

Integration of Artificial Intelligence into Medical Education: A Mixed-Methods Study Identifying the Risks, Safeguards, and Optimal Approaches to Protect Clinical Skill Development across West African Countries

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Abstract

Background

Artificial intelligence (AI) offers transformative potential for medical education through personalised learning, simulation, and decision support, especially in resource-limited settings like West Africa. However, there are concerns regarding over-reliance on AI, potentially undermining core clinical skills such as diagnostic reasoning, physical examination, and independent judgement. Empirical evidence on risks, safeguards, and optimal integration strategies in low-resource African contexts remains scarce.

Methods

This mixed-methods study targeted physicians affiliated with the West African College of Physicians. A structured online survey (n = 136) assessed AI literacy, perceived risks to clinical skill development, attitudes toward AI, and understanding of AI limitations using Likert scales and knowledge items. Purposive key informant interviews (n = 72) with physician educators, programme directors, clinicians, technical experts, and policymakers explored experiences, concerns, safeguards, and curriculum recommendations. Quantitative data were analysed descriptively on SPSS version 29.0; and qualitative data underwent thematic framework analysis in NVivo.

Findings

Survey respondents were predominantly Nigerian (84.6%), balanced by gender (51.5% female), with diverse clinical experience. AI literacy was low: 32.4% lacked basic familiarity, and 67.6% lacked confidence in assessing AI outputs. Major gaps included unawareness of algorithmic bias (41.9%) and population variability in AI performance (36.8%). Most (87.5%) rejected uncritical acceptance of AI recommendations. High concern existed about threats to autonomy (77.9%), weakened diagnostic skills (71.3%), and deskilling of younger clinicians (68.4%). However, 94.1% expressed willingness to use AI if proven effective and safe. Qualitative themes emphasised systemic training gaps, the need for “informed sceptics”, longitudinal curriculum integration, hands-on experience, and safeguards prioritising clinical reasoning over AI dependence.

Conclusion

West African clinicians show significant AI literacy deficits and apprehension about the erosion of clinical skills yet demonstrate conditional openness to AI. Integration requires foundational literacy, longitudinal embedding, practical training, ethical focus, and competency assessments that preserve independent judgement. Addressing faculty expertise and infrastructure barriers is essential to prepare competent, AI-literate physicians without compromising clinical proficiency.

INTRODUCTION

Artificial intelligence (AI) is changing medical education worldwide in ways never seen before. AI opens new possibilities for personalised learning, automated assessment, better clinical decision support, and greater access to medical knowledge.^{1,2} AI applications in medical education encompass intelligent tutoring systems, virtual patients, automated feedback on clinical reasoning, and simulation-based learning environments.^{3,4} These technologies are especially promising for settings with limited resources, where a lack of faculty, limited clinical exposure, and inconsistent access to a variety of patient cases make traditional training methods less effective.^{5,6}

Nonetheless, the incorporation of AI into medical education poses considerable risks, particularly concerning the cultivation of essential clinical competencies traditionally refined through supervised practice, repetition, and incremental responsibility.^{7,8} There are concerns that depending too much on AI tools could hurt the growth of important clinical skills, such as diagnostic reasoning, physical examination techniques, clinical judgement under uncertainty, and the ability to put together information from many sources in complicated patient cases.^{9,10} As AI systems advance and become more accessible, there exists a significant risk that learners might circumvent the cognitive challenges necessary for profound learning, choosing instead algorithmic shortcuts that yield answers without promoting comprehension.¹¹

In the context of medical education in West Africa, these factors become especially important and complicated. Medical schools and residency training programmes in the area face many problems, including high trainee-to-faculty ratios, limited access to a wide range of clinical cases, insufficient simulation facilities, and varying levels of supervision quality.^{12,13} Medical residents frequently handle substantial patient loads with constrained resources, presenting both challenges and opportunities for AI integration.¹³ AI could improve learning by

making clinical decision-making better and providing educational support. However, there is a real concern that using AI in the wrong way could worsen existing training gaps by replacing the supervised clinical experiences necessary for developing competency.^{14,15}

