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Artificial intelligence in Nigerian oncology practice: A qualitative exploration of oncologists' perspectives

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ABSTRACT

Background: Artificial intelligence (AI) offers potential solutions to address critical challenges in oncology practice, particularly in resource-constrained settings like Nigeria. However, successful implementation requires understanding healthcare providers' perspectives, which remain largely unexplored in the Nigerian context.
Aim: To explore Nigerian oncologists' perspectives on AI applications in oncology practice, identifying knowledge levels, perceived benefits, implementation barriers, and priority areas for AI integration.
Methods: This qualitative study employed a descriptive exploratory design. Semi-structured interviews were conducted with 15 oncologists from nine major Nigerian healthcare institutions. All interviews were conducted in English. These institutions represent tertiary referral centres predominantly located in urbanised areas across different Nigerian geopolitical zones, including Southwest (OAUTH, LUTH, UCH, LASUTH, LAUTH), South-South (ISTH, UBTH), and North-Central (BSUTH, UATH). Participants represented various oncology specialties with experience ranging from 1 to 20 + years. Data were analysed using Braun and Clarke's six-phase thematic analysis approach with independent coding by multiple researchers to ensure inter-coder reliability.
Results: Nine key themes emerged: (1) Current Knowledge and Awareness of AI in Oncology; (2) Perceived Benefits of AI in Oncology Practice; (3) Perceived Barriers to AI Implementation; (4) AI in Oncology Research; (5) Data Management and Ethical Concerns; (6) Trust and Adoption Readiness; (7) Human-AI Interaction and Patient Dynamics; (8) Future Directions and Knowledge Requirements; and (9) Resource Allocation and Infrastructure Development. Participants demonstrated limited theoretical knowledge of AI applications, with most lacking practical implementation experience. Participants recognised AI's potential to address workforce shortages and improve diagnostic accuracy but identified significant barriers including financial constraints, infrastructure limitations, and insufficient technical expertise.
Conclusion: Nigerian oncologists expressed cautious optimism about AI's potential to transform cancer care delivery despite substantial implementation challenges. Successful AI integration requires addressing infrastructure deficits, developing appropriate regulatory frameworks, and building technical capacity. A phased implementation approach focusing initially on diagnostic support applications is recommended, alongside sustained investment in digital infrastructure and workforce development.

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1. Introduction

Artificial Intelligence (AI) is revolutionising healthcare delivery worldwide, offering unprecedented opportunities to enhance clinical decision-making, improve diagnostic accuracy, optimise treatment planning, and streamline healthcare operations [1–3]. In oncology specifically, AI applications have shown promising results across the cancer care continuum, from early detection and diagnosis to treatment selection, monitoring, and survivorship care [4,5]. These technological advancements are particularly significant given the rising global cancer burden, with approximately 20 million new cancer cases and 9.7 million cancer deaths reported in 2022, numbers expected to increase by 77 % by 2050 [6].

For low- and middle-income countries (LMICs) like Nigeria, the burden of cancer is especially concerning. Nigeria faces a disproportionate cancer burden characterised by late-stage presentations, limited access to diagnostic and treatment facilities, workforce shortages, interprofessional rivalry and high mortality rates [7]. With only about 70 clinical oncologists serving a population of over 200 million [8], Nigeria has a severe oncologist-to-patient ratio of approximately 1:2.5 million, compared to the recommended 1:160,000. This further puts the number of clinical oncologists per new cancer cases to 26:3923 patients [9]. This shortage is compounded by limited radiotherapy equipment, with only seven functional radiotherapy centres out of nine across the country as of 2023, most concentrated in urban areas [10].

In this context, AI technologies offer potential solutions to address these challenges by extending the reach and capabilities of the limited oncology workforce, improving diagnostic accuracy, optimising treatment planning, and enhancing patient monitoring and follow-up [4]. The integration of AI in oncology practice could potentially transform cancer care delivery in resource-constrained settings by democratising access to specialised expertise, reducing diagnostic delays, and improving treatment outcomes [11].

