faster, more accurate, and cost-effective solutions for disease detection. While AI cannot replace doctors,it enhances medical decision- making, leading to better patient outcomes. However, ethical concerns and regulatory challenges must be addressed for AI's full potential to be realized.

OBJECTIVES OF THE RESEARCH

The aims will be achieved through the following ojectives

1. To explore AI-driven technologies used in medical diagnosis.
2. To analyze real-world case studies of AI applications.
3. To assess the impact of AI on accuracy, efficiency, and patient outcomes.

LITERATURE REVIEW

Artificial Intelligence (AI) has revolutionized the field of medical diagnosis by enhancing accuracy, efficiency, and predictive capabilities. AI-driven technologies, including

machine learning (ML), deep learning (DL), and natural language processing (NLP), are increasingly used to assist healthcare professionals in disease detection, imaging analysis, and decision-making (Topol, 2019).

Artificial Intelligence (AI) has emerged as a transformative force in healthcare, particularly in medical diagnosis. AI-driven technologies such as machine learning (ML), deep learning (DL), and natural language processing (NLP) are increasingly being used to enhance diagnostic accuracy, efficiency, and patient outcomes (Topol, 2019).

The integration of AI in medical diagnosis has shown promising results in fields such as radiology, pathology, cardiology, and oncology. However, despite these advancements, challenges such as data privacy, algorithmic bias, and integration into clinical practice remain key concerns (Jiang et al., 2021).

The review of literature explore how AI is used in medical diagnoses, its advantages, the problems it faces, and where it's headed.

Ai Technologies In Medical Diagnosis

AI uses machine learning algorithms to analyze large set of medical data to find patterns and make predictions for patients. AI use specialized type of machine learning, called deep learning, utilizes neural networks to handle complex datasets, particularly in medical imaging (Esteva et al., 2017).

For example, convolutional neural networks (CNNs) have been successfully applied to detect diseases in radiology, dermatology, and pathology (Liu et al., 2019).

For example, in dermatology, deep learning algorithms have demonstrated dermatologist-level accuracy in identifying melanoma from dermoscopic images (Esteva et al., 2017). In addition to that by Using CNN-based models, AI can detect pneumonia in chest X-rays with great accuracy, often even outperforming human radiologists (Rajpurkar et al., 2018).

A1 Enhanced Accuracy

AI models trained on large datasets have demonstrated high diagnostic accuracy in detecting conditions such as breast cancer, pneumonia, and cardiovascular diseases (Rajpurkar *et al.*, 2018). Previous studies revealed that AI-assisted diagnostics can lower the number of false positives and false negatives, which ultimately leads to better results for patients (Liu *et al.*, 2019).

AI has proven to be highly accurate in diagnosing various medical conditions. For instance, (Gulshan et al. 2016), revealed that AI algorithms were just as accurate as ophthalmologists in detecting diabetic retinopathy from retinal images. Additionally, AI models have been used to precisely diagnose cardiovascular diseases by analyzing echocardiograms and electrocardiograms (ECGs) (Jiang *et al.*, 2021).

Increased Efficiency

AI speeds up the diagnostic process by automating repetitive tasks, reducing workload, and providing real-time decision support (Jiang *et al.*, 2021).

For example, AI-powered tools can quickly analyze medical images, allowing radiologists to focus on complex cases. This reduces the time taken for diagnosis and enables early intervention (McKinney *et al.*, 2020).

AI speeds up the diagnostic process by automating repetitive tasks, allowing healthcare professionals to focus on more complex cases. For example, AI tools can analyze thousands of radiology images in minutes, which significantly reduce the time it takes to get a diagnosis (McKinney et al., 2020). In addition to that, AI can prioritize urgent cases to ensure critical patients get timely care.

Improved Patient Outcomes

Early and accurate diagnosis facilitated by AI leads to timely treatment, reducing complications and mortality rates (Ardila *et al.*, 2019). AI-driven predictive analytics also help in personalized treatment planning, ensuring better healthcare management (Topol, 2019).

