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Impact of Artificial Intelligence (AI) on the Management of Public Health: Evidence from Federal Medical Centre (FMC), Makurdi, Nigeria

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Abstract

Background: Artificial Intelligence (AI) is transforming healthcare delivery globally by improving diagnostic accuracy and patient treatment. As digital health innovations become more prevalent, understanding their specific impact within Nigerian medical institutions is essential for enhancing public health management.

Objectives: This study examined the impact of AI on public health management with the Federal Medical Centre (FMC), Makurdi, as a case study. Specifically, it investigated how AI influences patient diagnosis processes and treatment outcomes.

Methodology: The study was anchored on the Diffusion of Innovations (DOI) theory. A cross-sectional survey research design was adopted, focusing on a sample of 384 staff members at FMC, Makurdi, determined using the Cochran formula. Data were collected through a structured questionnaire and analysed using descriptive statistics and Pearson's Correlation Coefficient.

Results: The findings revealed that AI significantly improves diagnostic processes by reducing clinical errors and supporting early disease detection. Furthermore, AI adoption was found to enhance patient treatment through real-time decision-making support and more efficient chronic

disease management. Statistical analysis indicated a strong positive correlation between AI integration and improved healthcare delivery.

Conclusion: The study concluded that AI adoption positively impacts public healthcare delivery at FMC, Makurdi. It is recommended that the hospital management provide targeted staff training and secure adequate funding for AI infrastructure to optimise the utility of these technologies.

Keywords: Artificial Intelligence, Healthcare Delivery, Patient Diagnosis, Treatment Outcomes.

Introduction

Artificial Intelligence (AI) has emerged as a transformative force in global healthcare, revolutionising the way medical systems operate, deliver care, and manage patient data. Globally, AI technologies are increasingly applied to predictive analytics, diagnostics, treatment planning, and patient monitoring, offering unprecedented opportunities to enhance efficiency, accuracy, and access to healthcare services (Alam, 2024; Giri et al., 2025). In developed nations, AI-driven systems assist healthcare professionals in identifying patterns within complex medical datasets, thereby improving diagnostic precision and optimising patient management. In the United States and Europe, for instance, applications in radiology, pathology, and telemedicine have significantly reduced clinical errors and enhanced the early detection of critical illnesses (Ojedokun et al., 2024).

The integration of AI in advanced economies has facilitated a shift towards predictive and personalised healthcare. In the United Kingdom, the National Health Service (NHS) employs AI-powered tools to analyse electronic health records, predict hospital admissions, and tailor treatment plans for chronic conditions such as diabetes and heart disease (Vitus, 2024). Similarly, in Germany and Japan, AI assists in robotic surgeries and precision medicine, supporting clinicians during complex procedures and enabling robust remote patient monitoring (Ojedokun et al., 2024). These applications serve as a benchmark for emerging healthcare economies like Nigeria, which seek to leverage technology for more effective public health management.

In the Nigerian context, the adoption of AI is at an emergent stage but is rapidly gaining traction. Recent studies highlight its potential to streamline patient management and optimise the allocation of scarce medical resources (Okwukwu et al., 2025; Samuel et al., 2025). In tertiary institutions such as the Federal Medical Centre (FMC), Makurdi, AI has the capacity to support laboratory diagnostics, electronic medical records, and patient tracking systems, thereby reducing delays in clinical pathways. While challenges such as inadequate infrastructure, limited technical expertise, and data management constraints persist, the strategic implementation of AI promises to enhance both the clinical and administrative dimensions of healthcare delivery (Ortsa & Nguhunden, 2025; Verkaa et al.2024).

Specifically, the influence of AI at FMC, Makurdi, is observed in its ability to refine diagnostic processes and inform treatment decisions. By leveraging AI-enabled tools, clinicians can detect diseases more accurately and promptly, reducing human error and facilitating evidence-based interventions (Oladipo et al., 2024). Furthermore, AI-driven systems support treatment planning

by analysing patient histories and recommending optimal therapies, thereby improving quality of care and patient safety (Amanawa & Amanawa, 2024). Understanding these dynamics is crucial for evaluating the impact of technology on healthcare in Benue State and informs policy decisions regarding future investments in medical infrastructure.