The notion of “AI literacy” for medical trainees has arisen as an essential competency, including comprehension of AI’s capabilities and limitations, critical evaluation of AI outputs, identification of algorithmic bias, and suitable incorporation of AI recommendations into clinical decision-making.^{16,17} In West Africa, where AI tools created in developed countries may be used without being tested in the area, these literacy skills are even more important.^{18,19} But structured AI education is not a common part of medical school curricula in the area, so graduates will not be ready to work in clinical settings that use AI.^{20,21}

Even though there is more discussion about AI in medical education worldwide, there is sparse empirical evidence on the best ways to use AI in settings with limited resources while still allowing important clinical skill development.^{3,6} The majority of current guidance originates from high-income nations characterised by distinct educational infrastructures, faculty resources, and clinical training settings.^{1,2} This study fills this important gap by systematically examining the perceived risks, necessary safeguards, and best practices for using AI in West African medical education while ensuring that residents learn the clinical judgement, manual skills, and decision-making they need to practice safely and effectively.

Research Questions

1. What are clinicians’ perspectives on the risks of using artificial intelligence in medical education in West Africa, especially when it comes to developing clinical skills, diagnostic reasoning, and clinical judgement?
2. What do West African clinicians think are the best ways to make sure that AI integration improves rather than harms clinical skill development?
3. What do West African clinicians and trainees know about AI, and what do they still need to learn about its strengths and weaknesses?
4. What is the best way to use AI in medical curricula in West Africa that balances the benefits of AI with the need to protect important clinical skill development?

METHODOLOGY

Study Design

This study utilised a mixed-methods design, integrating quantitative survey techniques and qualitative analysis using key informant interviews. The design was chosen to fully describe current levels of AI literacy, identify what people perceive as risks, and provide a deeper look at what teachers and students think are the best ways to protect themselves and use AI.²²

Study Population

The target group included doctors who are members of the West African College of Physicians (WACP), the main provider of postgraduate medical education in the sub-region. The members of this college come from both English-speaking and French-speaking countries in the sub-region. Most of the WACP fellows and members work in Nigeria, but they can work in any country in West Africa. A convenience sampling method was utilised, leveraging the college’s current communication channels to recruit participants. Any physician recorded in the WACP contact database throughout the study period was qualified for inclusion.

The target population were physicians including: (1) medical residents in postgraduate training in a variety of specialities; (2) medical educators, such as consultants and faculty members who are in charge of developing the curriculum and supervising trainees; and (3) programme directors and departmental heads who are in charge of residency training programmes.

Sample size and sampling

The target sample size was 136. A stratified sampling method was utilised with teaching hospitals intentionally selected to ensure regional representation. For the qualitative part, 72 key informants were purposively selected to capture a wide range of views, based on their areas of expertise, years of teaching experience, prior use of technology, and roles as educational leaders.

Data collection tools

Quantitative Survey: A structured questionnaire was developed based on established frameworks for technology acceptance in education, AI literacy literature, and research on clinical skill development.^{23–25} The instrument comprised sections addressing: (1) demographic and training attributes; (2) familiarity with AI and prior exposure; (3) comprehension of AI's capabilities and limitations; (4) perceived risks associated with AI integration for clinical skill development; (5) attitudes towards AI in education; (6) preferred safeguards and integration strategies; and (7) confidence in clinical decision-making both with and without AI assistance, as well as conditional willingness to adopt AI tools if proven effective and safe (measured via 5-point Likert agreement with the statement: "I would use AI tools in my clinical practice or training if they are proven to be effective and safe"). We used 5-point Likert scales, multiple-choice knowledge questions, and categorical responses to measure the items. The instrument was pre-tested with 15 Nigerian physicians and subsequently improved for clarity, cultural appropriateness, and length.

Qualitative Guides (Key Informant Interview): Semi-structured interview guides were used to investigate: (1) current ideas about AI and how it could be used in medical education; (2) specific worries about how AI could affect the development of clinical skills; (3) experiences, if any, with AI tools in training; (4) opinions on the right safeguards and timing for integration; (5) opinions on how AI should be included in curricula; and (6) training and support needs for both educators and trainees. The guides were designed to be flexible, allowing them to explore new themes and unexpected survey results.

Data Collection

Survey administration: The survey was administered in February 2026 through a mix of online methods, including professional networks, WhatsApp groups for residents, and email lists. The online version was hosted on a safe platform that encrypted data. Everyone who took part gave their full consent before doing so. It took less than 60 minutes to finish the survey.