AI-powered predictive analytics help detect diseases early, enabling timely treatment and improving patient's chances of a good outcome. In a similar vein, AI-driven personalized medicine customizes treatments for individual patients using their specific data, which makes the treatments more effective (Topol, 2019).

Additionally, AI aids in reducing diagnostic errors, which are a significant cause of medical malpractice and adverse patient outcomes.

METHODOLOGY

The study was conducted in Birnin Kebbi metropolis, the capital of Kebbi State, located in Northwestern Nigeria. The area comprises major healthcare institutions including Federal Teaching Hospital Birnin Kebbi (FTH), Kebbi Medical Centre Kalgo, and other public and private hospitals, making it suitable for studying AI integration in medical diagnostics.This research outlines the methodological approach used to investigate the role of artificial intelligence (AI) in medical diagnosis within the Birnin Kebbi metropolis. The main instrument used for data collection was a structured questionnaire. The questionnaire was divided into five sections and contained both closed-ended and open-ended questions to collect quantitative and qualitative data related to:Awareness of AI technologies,Extent of AI use in diagnostics, Real-world applications and experiences

Perceived impact on accuracy, efficiency, and patient outcomes. Challenges and recommendations. The collected data were coded and analyzed using descriptive statistics such as percentages, frequency tables. The analysis was carried out using

Microsoft Excel and SPSS software to interpret responses and answer the research questions objectively.

Results

TABLE 1: Professional Respondents

RESPOND	PERCENTAGE
Medical doctors	30%
Radiologist	25%
Medical technologist	20%
Healthcare IT professionals	15%
Others (including nurses, biomedical engineer etc)	10%
Total	100%
Years of Experience	
RESPOND	PERCENTAGE
Less than 5 years	15%
5 to 10 years	35%
11 to 20 years	30%
Over 20 years	20%
Total	100%

Source: field work, july 2025

TABLE 2: Type of Institution

RESPOND	PERCENTAGE
Public hospitals	45%
Private Hospitals	30%
Research institutions	10%
Clinics	10%
Others	5%
Total	100%
Familiarity with AI in Medical Diagnosis	
RESPOND	PERCENTAGE
Yes	80%
No	20%
Total	100%
AI Technologies Used in Institutions	
RESPOND	PERCENTAGE
Machine Learning Algorithm	25%
Natural Language Processing (NLP)	15%
Computer Vision/Image Analysis	20%
Predictive Analytics	15%

RESPOND	PERCENTAGE
Robotics-Assisted Diagnosis	20%
Others	5%
Total	100%
Integration Level of AI in Diagnostic Procedures	
RESPOND	PERCENTAGE
Respondents	Percentage
Not at All	10%
Minimal use	30%
Moderate	35%
Extensive use	20%
Fully integrated	5%
Total	100%
Diagnostic Departments Utilizing AI	
RESPOND	PERCENTAGE
Radiology	70%
Pathology	45%
Cardiology	30%
Oncology	25%
Laboratory Diagnostics	40%
None	10%

Source : field work, july 2025

TABLE 3. Involvement in AI Projects or Case Studies

RESPOND	PERCENTAGE
Yes	55%
No	45%
Total	100%
Outcomes of AI Implementation	
RESPOND	PERCENTAGE
Improved diagnostic accuracy	65%
Faster results	60%
Increased patients satisfaction	50%
No significant change	10%
Other	5%
Impact on Diagnostic Accuracy	
RESPOND	PERCENTAGE
No impact	10%
Slight improvement	20%
Moderate improvement	35%
Significant improvement	30%
Transformational	10%

RESPOND	PERCENTAGE
Total	100%
Impact on Efficiency (Time and Workload)	
RESPOND	PERCENTAGE
No Impact	10%
Minor efficiency gain	20%
Moderate efficiency gain	40%
Major efficiency gain	30%
Total	100%
Impact on Patient Outcomes	
RESPOND	PERCENTAGE
No change	10%
Some improvement	50%
Significant improvement	30%
Cannot determine	10%
Total	100%

Source : field work, july 2025

TABLE 4: Challenges or Concerns with AI in Diagnostics

RESPOND	PERCENTAGE
Data privacy/security	60%
Lack of training	50%
High cost	55%
Ethical concerns	40%
Dependence on technology	30%
Others	5%
Overall Perception of AI in Medical Diagnosis	
RESPOND	PERCENTAGE
Very positive	20%
Positive	50%
Neutral	20%
Negative	5%
Very negative	5%
Total	100%
Support for Further AI Adoption	
RESPOND	PERCENTAGE
Yes	65%
No	10%
Maybe (depends on conditions)	25%
Total	100%

Source: field work, July 2025.