Despite global advancements, there remains a paucity of empirical research focusing specifically on how AI influences patient care, diagnostic processes, and treatment outcomes within Nigerian public healthcare institutions like FMC, Makurdi. Existing studies are often conceptual, limited to pilot projects, or focused on private urban settings, leaving a gap in the understanding of systematic AI application in federal medical centres. This study, therefore, seeks to address this gap by examining the impact of AI on the management of public health at FMC, Makurdi.

Research Objectives

The following objectives guide this study:

1. To examine the influence of AI on patient diagnosis processes at FMC, Makurdi.
2. To investigate the influence of AI on patient treatment at FMC, Makurdi.

Research Hypotheses

This study will test the following null hypotheses:

- **H01:** There is no significant relationship between AI adoption and patient diagnosis processes at FMC, Makurdi.
- **H02:** There is no significant relationship between AI adoption and patient treatment outcomes at FMC, Makurdi.

Review of Literature

Artificial Intelligence, Patient Care, and Diagnostic Processes

Artificial Intelligence (AI) has exerted a profound impact on patient care and diagnostic processes by providing tools that enhance clinical accuracy, speed, and personalisation. In developed nations, AI systems are extensively employed to assist with medical imaging, patient triage, and early disease detection. For instance, in the United States and Europe, algorithms such as those integrated into IBM Watson Health and Google DeepMind have analysed radiological images with accuracy levels comparable to human radiologists. Esteva et al. (2017) demonstrated that deep learning algorithms could classify skin cancer with the same precision as dermatologists. Furthermore, AI-driven chatbots and virtual health assistants are increasingly used to gather patient symptoms, provide preliminary diagnoses, and recommend care pathways, thereby reducing the burden on healthcare personnel and improving the overall patient experience. These tools also support chronic disease management through AI-enabled platforms that monitor patients remotely and adjust treatment plans based on real-time data (Topol, 2019).

The application of AI in healthcare diagnostics is also expanding rapidly across Asia, driven by a high disease burden and a burgeoning technology sector. In China, AI has been deployed for the diagnosis of pneumonia and COVID-19 using CT scans; hospitals utilise platforms such as Alibaba AI to distinguish viral from bacterial infections within seconds (Jiang et al., 2020). Similarly, India has adopted AI tools such as Qure.ai and Niramai for tuberculosis and breast cancer screening, respectively. These solutions leverage machine learning to interpret diagnostic images and detect early signs of disease, particularly in rural areas with limited access to specialists. AI has proven to be a vital innovation in regions with high patient-to-doctor ratios, assisting healthcare workers in making timely, informed decisions within resource-constrained environments (Reddy et al., 2019).

In the Nigerian context, local and collaborative efforts highlight the growing relevance of AI in diagnostics and patient engagement. A notable example is the Ubenwa AI system, developed by Nigerian researchers, which uses machine learning to analyse the cries of newborns to detect birth asphyxia. This offers a non-invasive and rapid diagnostic tool suitable for low-resource settings. Olanrewaju and Adebayo (2021) report that some tertiary hospitals in Nigeria are beginning to adopt AI-driven diagnostic tools for interpreting laboratory results and radiological scans, although such practices are currently limited to pilot programmes or private institutions. Additionally, AI-powered chatbots like MedicBot assist patients in self-assessing symptoms and receiving healthcare guidance, which is particularly valuable in areas with limited access to medical professionals. Despite these advancements, broader integration is hindered by inadequate infrastructure, a lack of specialised training, and limited funding.