Qualitative data collection: Key informant interviews were conducted following an initial analysis of survey data to facilitate examination of findings that necessitate enhanced comprehension. Interviews were conducted by trained qualitative researchers in either English or French, as necessary. Each interview was recorded with permission and lasted less than an hour.

Data Analysis

Quantitative analysis

The survey data was moved to SPSS version 29.0 (IBM Corp., Armonk, NY, USA) for analysis.²⁶ Checking for completeness, consistency, and values that were too high or too low was part of the data cleaning process. For all variables, we analysed the descriptive statistics (frequencies, percentages, means, and standard deviations). To assess how well people understood AI's limitations, they were given knowledge items and asked to indicate whether each was correct or incorrect.

Qualitative analysis

Audio recordings were transcribed verbatim and translated into English as needed. Transcripts were imported into NVivo version 14 for thematic analysis using the framework approach.²⁷ Two researchers independently coded a portion of the transcripts to establish an initial coding framework, which was subsequently refined through discussion and consensus. Themes were discerned through inductive reasoning (arising from data).

Ethical Consideration

The Ethical Clearance Committee of the University of Nigeria Teaching Hospital granted permission for the study to proceed; ethical clearance number UNTH/HREC/2026/01/4157. Participants could choose to take part, and their privacy was protected by using unique, anonymous codes, entering data on password-protected Android tablets, and keeping the devices secure. The Declaration of Helsinki's ethical standards were followed during the study.

RESULTS

Quantitative Results

Respondents' Characteristics

The West African College of Physicians (WACP) platform (Email and WhatsApp) was utilised to disseminate the survey link, resulting in 137 physicians accessing the link and 136 completing the responses (one physician declined consent). Table 1 provides the profile of the study sample, showing that the majority of respondents were from Nigeria (84.6%), with smaller representations from Ghana (5.9%), Liberia (3.6%), Togo (2.9%), Niger (1.5%), and Côte d'Ivoire (1.5%). Gender distribution was relatively balanced (51.5% female, 48.5% male). The largest age group was 35–44 years (30.1%), followed by 45–54 years (26.5%). One-third of respondents (33.0%) had over 20 years of clinical experience.

Table 1
Demographic characteristics of survey respondents

Demographic Variables	Category	Frequency	Percent
Country	Nigeria	115	84.6
	Ghana	8	5.9
	Liberia	5	3.6
	Togo	4	2.9
	Niger	2	1.5
	Côte d'Ivoire	2	1.5
Gender	Female	70	51.5
	Male	66	48.5
Age group (in years)	25–34	26	19.1
	35–44	41	30.1
	45–54	36	26.5
	55–64	21	15.4
	65+	11	8.1
	Prefer not to say	1	0.7
Clinical Experience (in years)	0–5	15	11.0
	6–10	27	19.9
	11–15	27	19.9
	16–20	22	16.2
	20+	45	33.0

Table 2 presents findings on AI literacy among survey respondents, combining self-reported familiarity with objective assessments of confidence in evaluating AI outputs. It assesses the current state of AI literacy by combining data on familiarity and confidence. It shows that over a quarter (32.4%) of respondents lack even basic familiarity with AI. Critically, 67.6% lack confidence in assessing the reliability of AI outputs. The 19.1% shows high familiarity or expertise.

Table 2
AI literacy and training gaps among current clinicians

Indicator	Category	Frequency (n)	Percent (%)	Implications for Education
AI familiarity	Not/Somewhat familiar	44	32.4	Foundational AI literacy urgently needed
	Moderately familiar	66	48.5	Intermediate understanding exists
	Highly familiar/expert	26	19.1	Potential peer educators identified
Confidence in assessing AI outputs	Confident	36	26.5	Minority can critically appraise AI
	Reliable/very Reliable			
	Not confident (unreliable /very unreliable)	92	67.6	Majority lack critical appraisal skills
	Unsure	8	5.9	Uncertainty

Table 3 quantifies clinician perceptions and attitudes towards educational risks posed by AI. Over three-quarters (77.9%) of respondents agree that AI threatens their clinical autonomy. A substantial majority (71.3%) believe that over-reliance on AI could weaken diagnostic skills, and 68.4% specifically express concern that AI may deskill younger clinicians.