Several recent studies have demonstrated the feasibility and effectiveness of AI applications in oncology practice. For instance, some studies have reported high diagnostic accuracy of AI-assisted platforms for breast cancer detection globally [12–14]. In Africa, the use of AI-powered oncology service delivery has been slow but steadily progressing [15]. To mention a few, the following AI-powered diagnostic projects have witnessed tremendous success across Africa: In Morocco, the Democratic Republic of Congo, and Senegal (2020), the use of AI and image processing technologies in pathology has enabled the accurate detection of cancer signs in tissue samples [16]; Ubenwa in Nigeria is a start-up that is using signal processing and machine learning to improve the diagnosis of birth asphyxia in low-resource settings based on crying patterns of newborns [17]; PapsAI in Uganda (2018) is a low-cost digital microscope slide scanner that produces high-resolution cervical cell images for automatic analysis [18,19]; MinoHealth in Ghana (2017) utilises an AI system for diagnosing, forecasting, and prognosticating conditions such as breast cancer [20]; Intixel in Egypt (2018) aids radiologists by classifying patients, annotating abnormalities in scans, and automatically drafting reports [21]; Neuralabs Africa in Senegal and Kenya (2020) employs deep learning and computer vision to transform imaging diagnosis, with algorithms capable of identifying diseases in real-time [22]; Vectorgram Health in Kenya (2022) utilises a model trained on 369,000 mammogram examinations to analyse scans in as little as three seconds [23]; and Hurone AI in Rwanda (2021) remotely monitors patient signs and symptoms via simple short message service (SMS) and notifies clinicians about potential red flags based on symptom analysis [24].

Despite these promising developments, the integration of AI in oncology practice in Nigeria and similar LMICs faces numerous challenges, including infrastructure limitations, financial constraints, workforce readiness, ethical and regulatory considerations, and sociocultural factors [7,25]. Moreover, most AI applications are developed and validated in high-income countries, raising questions about their transferability and applicability in different healthcare contexts [26].

The successful implementation of AI in oncology practice requires not only technological readiness but also alignment with the needs, preferences, and capabilities of healthcare providers who will ultimately use these technologies [27]. Understanding oncologists' perspectives on AI application; their knowledge, attitudes, perceived benefits, concerns, and readiness for adoption is crucial for identifying potential implementation barriers and facilitators and for developing contextually appropriate AI integration strategies [28].

While some studies have explored healthcare providers' perspectives on AI in high-income countries [29,30], there is a notable paucity of research examining these issues in LMICs, particularly in the African context. In a recent systematic review by Sahoo et al. [30], the authors identified only eleven studies exploring healthcare providers' perspectives on AI globally with only two originating from developing nations and none from Africa. Interestingly, none of these studies focused specifically on oncologists or cancer care. This knowledge gap limits our understanding of the unique contextual factors that may influence AI adoption in oncology practice in these settings.

Nigeria, as Africa's most populous country with a growing cancer burden and a developing healthcare technology landscape, provides an important context for exploring these issues. The country has recently shown a growing interest in digital health technologies, with artificial intelligence holding the potential to transform the country's healthcare sector and bring it firmly into the 21st century [31]. Several Nigerian teaching hospitals have begun piloting AI applications for diagnostic support and clinical decision-making, though oncology-specific applications remain limited [32].

Understanding the perspectives of Nigerian oncologists on AI is particularly timely given these recent developments and could provide valuable insights for policymakers, healthcare administrators, technology developers, and implementation scientists working to harness AI's potential for improving cancer care in similar contexts. Such insights could inform the development of contextually appropriate AI solutions, identify priority areas for AI implementation, guide workforce capacity building efforts, and shape regulatory frameworks to ensure safe and ethical AI use [33].