Artificial Intelligence and Patient Treatment

Artificial Intelligence has significantly advanced patient treatment by offering innovative methods for personalising care, optimising treatment plans, and improving clinical outcomes. In high-income countries, AI is increasingly utilised to assist in real-time treatment decisions, particularly for chronic conditions and complex pathologies. AI algorithms are now integrated into decision-support systems that help clinicians select the most effective therapies based on individual patient data and historical treatment outcomes. In oncology, AI-driven systems like IBM Watson for Oncology analyse vast datasets of medical literature and clinical trial results to recommend tailored treatment regimens. According to Langer et al. (2019), AI's ability to process large volumes of medical data enables precise treatment decisions that account for individual patient variability, thereby enhancing the efficacy of personalised care. Moreover, AI supports robotic surgeries, where precise systems assist surgeons in performing minimally invasive procedures with greater accuracy, which improves recovery times and reduces complications (Topol, 2019).

In Asia, AI has been adopted across diverse healthcare settings to optimise treatment processes, especially for chronic disease management. In China, AI-powered platforms develop customised protocols for hypertension, diabetes, and cardiovascular diseases. For example, Tencent AI systems, in collaboration with various hospitals, manage patient care by analysing health records to provide personalised recommendations. In India, tools like Niramai and Qure.ai determine treatment pathways by detecting the early stages of breast cancer and tuberculosis, ensuring intervention occurs before conditions become severe. Reddy et al. (2019) note that the integration

of AI with mobile health technologies has enabled continuous patient monitoring, allowing for dynamic treatment adjustments and reduced hospital readmissions.

In Nigeria, the role of AI in patient treatment is emerging with a focus on improving healthcare delivery in under-resourced regions. Tools such as the aforementioned Ubenwa system are crucial for providing early treatment interventions for birth asphyxia. Olanrewaju and Adebayo (2021) observe that AI is also being integrated into the management of chronic diseases like diabetes and hypertension, where machine learning models predict disease progression and suggest individualised treatment adjustments. Furthermore, AI is enhancing drug administration within hospitals, ensuring accurate dosages and minimising medication errors. While widespread adoption is currently hindered by infrastructure deficits and the need for comprehensive regulatory frameworks, the potential for AI to revolutionise patient treatment in Nigeria is considerable, provided there is adequate funding and cross-sector collaboration.

Theoretical Framework

Diffusion of Innovations Theory: Origin and Proponents

The Diffusion of Innovations (DOI) theory is the seminal work of communication scholar and sociologist Everett M. Rogers (1962). The theory's origins are rooted in rural sociology and agricultural research; specifically, early 20th-century studies examining how farmers in Iowa adopted hybrid seed corn. Rogers formalised the framework to explain how new ideas, practices, or technologies are communicated and adopted over time within a social system. According to Rogers, an innovation is any idea, practice, or object perceived as new by an individual or unit of adoption, while diffusion is the social process through which information about this innovation spreads via communication channels to influence behaviour and decision-making (García-Avilés, 2020; Zhang et al., 2015).

In essence, diffusion is not merely the introduction of a technology; it is a nuanced process through which individuals learn about, evaluate, and ultimately decide to adopt or reject an innovation. Rogers highlighted that adoption depends significantly on both the characteristics of the innovation itself and the social context—or the social system—in which it is introduced.

Core Assumptions and Attributes of DOI

DOI theory assumes that the adoption of an innovation is a process influenced by four main elements: the innovation itself, communication channels, time, and the social system. Rogers (2003) identified five perceived attributes of innovations that significantly influence the rate of adoption:

- **Relative Advantage:** The degree to which an innovation is perceived as being better than the idea or practice it supersedes.
- **Compatibility:** The degree to which an innovation is perceived as consistent with existing values, past experiences, and the needs of potential adopters.
- **Complexity:** The degree to which an innovation is perceived as relatively difficult to understand and utilise.

- Trialability: The degree to which an innovation may be experimented with on a limited basis.
- Observability: The degree to which the results of an innovation are visible to others.

While DOI is a robust framework, critics have noted certain weaknesses. The theory can sometimes oversimplify adoption by assuming a level of homogeneity within a population, potentially neglecting internal organisational politics or external pressures such as regulatory environments, infrastructure limitations, and socio-economic barriers (Rogers, 2003).

