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ARTIFICIAL INTELLIGENCE IN MEDICAL EDUCATION IN NIGERIA: CURRENT APPLICATIONS, CHALLENGES, AND FUTURE DIRECTIONS

Chukwukwe I.O.[1], Chikezie T.[2], Ekwufulem O.N.[1], Chukwuoke T.V.[3], Uwanuruochi V.N.[4], Chikezie K.[6],

1. *Ophthalmology Department, Federal Medical Centre Umuahia, Abia State, Nigeria.*
2. *Reachverse Solutions Limited, Lagos, Nigeria.*
3. *Department of Sustainable Environmental Studies – GEIS, Centre of Excellence in Sustainable Procurement, Environmental & Social Standards, Federal University of Technology, Owerri.*
4. *Department of Internal Medicine, Federal Medical Centre, Umuahia.*
5. *Department of Haematology and Blood Transfusion, Abia State University Uturu / Federal Medical Centre. Umuahia, Abia State.*

Corresponding Author: Chukwukwe IO | Email: chukwukweifeyinwa68@gmail.com

Abstract

Background: Nigeria's medical education system operates under compounding structural pressure, marked by overcrowded institutions, declining training standards, and a persistent loss of skilled doctors to international migration. Artificial intelligence (AI) has emerged globally as a transformative pedagogical tool, yet its application within Nigerian medical education remains poorly characterised. This narrative review examines current AI applications in medical education, identifies barriers to adoption within the Nigerian context, and proposes AI integration as a retention-oriented intervention in the country's healthcare workforce crisis, with particular attention to ophthalmology training.

Methods: A narrative review of peer-reviewed literature was conducted across PubMed, MEDLINE, Scopus, and Google Scholar covering publications from 2019 to 2026, supplemented by Nigerian institutional reports and policy documents. Search terms included combinations of artificial intelligence, medical education, Nigeria, digital health, and brain drain. Findings were synthesised thematically.

Results: AI applications in medical education globally include adaptive learning platforms, automated assessment generation, and clinical simulation. In Nigeria, a majority of surveyed medical and allied health students report informal use of generative AI tools, driven by efficiency rather than institutional guidance. Adoption barriers include limited broadband infrastructure, low digital literacy among educators, absent regulatory frameworks, and inadequate simulation resources. Within ophthalmology, AI-generated virtual patient scenarios offer a reproducible alternative to scarce physical simulation equipment.

Conclusion: AI integration in Nigerian medical education should be reframed as a structural workforce intervention rather than a pedagogical novelty. Coordinated investment in broadband infrastructure, context-specific AI model development, formal curricular integration, and national regulatory frameworks offers a tractable pathway toward improved training quality and physician retention.

Keywords: *Artificial intelligence; Medical education; Nigeria; Brain drain; Digital health; Ophthalmology; Low resource settings*

1. INTRODUCTION

Medical education forms the structural foundation upon which national healthcare systems are built, yet Nigeria's training pipeline faces compounding strain from multiple directions simultaneously. Nigerian medical schools have, in recent years, faced criticism over a perceived decline in training standards, with institutions frequently operating well beyond their designed capacity for both staff and clinical exposure (Toluhi et al, 2023). This strain coincides with an accelerating exodus of trained physicians: approximately half of Nigerian-trained doctors now practise abroad, and Nigeria's doctor-to-population ratio of 38 per 100,000 remains far below the World Health Organization benchmark of 166 per 100,000 (Umar et al, 2025). Evidence increasingly suggests that this attrition is not attributable solely to remuneration and security concerns. A mixed methods study among Nigerian medical trainees found that the perceived quality of training itself meaningfully shapes the decision to migrate, with gaps in clinical competency development functioning as both a push factor and a marker of broader institutional underinvestment (Hallquist et al, 2025).

Artificial intelligence has, within the same period, moved from a peripheral curiosity to a mainstream feature of medical training worldwide. Large language models, adaptive learning systems, and AI-driven simulation platforms are reshaping how clinical knowledge is taught, assessed, and reinforced (Hallquist et al, 2025). A 2026 systematic narrative review synthesising 48 studies on AI integration in medical education found consistent evidence of impact across personalised learning, adaptive assessment, and advanced simulation, while also noting substantial variation in how rigorously these interventions had been evaluated (Bin Abdulrahman et al, 2026). A parallel scoping review covering 42 studies similarly concluded that although AI has demonstrated genuine clinical potential, its influence on formal medical education curricula remains limited relative to its demonstrated capability(Shaw et al, 2025).