A large majority of respondents expressed conditional openness to AI use in clinical and educational settings. Specifically, 94.1% agreed or strongly agreed with the statement: "I would use AI tools in my clinical practice or training if they are proven to be effective and safe." Only 4.4% (6/136) disagreed or strongly disagreed, with the remaining 1.5% (2/136) neutral or unsure.

Table 3
Risks to clinical skill development (clinician perceptions and attitudes)

Risk Factor	Agree/Strongly Agree (%)	Neutral (%)	Disagree/Strongly Disagree (%)
AI threatens my clinical autonomy	77.9	10.3	11.8
Over-reliance on AI could weaken diagnostic skills	71.3	15.5	13.2
AI may deskill younger clinicians	68.4	18.4	13.2
I would use AI tools if proven effective and safe	94.1	1.5	4.4

Table 4 shows clinicians' understanding of key AI limitations. A positive finding is that most respondents (87.5%) correctly reject the notion that AI recommendations should be accepted without question. However, significant knowledge gaps exist: 41.9% are unaware of AI's potential for bias, and 36.8% do not understand that AI performance can vary across different populations.

Table 4
Current understanding of AI limitations

Statement	Correct Understanding (%)	Uncertain/ Incorrect (%)
AI recommendations should be accepted without question	87.5	12.5
AI can exhibit bias based on training data	58.1	41.9
AI performance may vary across different populations	63.2	36.8

Table 5 shows that 67.6% cannot reliably assess AI output, and 41.9% are unaware of AI bias potential. While 77.9% fear loss of autonomy, 28.6% lack basic AI familiarity.

Table 5
Optimal approaches for AI integration into medical education (inferred from data)

Educational Domain	Current Gap (% demonstrating gap)	Recommended Educational Intervention
Critical appraisal of AI (cannot reliably assess AI output)	67.6%	Introduce “AI Evidence Critique” modules in clinical rotations
Understanding AI limitations (unaware of AI bias potential)	41.9%	Include training on algorithmic bias and dataset representativeness
Balancing AI with autonomy (fear loss of autonomy)	77.9%	Ethics curriculum on synergistic clinician-AI decision-making
AI literacy foundation (lack basic familiarity)	32.4%	Mandatory foundational AI courses in undergraduate medical curriculum

Qualitative Results

A total of 72 key informant interviews were completed. This section displays what physicians in various capacities, including technical leadership, data science, AI development, programme directors, and medical educators, said about the current gaps, the skills they want students to have, and the best ways to use AI in medical education.

Table 6
Qualitative Participants

Informant Category	Number of Participants
Technical Leads	15
AI Developers	9
Data Scientists	16
Programme Directors	7
Policymakers	6
Ministry Officials	6
Senior Clinicians	3
Hospital Leadership	4
Department Heads	2
Medical Educators	4

Current shortcomings in medical education pertaining to AI

Teachers all agree that the current training is insufficient and that there are significant gaps in basic knowledge. The biggest problem is that students don’t learn enough about basic AI and data science concepts, so they can not verify the accuracy and completeness of digital health records. They also lack sufficient hands-on experience with clinical AI tools and do not understand ethics and data privacy issues well. Respondents think that AI is an “add-on” and not a core tool. One programme director said that “many programmes treat AI as a standalone elective or a technical ‘add-on’ rather than a core clinical tool”, missing the point that it is becoming the “new anatomy”.

Important skills for future medical graduates

Everyone agreed that medical graduates need to understand how AI works in clinical settings, not how to code. One respondent reported that “graduates need to have a basic understanding of AI concepts and terminology” in order to be “informed sceptics”. They also need to be able to “critically appraise AI tools and algorithms” and “identify potential bias”. There was an emphasis on safety in terms of moral use. A respondent noted that graduates need to know how to “interpret and critically evaluate AI tools”, know “when an AI recommendation contradicts established medical evidence”, and safely use AI “to support clinical decision-making while maintaining patient-centred care”. The people who answered said that students need to know their limits. One person said that a core skill is knowing what AI can’t do. Students need to know “the limitations” of the tools they use to “keep professional accountability”.