Application of DOI to AI at FMC Makurdi

Applying DOI to the impact of Artificial Intelligence (AI) on public health management at the Federal Medical Centre (FMC), Makurdi, provides a structured lens for understanding how healthcare professionals integrate technological innovations into clinical practice.

For instance, AI diagnostic tools, such as machine learning algorithms for imaging analysis, can be assessed for relative advantage by measuring how they enhance diagnostic accuracy and speed compared to traditional manual methods. Compatibility considers how these AI systems align with existing clinical workflows and the hospital's electronic medical record (EMR) systems. Complexity addresses the technical ease with which medical staff can operate AI interfaces, while trialability is observed when staff pilot AI applications in specific departments before full-scale hospital implementation. Finally, observability occurs when improved diagnostic precision or faster patient recovery times become visible to the medical community, thereby encouraging broader acceptance.

Furthermore, DOI theory highlights the importance of communication channels—both formal administrative training and informal peer-to-peer interactions—in disseminating knowledge about AI. By analysing adoption through these five attributes, this study evaluates how AI has influenced patient diagnosis processes and treatment decisions at FMC Makurdi, identifying both the facilitators of and barriers to effective technological integration in public healthcare delivery.

Methodology

This study adopted a cross-sectional survey design to examine the impact of artificial intelligence (AI) on public health management at the Federal Medical Centre (FMC), Makurdi, enabling data collection at a single point in time. The population consisted of FMC staff, and Cochran's formula was used to determine a sample size of 384 respondents. Data were collected using a structured questionnaire divided into four sections covering AI technologies, their influence on patient care and diagnosis, patient treatment, and associated challenges, with responses rated on a five-point Likert scale. Questionnaire copies were administered face-to-face with the assistance of two trained research assistants during the morning hours. Data analysis was conducted using SPSS version 25, employing descriptive statistics (frequencies, percentages, means, and standard deviations) and inferential statistics, specifically Pearson's correlation, to examine the relationship between AI application and its impact on patient diagnosis and treatment at FMC, Makurdi.

Results

A total of 384 questionnaires were administered to the staff of the Federal Medical Centre (FMC), Makurdi. Of this number, 312 questionnaires were validly completed and returned, representing a response rate of 81.2%. The remaining 72 questionnaires (18.8%) were either not returned or improperly filled. This high response rate provides a statistically significant basis for generalising the findings to the study population.

Table 1: Respondents' rating of the influence of AI on patient diagnosis processes in FMC, Makurdi

S/N	AI and patient care and diagnosis processes	SA	A	UD	D	SD	Mean	Std.D
1	AI speeds up disease diagnosis	196	55	32	18	11	4.30	1.091
2	It enhances diagnostic accuracy	240	37	17	11	7	4.58	.915
3	AI supports early disease detection	280	10	6	8	8	4.75	.830
4	AI enables remote patient assessments	146	141	10	15	9	4.26	.982
5	It reduces diagnostic errors	216	50	36	5	5	4.50	.878
6	It assists in interpreting medical images	101	203	3	3	2	4.28	.596

Source: Field Survey, 2025; **Key:** SA = Strongly Agree; A= Agree; UD = Undecided; D = Disagree; SD = Strongly Disagree (N=518)

The data in Table 1 showed that respondents generally perceive AI to have a strong positive influence on patient care and diagnosis processes. It was revealed that the highest-rated item is the statement AI supports early disease detection, with a mean score of 4.75 and a standard deviation of 0.830, which is above the benchmark of 2.50, indicating widespread agreement among respondents. It could be inferred from the findings that the statement, AI enhances diagnostic accuracy was also highly rated, with a mean of 4.58 (SD = 0.915), showing strong confidence in AI’s ability to improve the precision of medical diagnoses. Similarly, the statement that AI reduces diagnostic errors had a mean of 4.50 (SD = 0.878), reflecting respondents' belief that AI contributes significantly to minimising human error in medical assessments.