DISCUSSION

High Awareness of AI among Healthcare Professionals

The findings revealed that a significant majority (80%) of healthcare professionals are familiar with AI-driven technologies in medical diagnosis. This high level of awareness suggests that AI concepts are increasingly penetrating the healthcare industry. This aligns with global research indicating that technological exposure among healthcare workers is growing, especially with the proliferation of digital health tools and telemedicine. However, awareness alone does not translate into proficiency or utilization. This points to a need for more structured training and hands-on exposure to AI systems within healthcare institutions to bridge the gap between awareness and effective usage.

Limited yet Growing AI Integration in Diagnostics

Despite the high level of awareness, the integration of AI into diagnostic procedures is still predominantly at the minimal (30%) to moderate (35%) level. Only a small proportion (5%) reported full integration of AI. This pattern reflects typical technology adoption curves in developing healthcare systems, where financial, infrastructural, and regulatory barriers slow down widespread implementation. The finding is consistent with previous studies indicating that while AI solutions are available, the readiness for adoption varies based on institutional capacity, leadership vision, and funding availability.

AI Adoption is Predominantly in Radiology and Laboratory Diagnostics

The study shows that AI is most commonly used in Radiology (70%) and Laboratory Diagnostics (40%), which corresponds with the global trend where image-based specialties lead in AI utilization. Computer vision tools significantly help radiology by analyzing X-rays, MRIs, and CT scans. Likewise, machine learning assists laboratory diagnostics, making sample analysis faster and more accurate. The lower use of AI in fields like cardiology and oncology suggests that either AI applications are still developing in these areas or face greater challenges related to diverse data and complex decision-making.

Positive Impact on Diagnostic Accuracy and Efficiency

The respondents reported substantial benefits from AI adoption: 65% experienced improved diagnostic accuracy, and 70% reported efficiency gains in terms of time savings and workload reduction. These findings affirm the core value proposition of AI in healthcare. Enhanced diagnostic accuracy reduces human error, while improved efficiency leads to faster service delivery and better resource utilization. However, the

fact that only a small proportion labeled AI's impact as "transformational" indicates that there is still room for further AI optimization and scaling.

Conclusion, Recommendations

The study concludes that AI-driven technologies are gaining traction in medical diagnostics within the surveyed institutions. While there is a high level of awareness and notable benefits in terms of accuracy and efficiency, actual implementation remains moderate. Radiology and laboratory diagnostics are the primary beneficiaries of AI, while other specialties are yet to fully embrace the technology. Persistent challenges such as data privacy concerns, high costs, and lack of training hinder full adoption. However, the overall perception of AI remains positive, with most respondents supporting further adoption. It also Recommend the following:

1. **Strengthen Training and Capacity Building:** Healthcare institutions should invest in regular training programs for healthcare workers to ensure they are proficient in AI tools and systems.
2. **Enhance Data Privacy and Security Measures:** Governments and institutions should develop stringent data protection frameworks to safeguard patient information in AI-driven processes.
3. **Provide Financial Incentives and Support:** Governmental bodies and private stakeholders should offer grants, subsidies, or tax breaks to reduce the financial burden associated with AI adoption.
4. **Promote Research and Development (R&D):** There should be increased funding for research on locally adaptable AI solutions that suit the healthcare challenges in the region.
5. **Gradual Integration Strategy:** Institutions should adopt AI incrementally, starting with high-impact areas like radiology and laboratory diagnostics before expanding to other specialties.

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