This study therefore aims to explore Nigerian oncologists' perspectives on AI applications in oncology practice, with specific objectives to: (1) assess their current knowledge and awareness of AI applications in oncology; (2) identify perceived benefits and potential opportunities for AI integration in oncology practice; (3) examine perceived barriers and challenges to AI implementation; (4) explore perspectives on ethical, legal, and governance considerations related to AI use; and (5) identify priority areas and readiness for AI adoption in Nigerian oncology practice.

The findings from this study will contribute to the limited body of evidence on healthcare providers' perspectives on AI in LMICs, inform context-specific strategies for AI integration in oncology practice, and ultimately support efforts to leverage AI for improving cancer care outcomes in resource-constrained settings. Moreover, these insights may be relevant to other similar contexts facing comparable challenges in cancer care delivery and considering AI adoption as a potential solution.

2. Methods

2.1. Study design and approach

This qualitative study employed a descriptive exploratory design to investigate oncologists' perspectives on artificial intelligence applications in oncology practice within the Nigerian healthcare context. A thematic analysis approach was utilised to identify, analyse, and report patterns within the data [34]. This methodology was selected for its flexibility and ability to provide rich, detailed accounts of complex phenomena while identifying both commonalities and differences across participants' experiences.

2.2. Participants and sampling

Participants were recruited using purposive sampling with specific criteria including physicians currently practising in oncology or related specialties (including surgical oncology, radiation oncology, and medical oncology) with a minimum of one year of clinical experience in a Nigerian healthcare institution. Recruitment continued across diverse oncology specialties and institutions to ensure representation. Data saturation was assessed during collection by monitoring when no new themes emerged from subsequent interviews.

A total of 15 oncologists participated in the study, comprising 9 males and 6 females. Participants represented various oncology specialties including radiation oncology, surgical oncology, medical oncology, and radiologists involved in oncology care. They were recruited from nine major tertiary healthcare institutions strategically distributed across Nigeria's geopolitical zones: Obafemi Awolowo University Teaching Hospital (OAUTH) - Southwest zone, Lagos University Teaching Hospital (LUTH) - Southwest zone, Irrua Specialist Teaching Hospital (ISTH) - South-South zone, University of Abuja Teaching Hospital (UATH) - North-Central zone, University of Benin Teaching Hospital (UBTH) - South-South zone, Benue State University Teaching Hospital (BSUTH) - North-Central zone, University College Hospital (UCH) - Southwest zone, Lagos State University Teaching Hospital (LASUTH) - Southwest zone, and Ladoke Akintola University Teaching Hospital (LAUTH) - Southwest zone. Fig. 1 shows a detailed geographic distribution map showing the participating institutions across Nigeria's geopolitical zones.

It is important to note that these institutions represent tertiary referral centres predominantly located in urbanised, relatively well-resourced environments within Nigeria's healthcare ecosystem. This sampling approach, while ensuring access to experienced oncologists with exposure to modern healthcare technologies, may underrepresent perspectives from peripheral, rural, or lower-tier oncology services where digital divides and infrastructural challenges are most pronounced.

Participants' professional experience ranged from 1 to over 20 years, with the majority having 10–15 years of experience. Most participants were between 35 and 55 years of age, with 10 identifying as Christian and 5 as Muslim. All participants were married and most had children between the ages of 10–18 years.

2.3. Data collection

Semi-structured in-depth interviews were conducted between September 2024 and March 2025. All interviews were conducted in English, which is the official language of instruction and practice in Nigerian medical institutions. No translation was required as all participants were fluent English speakers. All interviews were conducted remotely via video or telephone call/meeting due to geographical dispersion. Each interview lasted between 30 and 45 min and was guided by a semi-structured interview protocol developed based on a review of relevant literature and consultation with experts in health informatics and oncology.