This gap between technical capability and curricular integration is more pronounced in low- and middle-income settings, where infrastructural, regulatory, and human resource constraints intersect. Nigeria exemplifies this tension. On one hand, informal adoption of generative AI tools among Nigerian medical students appears widespread and largely self-directed (David-Olawade et al, 2025). On the other, no comprehensive national framework yet governs how such tools should be incorporated into formal curricula, assessed for safety, or evaluated for educational efficacy (Pupic et al, 2023). This review departs deliberately from the conventional pedagogy-focused analyses that dominate the literature on AI in medical education, in which the technology is evaluated chiefly against learning outcomes and examination performance. Instead, it advances a workforce-centred reading: that in a context defined by acute and ongoing physician attrition, AI adoption carries a second, underappreciated function. It may serve as a tangible signal of institutional

modernisation capable of influencing a trainee's decision to remain within the Nigerian system. This interpretive stance, rather than a simple inventory of tools and applications, is the central contribution of this review. It situates AI not merely as an educational technology but as a potential lever within the broader retention crisis facing Nigerian medicine.

2. METHODS

This is a narrative review rather than a systematic review, reflecting the heterogeneous and rapidly evolving nature of the literature on AI in medical education, much of which spans disciplines not amenable to a single systematic search strategy. A structured search was conducted across PubMed, MEDLINE, Scopus, and Google Scholar for literature published between January 2019 and June 2026. Search terms combined artificial intelligence, machine learning, medical education, clinical training, Nigeria, sub-Saharan Africa, brain drain, and digital health using Boolean operators. Reference lists of identified articles were hand searched for additional relevant sources; a process commonly referred to as citation chaining.

Sources were prioritised according to relevance, recency, and methodological transparency, with preference given to systematic reviews, scoping reviews, and primary studies published from 2024 onward. Nigerian government policy documents, including the National Artificial Intelligence Strategy and reports from the Federal Ministry of Health and Social Welfare, were included to ground the discussion in the prevailing national policy context (Ogbonna et al, 2026). Grey literature, including reputable health policy commentary, was included sparingly and only where it supplemented peer-reviewed evidence rather than substituting for it. Findings were synthesised thematically around three domains: current applications of AI in medical education, structural barriers to adoption in Nigeria, and future policy directions.

This review is subject to the inherent limitations of the narrative method, which does not follow a fully systematic protocol and therefore carries a degree of selection subjectivity. More substantively, the evidence base specific to Nigeria remains thin. Most cited Nigerian studies are small, single-institution, cross-sectional surveys of self-reported attitudes rather than studies of measured educational outcomes, and none has directly examined whether AI exposure influences trainee retention, the central hypothesis advanced in this review. Much of the supporting evidence on AI applications and efficacy is drawn from high-income settings and may not transfer cleanly to the infrastructural and institutional realities of Nigerian medical schools. These constraints are acknowledged throughout and are addressed directly in the Future Directions section.

Current Applications of Artificial Intelligence in Medical Education

Globally, AI applications in medical education cluster around several recurring functions: automated generation of examination content, production of clinical vignettes and virtual patient scripts, diagnostic and clinical reasoning support, and administrative automation such as residency application screening (Hallquist et al, 2025). A systematic review of PubMed-indexed literature through mid-2024 identified consistent use of large language models for generating board-style examination questions and structuring clinical teaching scripts, alongside emerging use as an adaptive learning aid for individual trainees (Hallquist et al, 2025). These applications share a common appeal in low-resource settings: they substitute computational scale for the human faculty time and physical infrastructure that such settings typically lack.

Within Nigeria specifically, a cross-sectional study of healthcare students found strong self-reported enthusiasm for AI adoption, but this enthusiasm coexisted with substantial knowledge gaps and limited structured exposure, alongside notable scepticism about whether expressed willingness would translate into safe clinical practice (David-Olawade et al, 2025). This finding is consistent with the broader African picture: countries including Nigeria, Kenya, South Africa, and Ghana have been identified as regional leaders in developing AI solutions for healthcare, yet the translation of this innovation activity into formal medical curricula has lagged behind (Adeyanju et al, 2025).