The use of AI in speeding up disease diagnosis had a mean of 4.30 (SD = 1.091), suggesting that respondents recognise its role in accelerating diagnostic processes. AI-assisted interpretation of medical images was also favourably rated, with a mean of 4.28 (SD = 0.596), highlighting the technology’s contribution to visual diagnostics, including X-rays and scans. Also, the statement that AI enables remote patient assessments received a mean of 4.26 (SD = 0.982), indicating moderate to strong agreement that AI facilitates patient evaluations outside traditional clinical settings. This data implies that the use of AI influences patient care and the diagnostic process in FMC, Makurdi.

The findings were in line with previous research, such as Olanrewaju and Adebayo (2021), who found that some tertiary hospitals in Nigeria are beginning to adopt AI-driven diagnostic tools for

interpreting lab results and radiological scans, though such practices remain limited to pilot programs or private institutions. Additionally, AI-powered chatbots like MedicBot are helping patients self-assess symptoms and receive healthcare guidance, which is especially valuable in areas with limited access to medical professionals.

Table 2: Respondents' rating of the influence of AI on patient treatment in FMC, Makurdi

S/N	AI and patient treatment	SA	A	UD	D	SD	Mean	Std.D
1	AI personalises treatment plans	150	130	15	11	6	4.30	.868
2	It improves drug dosage accuracy.	12	10	260	17	13	2.97	.638
3	AI supports real-time treatment decisions	251	35	10	8	8	4.64	.870
4	It enhances surgical precision	194	73	8	18	19	4.30	1.158
5	AI predicts treatment outcomes	280	17	6	5	4	4.81	.667
6	AI aids in chronic disease management	286	5	8	5	8	4.78	.792

Source: Field Survey, 2025; **Key:** SA = Strongly Agree; A= Agree; UD = Undecided; D = Disagree; SD = Strongly Disagree (N=518)

The data presented in Table 2 revealed respondents' perceptions of how Artificial Intelligence (AI) influences patient treatment at FMC, Makurdi. Respondents strongly agreed that AI predicts treatment outcomes with a mean score of 4.81 and a standard deviation of .667 and it aids in chronic disease management with a mean of 4.78 (SD = .792).. The item that AI enhances surgical precision had a mean of 4.30 (SD = 1.158), indicating notable agreement, though with greater variability in responses, possibly due to differing experiences or awareness levels regarding AI-assisted surgeries. The findings indicate that AI is largely perceived as a valuable tool in enhancing clinical decision-making, managing chronic diseases, and predicting treatment outcomes at FMC, Makurdi. The study aligns with that of Langer et al. (2019), who observed that AI's ability to rapidly process and analyse large volumes of medical data enables more precise treatment decisions that account for individual patient variability, significantly improving the efficacy of personalised care.

Table 3: Pearson correlation between AI care and diagnosis processes in FMC, Makurdi

S/N	0	1	2	3	4	5	6
1	AI speeds up disease diagnosis	1					
2	It enhances diagnostic accuracy	.184	1				
3	AI supports early disease detection	.475**	-.097	1			
4	AI enables remote patient assessments	.271**	.001	-.038	1		
5	It reduces diagnostic errors	.613**	.014	.378**	.245**	1	
6	It assists in interpreting medical images	-.402**	-.263**	.179**	.480**	.453**	1

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

* . Correlation is significant at the 0.05 level (2-tailed).

The Pearson correlation results in Table 3 revealed that the aspects of AI were significantly correlated with patient care and diagnostic processes in FMC, Makurdi, at the 0.01 and 0.05 levels. Therefore, the null hypothesis, which stated that there is no significant relationship between AI and patient care and diagnosis processes in FMC, Makurdi, was rejected, while the alternate hypothesis, which stated that there is a significant relationship between AI and patient care and diagnosis processes in FMC, Makurdi, was accepted.