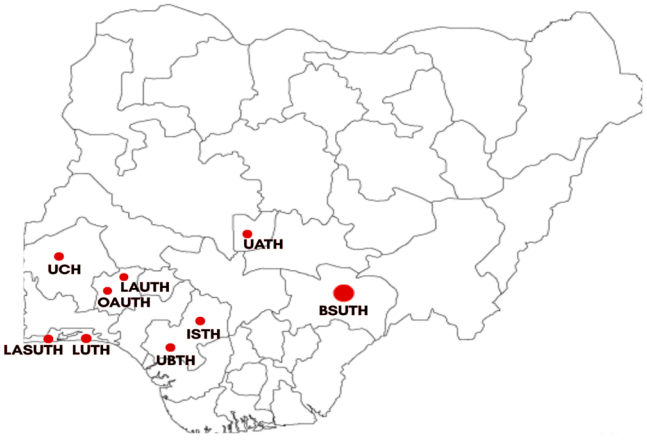

Fig. 1. Geographic distribution map showing the participating institutions across Nigeria's geopolitical zones.

The interview guide explored participants' knowledge and awareness of AI applications in oncology, perceived benefits and barriers to AI implementation, experiences with AI-based services (if any), perspectives on using AI in oncology research, ethical considerations related to AI use, trust and governance issues, and future directions for AI integration in oncology practice.

All interviews were audio-recorded with participants' consent and transcribed verbatim. Field notes were also taken during the interviews to capture non-verbal cues and contextual information. Data collection continued until theoretical saturation was achieved, which was determined when three consecutive interviews yielded no new themes or insights.

2.4. Ethical considerations

Ethical approval was obtained from BOWEN University Teaching Hospital Research Ethics Committee with the approval number "BUTH/REC-1134" prior to commencing the study. Verbal informed consent was obtained from all participants before the interviews. Confidentiality and anonymity were maintained by assigning unique identifiers to each participant and removing any potentially identifying information from the transcripts. Participants were informed of their right to withdraw from the study at any time without consequences.

2.5. Data analysis

The data were analysed using the six-phase thematic analysis approach described by Braun and Clarke (2006) [34]:

1. **Familiarisation with the data:** All transcripts were read and re-read by the research team to gain familiarity with the data. Initial notes on potential codes and patterns were made during this phase.
2. **Generating initial codes:** A systematic coding of interesting features across the entire dataset was conducted by two independent researchers, with data relevant to each code collated.
3. **Searching for themes:** Codes were sorted into potential themes, and relevant data extracts were gathered under each potential theme through collaborative discussion.
4. **Reviewing themes:** Themes were checked in relation to the coded extracts and the entire dataset to ensure they accurately reflected the data and created a coherent thematic map.
5. **Defining and naming themes:** Clear definitions and names were generated for each theme, with ongoing analysis to refine the specifics and generate clear definitions.
6. **Producing the report:** Compelling extract examples were selected, and the final analysis was related back to the research question and literature.

NVivo 12 software was used to facilitate data organisation, coding, and analysis. Two researchers independently coded the data, with a third researcher reviewing discrepancies. Inter-coder reliability was established through discussion and consensus-building when disagreements arose.

To enhance the trustworthiness of the findings, several strategies were employed, including:

- **Investigator triangulation:** Data were independently coded by two researchers and interpretations were compared and reconciled.

- **Member checking:** Preliminary findings were shared with a subset of participants to verify accuracy and resonance with their experiences.
- **Peer debriefing:** Regular discussions among the research team to challenge assumptions and explore alternative interpretations.
- **Reflexivity:** Researchers maintained reflexive journals to acknowledge and mitigate potential biases throughout the research process.

2.6. Methodological rigor

To ensure methodological rigor, we followed Lincoln and Guba's [35] criteria for establishing trustworthiness in qualitative research:

- **Credibility** was addressed through prolonged engagement with the data, member checking, and investigator triangulation.
- **Transferability** was enhanced through detailed descriptions of the research context and participant characteristics.
- **Dependability** was established by maintaining an audit trail of all methodological decisions and analytical processes.
- **Confirmability** was supported through reflexive practices and regular research team discussions to ensure findings were grounded in participants' accounts rather than researchers' biases or motivations.