Ophthalmology offers a particularly instructive case study. Simulation-based training in ophthalmology traditionally depends on costly equipment, including virtual reality phacoemulsification simulators and dedicated wet labs, resources that remain scarce across most Nigerian training centres. AI-generated virtual patient scenarios provide a markedly lower-cost alternative, allowing trainees to practise diagnostic reasoning across a range of ophthalmic presentations without the capital expenditure that physical simulation requires (Hallquist et al, 2025). While direct evidence from Nigerian ophthalmology training programmes remains limited, the broader literature on AI-assisted clinical simulation suggests meaningful potential for adaptation to subspecialty training contexts facing similar resource constraints.

A Comparative Perspective: Kenya and India

Situating Nigeria's experience alongside other low- and middle-income countries sharpens what is distinctive about its trajectory. In Kenya, infrastructural constraints closely mirror Nigeria's own, with only around a third of the population having reliable broadband access, yet the country has produced a concrete, locally built intervention. Juvenotes, an AI-powered platform piloted in Kenyan medical schools, automates the generation of examination-style questions and study content directly from academic course material, reducing dependence on scarce faculty time for content creation (Real-time AI-driven

pipeline for automated medical study content generation in low-resource settings: a Kenyan case study). This represents a narrower but more operational form of adoption than is currently documented in Nigeria, where AI use remains largely informal and student-initiated rather than embedded in an institutionally sanctioned tool.

India presents a different comparison, that of a much larger and more resource-heterogeneous medical education system. A systematic review of Indian medical student studies found high awareness and broadly positive perception of generative AI, but noted that most students lacked any formal training in its use, a finding that closely parallels the Nigerian pattern of enthusiasm outpacing structured exposure (Mateen et al, 2025). Indian researchers have also begun applying structured readiness instruments, such as the Medical Artificial Intelligence Readiness Scale for Medical Students, to measure this gap quantitatively rather than relying solely on descriptive surveys, an approach that Nigerian research has not yet adopted but could usefully replicate (Mateen et al, 2025).

Figure 2. Internet Connectivity and Medical Student AI Awareness: Nigeria, Kenya, and India

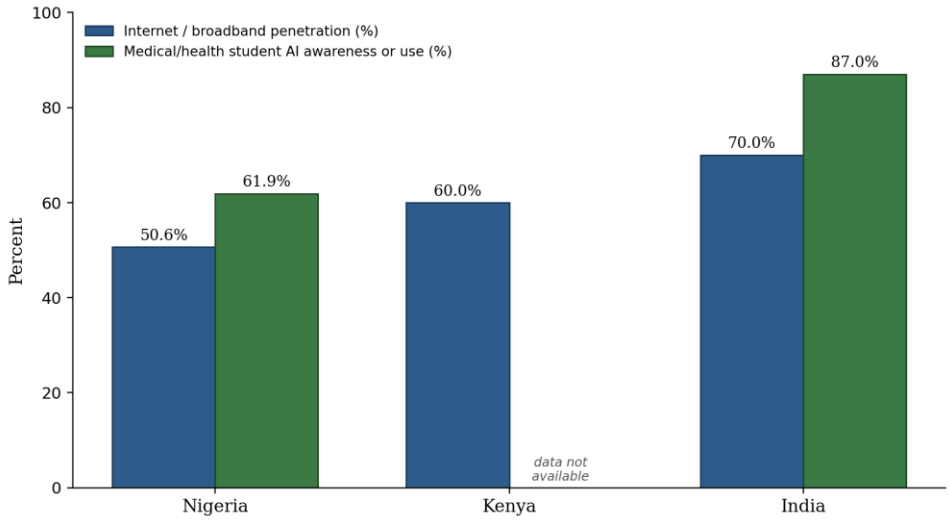

Figure 2. Internet connectivity and medical or health student AI awareness across Nigeria, Kenya, and India (Mateen et al, 2025, Nigerian Communications Commission, 2025, TS2 Tech, 2026) .[12,,14]

Note: connectivity figures and student AI awareness figures are drawn from separate sources using different survey methodologies and reference years, and should be read as broadly indicative rather than strictly equivalent across countries.