Best Ways to Combine Different Subjects

Teachers are clear that AI can't be taught in just one class; it needs to be a part of medical training as a whole. The general agreement is to start with a "foundational standalone course" (such as AI basics, ethics, or data literacy) and then "integrate AI longitudinally throughout the curriculum", demonstrating how it can be applied across different fields. It was said that practical, hands-on experience was the most important thing, and the preferred balance heavily favours practical application, with one educator suggesting a "60/40 split favouring hands-on experience". Students need direct experience with collecting data, using AI-enabled diagnostic tools, and interpreting AI outputs in real or simulated clinical situations. It was also pointed out that competency needs to be tested, and this should go beyond theory. Some suggested methods are "objective structured clinical examinations (OSCEs) with AI scenarios", "case-based discussions" where students have to explain or question an AI recommendation, and reports from the field.

Risks, Protections, and Barriers

Teachers know very well what the risks and problems are with implementation. The main danger is that students "stop using their own judgement" and lose their ability to think critically in a clinical setting. The safeguard is to "emphasise clinical reasoning and judgement first", teaching students to view AI as an assistant, not an authority. Key issues raised include "data privacy, algorithmic bias, informed consent, accountability, and equitable access." Students must be trained to recognise and address these.

De-skilling

People are worried that AI could make them "lazy about academic pursuit" and lead them to lose important clinical skills.

Obstacles to Integration

Limited faculty expertise, lack of resources and infrastructure, and an already crowded curriculum are some of the main obstacles to integration. There is also "resistance to changing long-standing traditional teaching methods", as was noted by a respondent. Staff members may not know enough about computers, and there may not be enough "modern hardware for all students".

DISCUSSION

This study represents the first systematic analysis of AI literacy levels, perceived risks, and educational requirements among West African clinicians, with direct ramifications for the incorporation of AI into medical education while safeguarding fundamental clinical skill development. By triangulating quantitative survey data from clinicians with qualitative insights from physicians, the study cultivates a comprehensive understanding of the current state of AI readiness and future directions for curriculum reform.

The AI literacy deficit: "Many programmes treat AI as a standalone elective."

The quantitative findings show that the current West African clinical workforce is severely lacking in AI literacy. For instance, 67.6% of respondents were unsure how to evaluate the reliability of AI outputs, indicating that even people somewhat familiar with AI were not very good at critically evaluating AI-generated information. Additionally, there were major gaps in knowledge about basic AI limitations, such as being unaware of AI's potential for bias and not understanding that AI performance can vary across populations. These gaps are concerning because safe and effective use of AI in clinical practice depends on clinicians' ability to critically evaluate AI recommendations, recognise when AI may be unreliable, and integrate AI outputs appropriately into clinical decision-making.^{17,28}

The finding that only a very small number of respondents were very familiar with AI or an expert, while others claimed they did not have a basic understanding of it, shows that AI literacy efforts need to reach people at many different levels. For those who don't know much about AI, a basic education is needed to understand what it is, how it works, and how it could be used in healthcare.²⁴ For the 48.5% that knew a little about AI, they need more advanced training that focuses on critical appraisal and appropriate use.¹⁶ The 19.1% who were very familiar with AI are a valuable resource who could be used as peer educators and champions for AI literacy initiatives, as has been noted elsewhere.²¹

The qualitative findings provide rich context for understanding this literacy deficit, revealing that the problem is rooted in systemic gaps in medical education. The findings show that current training is inadequate, with the biggest gap being the "limited teaching of basic AI and data science concepts", leaving physicians without the "ability to verify the accuracy and completeness of digital health records". The participants had "little hands-on experience with clinical AI tools" and a "poor understanding of ethics and data privacy issues."

The most intriguing finding is that AI was seen as an "add-on", not a core tool. One respondent made this point very clearly when she said, "Many programmes treat AI as a standalone elective or a technical 'add-on' rather than a core clinical tool." This is a powerful way to put it; anatomy is not taught as an elective; it is foundational to medical practice. The implication is clear: AI literacy should be repositioned from a peripheral technical skill to a core clinical competency.

The AI literacy gap in this study does not only apply to West Africa; studies from high-income areas have also shown that clinicians do not understand AI very well.^{29,30} But the effects may be worse in places with fewer resources, where AI tools developed elsewhere may be used without local validation and where there may not be enough regulatory oversight to stop the use of poorly validated systems.^{18,19} Clinicians who are unable to spot bias or recognise when AI performance may differ across their patient populations are at risk of making clinical decisions based on poor recommendations, which could compromise patient safety.³¹

The quantitative data show that many people were worried about how AI will affect clinical competence. More than three-quarters (77.9%) of respondents agree that AI threatens their clinical autonomy. A large majority (71.3%) think that relying too much on AI could weaken diagnostic skills, and 68.4% are especially worried that AI may deskil younger clinicians. The fact that people are worried about these related areas suggests that clinicians view AI as a systemic threat to clinical skill development, not just an isolated risk.