Table 4: Pearson correlation between AI and patient treatment in FMC, Makurdi

S/N	0	1	2	3	4	5	6
1	AI personalises treatment plans	1					
2	It improves drug dosage accuracy.	-.000	1				
3	AI supports real-time treatment decisions	.306**	.300**	1			
4	It enhances surgical precision	.370**	.141**	.555**	1		
5	AI predicts treatment outcomes	.101	.493**	.524**	.528**	1	
6	AI aids in chronic disease management	.097**	.503**	.473**	.563**	-	1
						.955**	

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

* . Correlation is significant at the 0.05 level (2-tailed).

Based on the findings in Table 4, the aspects of AI were found to significantly correlate with patient treatment in FMC, Makurdi, at 0.01 and 0.05. Therefore, the null hypothesis, which stated that there is no significant relationship between AI and patient treatment in FMC, Makurdi, was rejected, while the alternate hypothesis, which stated that there is a significant relationship between AI and patient treatment in FMC, Makurdi, was accepted. The results support the hypothesis that AI significantly improves drug dosage accuracy, supports real-time treatment decisions and enhances surgical precision.

Discussion

The study assessed the influence of Artificial Intelligence (AI) on patient diagnosis processes in the study area. The findings showed that respondents generally perceive AI to have a strong positive impact on diagnostic processes, including speeding up disease diagnosis, enhancing diagnostic accuracy, supporting early disease detection, reducing diagnostic errors, assisting in the interpretation of medical images, and enabling remote patient assessments in FMC, Makurdi. The tested hypothesis also indicates a significant relationship between AI and patient care and diagnostic processes, as revealed by the Pearson correlation results. This finding corroborates the study by Esteva et al. (2017), which found that deep learning algorithms could classify diseases with precision comparable to that of human experts, thereby enhancing early and accurate diagnosis. The findings above showed that AI significantly reduces human error, improves the timeliness of disease detection, and facilitates remote assessments in FMC, Makurdi, thereby demonstrating its practical value in clinical decision-making and patient care management.

The study assessed the influence of Artificial Intelligence (AI) on patient treatment in the study area. The findings showed that AI is largely perceived as a valuable tool in enhancing clinical

decision-making, supporting real-time treatment decisions, predicting treatment outcomes, aiding chronic disease management, personalising treatment plans, and enhancing surgical precision in FMC, Makurdi. The tested hypothesis also shows a significant relationship between AI and patient treatment, indicating that AI adoption positively affects how clinicians plan, adjust, and deliver treatments. This finding corroborates the study of Langer et al. (2019), who observed that AI's capacity to rapidly process and analyse large volumes of patient data enables precise treatment decisions tailored to individual patient variability. The findings above showed that AI significantly improves treatment outcomes, supports the management of chronic conditions, and enhances procedural accuracy in FMC, Makurdi, reflecting its potential to strengthen the quality of patient care and clinical efficiency.

Conclusion

This study revealed that Artificial Intelligence (AI) has a transformative impact on public health management at the Federal Medical Centre, Makurdi, significantly enhancing both patient diagnosis and treatment processes. AI technologies have been shown to accelerate disease detection, improve diagnostic accuracy, reduce errors, support remote assessments, personalise treatment plans, and optimise real-time clinical decisions, thereby strengthening the quality and efficiency of healthcare delivery. The study confirms that AI adoption is not only feasible but also highly beneficial in a federal healthcare setting, providing empirical evidence that aligns with global trends in AI-driven healthcare innovations. By demonstrating the practical advantages of AI in FMC, Makurdi, this study underscores the critical role of technology in modernising public health systems, promoting evidence-based care, and ultimately improving patient outcomes, while highlighting the need for strategic implementation, training, and infrastructure development to fully realise AI's potential in Nigeria's healthcare sector.

Recommendations

The study recommends that:

- i. The management of Federal Medical Centre, Makurdi, should invest in training programs for medical staff to improve their technical skills and confidence in using AI tools, ensuring effective adoption and optimal patient care.
- ii. The Federal Ministry of Health should provide adequate funding and infrastructure support for AI integration in public hospitals, enabling reliable implementation and overcoming resource-related barriers to technology use

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