Read together, these comparisons suggest that Nigeria's central deficit is not unique enthusiasm or unique barriers, since both appear broadly comparable to peer LMIC settings, but rather a lag in translating informal adoption into structured, institutionally owned interventions of the kind Kenya has piloted and into the kind of standardised readiness measurement India has begun to apply. This comparative reading reinforces,

rather than diminishes, the central argument of this review: that the missing ingredient in Nigeria is not technological possibility but institutional commitment.

Table 1. Summary of AI Applications, Barriers, and Opportunities in Nigerian Medical Education

Domain	Current Application or Status	Key Barrier	Opportunity
Assessment and content generation	Informal student use of generative AI for study aids and exam preparation	No institutional platform or quality control	Locally built tools modelled on Kenya's Juvenotes pilot
Clinical simulation	Minimal use; physical simulation remains the norm where available	High cost of simulation hardware; scarce wet labs	AI-generated virtual patient scenarios for ophthalmology and other subspecialties
Infrastructure	Uneven broadband access; frequent power interruptions	Limited rural connectivity; high data costs	Public-private broadband partnerships with telecommunications operators
Faculty and curriculum	No formal AI literacy curriculum for students or faculty	Generational gap in faculty digital literacy	Structured AI literacy training, informed by India's MAIRS-MS readiness model
Regulation and governance	General data protection law in place; no sector-specific AI guidance	Absence of medical education-specific AI policy	Sector-specific guidance from regulatory bodies, building on existing data protection law
Workforce retention	Not currently linked to AI adoption in practice or policy	No empirical Nigerian evidence connecting AI exposure to retention intent	Dedicated research testing AI integration as a retention-oriented intervention

Structural Barriers to Adoption in Nigeria

Despite genuine momentum, several structural barriers constrain meaningful AI integration into Nigerian medical education. Infrastructural limitations remain foundational: reliable broadband access is unevenly distributed, with rural and peri-urban training sites particularly disadvantaged, and intermittent power supply further compounds the unreliability of digital learning platforms (Mohac Africa, 2026). Across the wider African health technology landscape, fewer than half of countries currently maintain a comprehensive digital health plan, and rural internet penetration remains low, conditions that directly constrain the feasibility of AI-dependent educational tools outside major urban teaching hospitals (Mohac Africa, 2026).

Digital literacy among educators represents a second major constraint. Many Nigerian medical faculty members received their own training before the proliferation of generative AI tools, creating a generational gap between student familiarity and faculty capacity to supervise, evaluate, or meaningfully incorporate such tools into formal teaching (David-Olawade et al, 2025). This gap is compounded by the absence of institutional policy. Few Nigerian medical schools have published guidance on acceptable use of generative AI in coursework or assessment, leaving students to navigate ethical and academic integrity questions without formal direction (David-Olawade et al, 2025).

Regulatory and data governance frameworks remain similarly nascent. The Nigeria Data Protection Act of 2023 has strengthened the legal foundation for data privacy generally, representing an important safeguard against the misuse of patient or trainee data within AI systems (Ogbonna et al, 2026). However, sector-specific guidance addressing AI use in clinical education, including standards for data provenance, algorithmic bias, and accountability when AI-generated content informs clinical training, has not yet matured to the same degree. The Nigerian National Artificial Intelligence Strategy, while a meaningful policy milestone, was designed primarily with broader economic and innovation goals in view, and its application to medical education specifically requires further elaboration (Ogbonna et al, 2026).

Artificial Intelligence as a Retention Oriented Intervention

The conventional framing of AI in medical education centres on learning efficiency and competency outcomes. This review proposes a complementary framing specific to the Nigerian context: AI adoption as a structural signal within the broader physician retention crisis. Evidence indicates that the decision of Nigerian medical trainees to migrate is shaped not only by remuneration and security, but by a broader perception of institutional stagnation, encompassing outdated training methods, limited research infrastructure, and constrained opportunities for professional development (Hallquist et al, 2025).