These findings align with international literature highlighting analogous concerns among clinicians in high-income contexts.^{7–9} Theoretical frameworks indicate that cognitive offloading to technology may indeed hinder the cultivation of profound understanding and clinical reasoning.¹¹ The pertinent inquiry for medical education is not the existence of these risks, but the methodology for structuring AI integration to alleviate them while capitalising on AI's educational advantages.¹⁰

The qualitative data elucidate the specific nature of these concerns and indicate potential safeguards. Clinicians were acutely aware that the primary risk is that students could “cease exercising independent judgement” and forfeit their clinical reasoning skills. The safeguard, they stress, is to “prioritise clinical reasoning and judgement”, instructing students to regard “AI as an assistant, not an authority”. This framing is essential; it positions AI as a tool that enhances rather than replaces clinical thinking, maintaining the supremacy of human judgement while utilising AI's capabilities.

The high prevalence of these concerns in the West African context may reflect specific features of clinical training in resource-constrained settings. West African medical residents often develop clinical skills under challenging conditions, with limited supervision, high patient volumes, and constrained diagnostic resources.^{5,13} In such contexts, clinical autonomy may be particularly valued as a survival skill, and any technology perceived as threatening that autonomy may face substantial resistance.¹⁵ Similarly, concerns about deskilling may be amplified in settings where training opportunities are already limited and where any reduction in the already-scarce opportunities for supervised clinical reasoning could have a disproportionate impact on competency development.¹⁴

Importantly, clinicians also identified a specific fear of de-skilling, that AI could lead to “laziness in academic pursuit” and the erosion of core clinical skills. This concern should be addressed proactively in curricula to position AI as a tool that enhances rather than undermines clinical competence. As reported in the results, 94.1% of respondents in the study would use AI if proven effective, which suggests that clinicians were not rejecting AI outright but demanding that its integration be managed in ways that protect the competencies they have worked hard to develop.

“Smart Sceptics” Who Know What AI Can't Do

A favourable outcome of assessing clinicians' comprehension of significant AI limitations is that the majority of respondents accurately refute the idea that AI recommendations should be accepted uncritically, reflecting a general awareness of AI's fallibility. This result corresponds with studies indicating that clinicians acknowledge the necessity for oversight of AI systems.^{29,30} Nonetheless, the identified knowledge gaps are troubling, as they pertain to fundamental AI limitations that have direct consequences for clinical safety.

The finding that a lot of the clinicians didn't know that AI can be biased based on training data shows that they did not understand how AI systems learn from past data and could make existing disparities worse.^{18,19} This is especially a problem in West Africa, where AI tools trained on populations in high-income countries may work differently because of differences in how diseases show up, demographic characteristics, and healthcare delivery patterns.³² Those that don't understand that AI performance may vary across different populations may also not understand that AI recommendations need to be validated locally before being trusted. This gap could lead to people relying on AI tools that haven't been tested in West African populations, which could lead to misdiagnosis or bad treatment recommendations.²⁸

These qualitative findings from clinicians underscored the necessity of addressing these knowledge deficiencies through specialised training. One respondent articulated that graduates must possess a “basic understanding of AI concepts and terminology” to be “informed sceptics”. And that they require the “ability to critically appraise AI tools and algorithms” and “identify potential bias”. The notion of the “informed sceptic” is compelling; it embodies the ideal approach to AI: neither uncritical acceptance nor automatic rejection, but rather thoughtful engagement rooted in an understanding of both strengths and weaknesses.