Within this framing, investment in AI-powered simulation, adaptive assessment platforms, and structured clinical decision support tools may carry value beyond their immediate pedagogical function. Such investment signals to trainees that their institutions are actively modernising, potentially altering the calculus that currently favours emigration. This is consistent with broader workforce literature suggesting that opportunities for professional development and exposure to advanced practice environments function as meaningful retention factors, independent of salary considerations alone[2]. Although no Nigerian study has yet directly tested whether AI adoption in medical training measurably influences retention intentions, the theoretical linkage between perceived institutional modernity and migration decision-making is well established in the existing literature and merits dedicated empirical investigation.[1]

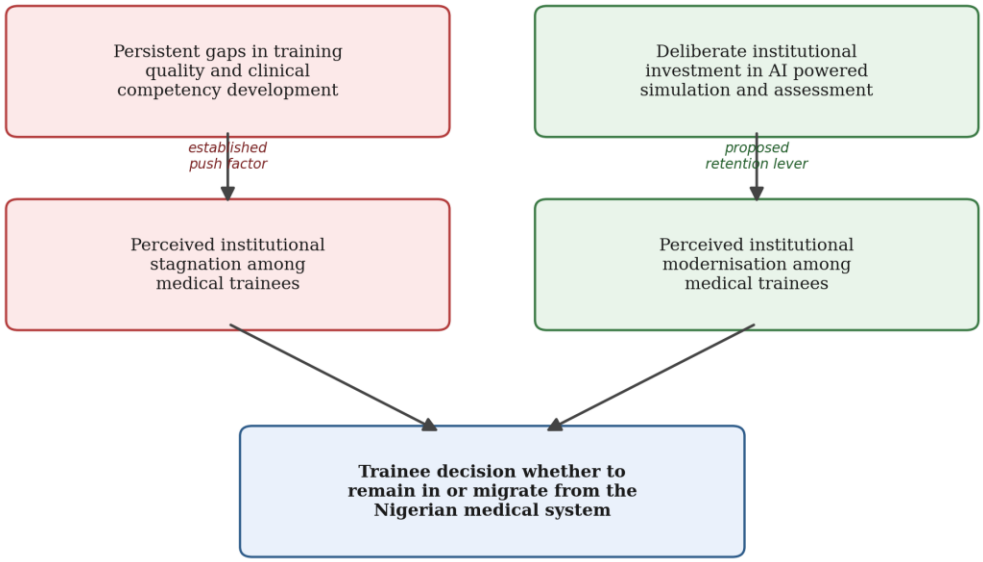

Figure 1. Conceptual model of AI investment as a proposed counterweight to an established training quality migration pathway.

Future Directions

Several concrete steps could accelerate responsible AI integration into Nigerian medical education. First, public-private partnerships between government agencies and telecommunications operators could expand affordable broadband access to training institutions outside major urban centres, addressing the most fundamental infrastructural barrier identified in this review (Mohac Africa, 2026). Second, context-specific AI models trained on Nigerian clinical data and disease patterns would likely outperform generic global models in relevance and accuracy for local training purposes, an approach already

being explored through emerging public-private collaboration in the wider Nigerian AI ecosystem (Ogbonna et al, 2026).

Third, formal AI literacy curricula should be developed for both students and faculty, addressing not only technical use but also the ethical and epistemic limitations of AI-generated clinical content. Fourth, national regulatory bodies, including the National Universities Commission and relevant postgraduate colleges, should develop sector-specific guidance on acceptable AI use in medical training and assessment, building on the data protection foundation already established (Ogbonna et al, 2026). Finally, future research should directly investigate whether exposure to AI-enhanced training environments measurably influences Nigerian trainees' retention intentions, moving the retention hypothesis advanced in this review from theoretical proposition to empirical evidence.

Conclusion

Artificial intelligence holds genuine promise for transforming medical education in Nigeria, offering scalable solutions to long-standing resource constraints in simulation, assessment, and adaptive learning. Realising this promise requires moving beyond informal, student-driven adoption toward deliberate institutional investment, supported by improved infrastructure, context-specific tool development, and coherent regulatory frameworks. This review has argued that such investment carries significance beyond immediate educational outcomes. In a healthcare system actively losing trained physicians to migration, AI integration represents a tangible, achievable signal of institutional modernisation, one that may meaningfully influence whether the next generation of Nigerian doctors choose to build their careers at home.

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