Regarding safe and ethical application, the focus was consistently on safety. As one respondent emphasised, graduates must understand how to “interpret and critically evaluate AI tools”, recognise “when an AI recommendation contradicts established medical evidence”, and safely apply AI “to support clinical decision-making while maintaining patient-centred care”. The respondents also stressed the need for students to understand what AI cannot do. A core competency was knowing the “limitations” of the tools they use to “maintain professional accountability”. Medical education should therefore ensure that graduates understand not only the capabilities of AI but also its limitations and the conditions under which it may be unreliable.¹⁷

Implications for Curriculum Development: “Integrated Throughout, Not a One-Off Lecture”

This study turned the gaps that were found into specific educational interventions by linking each area of need with the percentage of clinicians who showed a gap and suggesting a specific addition to the curriculum. This framework provides a structured way to develop the curriculum that systematically addresses the gaps that were found.

For those who were unable to reliably assess AI output, “AI Evidence Critique” modules integrated into clinical rotations would parallel existing training in critical appraisal of research evidence.¹⁶ This approach positions AI literacy as an extension of evidence-based medicine rather than a separate, technical competency. For the 41.9% unaware of AI bias potential, dedicated training on algorithmic bias and dataset representativeness would address this gap directly, ideally integrated into discussions of health equity and social determinants of health to ensure that students understand how AI can both perpetuate and potentially mitigate disparities.¹⁸

The 77.9% who are afraid of losing their independence need ethics classes that change the way clinicians and AI work together from being competitive to being helpful, using frameworks for human-AI collaboration in healthcare.^{17,33} These classes should also discuss how AI is changing the way clinicians work, framing the ideal clinician-AI relationship as one of shared decision-making where AI gives information and suggestions, but clinicians are still responsible for making the final decision. Finally, the 28.6% who don't know much about AI need basic courses at the undergraduate level to make sure that all future clinicians are AI literate.^{1,6}

The qualitative findings strongly endorsed this multi-level approach while emphasising that AI cannot be a one-off lecture; it must be woven into the fabric of medical training. Clinicians reached consensus on starting with a “foundational standalone course” (e.g., AI basics, ethics, data literacy) and then “integrating AI longitudinally throughout the curriculum”, showing its application in different specialities. This integrated approach ensures that students encounter AI repeatedly across diverse clinical contexts, building depth of understanding through varied applications.

Practical, hands-on experience was emphasised as essential. The preferred balance heavily favours practical application, with one educator suggesting a “60/40 split favouring hands-on experience”. Students need direct experience with data collection, AI-enabled diagnostic tools, and interpreting AI outputs in simulated or real clinical scenarios. This aligns with the theme emerging from both quantitative and qualitative data: the importance of supervised practice with AI tools in educational settings. Just as students learn clinical skills through supervised practice with patients, they need opportunities to use AI tools under supervision, with feedback on when AI recommendations are appropriate, when they should be questioned, and how to integrate AI into clinical reasoning.⁹ Simulation-based learning offers promise for this purpose, allowing students to encounter varied cases, compare their reasoning with AI recommendations, and develop skills in evaluating AI outputs without risk to real patients.^{3,4}

There was also a strong emphasis on the need to assess competency, and assessments must go beyond theory. Suggested methods include “objective structured clinical examinations (OSCEs) with AI scenarios”, “case-based discussions” where students must justify or challenge an AI recommendation, and field-based reports. It is very important that assessments of clinical competence are done without AI support so that students can learn to reason through difficult cases on their own. 71.3% of respondents were concerned that AI could weaken diagnostic skills, which is a valid concern because if AI is always available, students may never learn to reason through complex cases on their own.¹¹ Therefore, medical education programmes must set clear limits on how AI can be used in training, making sure that AI enhances rather than replaces the cognitive work that is necessary for learning.

Obstacles to Integration: “Limited Faculty Expertise, Lack of Resources”

The qualitative findings also show that there are big problems with putting these suggested educational changes into action. The main problems are “limited faculty expertise, lack of resources and infrastructure, and an already crowded curriculum”. There is also “resistance to changing long-standing traditional teaching methods”. “Inadequate computer knowledge” among faculty and a lack of “modern hardware for all students” are two major problems that can't be ignored. These barriers are not insignificant. Faculty cannot instruct on subjects they do not comprehend, and students cannot learn without the necessary equipment. Overcoming these obstacles will necessitate institutional

dedication, investment in faculty development, and innovative strategies for resource mobilisation. Collaborations with technology firms, international academic institutions, and professional organisations such as the West African College of Physicians may help to address some deficiencies. Furthermore, the data indicated that the 19.1% of clinicians with substantial AI knowledge could serve as peer educators, establishing a train-the-trainer framework that utilises existing expertise while enhancing local capacity.

Even with these problems, it is clear that action is needed. The AI literacy gap found in this study, along with the widespread worries about AI's effect on clinical skills and the lack of knowledge about AI's limits, calls for a coordinated response from clinicians, professional groups, and health regulators. The framework presented here shows how that response should happen, with specific interventions aimed at specific gaps and based on both quantitative evidence and qualitative insights from those in charge of training the next generation of West African doctors.

Limitations of the study

Several limitations should be considered when interpreting these findings. First, the sample was predominantly Nigerian, potentially limiting generalisability to other West African countries with different medical education systems and resources. Second, self-reported familiarity and confidence may not correspond to objectively measured knowledge, and the relationship between confidence and actual competence in AI appraisal requires further study. Third, the cross-sectional design captured perceptions at a single time point, whereas attitudes toward AI and understanding of its capabilities may evolve rapidly with experience and exposure. Fourth, the study focused on physicians' perceptions rather than direct measurement of learning outcomes; experimental studies are needed to test whether proposed educational interventions improve AI literacy and protect clinical skill development. Fifth, the rapid evolution of AI technology means that specific knowledge about AI capabilities and limitations may become outdated quickly, requiring ongoing curriculum revision.

CONCLUSION AND RECOMMENDATIONS

This study reveals significant deficiencies in AI literacy among West African clinicians, considerable apprehensions regarding AI's potential effects on clinical skill development, and critical knowledge gaps concerning AI's limitations. The qualitative insights from clinicians enhance this understanding by highlighting systemic deficiencies in current training, delineating essential competencies for future graduates, and offering specific recommendations for effective curriculum integration.

The combination of quantitative and qualitative evidence supports a multi-level, integrated approach to AI in medical education: foundational courses for basic literacy, longitudinal integration throughout clinical training, emphasis on hands-on experience, robust assessment methods, and explicit attention to ethical issues and limitations. The goal, as clinicians articulated, is to produce graduates who are "informed sceptics", that is, clinicians who can leverage AI's capabilities while recognising its limitations, who maintain independent clinical reasoning while incorporating AI insights, and who ultimately use AI to enhance rather than erode their professional competence.

In all, there is a need to overcome major obstacles like faculty development, infrastructure investment, and curriculum reform. However, the finding that almost all the respondents said they would use AI if it was proven effective shows that their resistance was not to technology itself, but to technology that threatens their professional autonomy and competence without showing any benefits. By incorporating AI education in ways that protect and improve clinical skills, clinicians can prepare a generation of doctors to work safely and effectively in a healthcare environment that uses AI.

For policy and practice in medical education, it is essential to underscore the significance of AI literacy for regulators, curriculum developers, medical schools, teaching hospitals, AI developers, and trainees. Key recommendations include instituting AI literacy as a fundamental competency, incorporating AI ethics into curricula, and offering training on the critical evaluation of AI recommendations. Medical schools should implement foundational AI courses, establish explicit AI usage policies, and develop simulation-based learning experiences. AI developers are encouraged to create educational tools that align with medical training goals, while trainees should proactively pursue AI learning opportunities and cultivate independent clinical reasoning skills.

Declarations

Ethics approval and consent to participate:

Ethical clearance for the study was obtained from the Ethical Clearance Committee of the University of Nigeria Teaching Hospital, ethical clearance number UNTH/HREC/2026/01/4157. Participation was voluntary, and confidentiality and protection against unauthorised access were maintained using unique anonymous codes, entering data on password-protected Android tablets, transmitting forms and storing them securely. The study was conducted in accordance with the ethical standards of the Declaration of Helsinki.

Consent for publication:

Not applicable.

Competing interests:

The authors declare no competing interests.

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Author Contribution

Data analysis and interpretation: BSCU, YJC, UUE, CCO, AU. Drafting the article: AO, BH, EME, SMY, KAU, EKI. Project supervision: BSCU. Reviewing and editing: All authors (BSCU, YJC, UUE, CCO, AU, AO, BH, EME, SMY, KAU, EKI) contributed critically to reviewing and editing multiple versions of the manuscript for important intellectual content. All authors read and approved the final version of the manuscript.

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Data Availability

The data is available from the corresponding author on reasonable request.

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