3. Results

3.1. Sociodemographic information of study participants

Table 1 presents the comprehensive sociodemographic characteristics of the 15 oncology professionals interviewed across various Nigerian tertiary hospitals. Participants included both males (n = 9) and females (n = 6), with the majority aged between 35 and 55 years. Most respondents were married and had children aged 10–18 years. The group comprised a mix of clinical, surgical, and radiation oncologists, and radiologists, with professional experience ranging from 1 to over 20 years. Christianity was the predominant religion, followed by Islam. This diversity in demographic and professional backgrounds provided rich perspectives on the integration of artificial intelligence in oncology care and research within the Nigerian healthcare context.

3.2. Thematic analysis of Nigerian oncologists' perspectives on AI in healthcare

The thematic analysis of interviews with 15 Nigerian oncologists revealed nine major themes regarding artificial intelligence in oncology practice. These themes encompassed current knowledge levels (generally limited theoretical understanding rather than practical experience), perceived benefits (efficiency, diagnostic accuracy, resource optimisation), and implementation barriers (financial, infrastructural, technical expertise). Additional themes included research considerations, data management and ethics, trust and adoption readiness, human-patient interactions, future skill requirements, and resource allocation needs. Together, these themes provide a comprehensive framework for understanding the factors influencing AI adoption in Nigerian oncology practice, highlighting both significant opportunities for improving cancer care and substantial challenges that must be addressed in this resource-constrained setting.

The sections below present each theme with supporting quotations organised in tables for clarity and improved readability. A summary of major themes is also highlighted in Fig. 2.

3.3. Current knowledge and awareness of AI in oncology

This theme explores oncologists' familiarity with AI concepts, applications, and implementations within their practice settings. As shown in Table 2, the analysis revealed significant variations in knowledge levels among participants, ranging from very limited awareness to moderate theoretical understanding, though most indicated minimal practical exposure to AI systems.

3.4. Perceived benefits of AI in oncology practice

Participants identified numerous potential benefits of AI integration in oncology practice, with particular emphasis on addressing critical healthcare delivery challenges in resource-constrained settings (see Table 3).

3.5. Perceived barriers to AI implementation

As detailed in Table 4, this theme captures the substantial challenges and obstacles that oncologists identified as potential hindrances to AI implementation in Nigerian oncology practice.

3.6. AI in oncology research

This theme explores participants' perspectives on AI applications in research, revealing limited current engagement but recognition of potential benefits.

Participants reported very limited active AI research in their institutions, with most research being comparative studies of AI diagnostic capabilities versus clinician assessments. Ethical frameworks and governance structures were identified as essential but currently inadequate for AI research oversight.

> *"The only one that I am very much aware of is the study on AI guided diagnostic capability i.e. comparing the findings of clinicians with AI diagnostic capability investment that is the one I am very much aware of" (Participant 1)*

Table 1
Comprehensive Sociodemographic Characteristics of Participants.

Participant	Sex	Institution	Specialty/Department	Years of Experience	Age Range	Religion	Marital Status	Children (10–18 years)
1	Male	OAUTH	Radiology	19 years (9 as radiologist)	45–55	Islam	Married	Yes
2	Female	LUTH	Surgical Oncology	20 years (6 as consultant)	40–45	Christian	Married	Yes
3	Male	ISTH	Oncology	15 years	35–45	Christian	Married	No
4	Female	UATH	Oncology	8 + years (since 2014)	42	Islam	Married	Yes
5	Male	OAUTH	Oncology	16 years	< 45	Islam	Married	Yes
6	Female	LASUTH	Radiology	17 years	40–45	Christian	Married	Yes
7	Male	UBTH	Oncology	4 years	25–35	Christian	Married	Yes
8	Female	UBTH	Radiation and Clinical Oncology	1 year	25–35	Christian	Married	Yes
9	Female	UBTH	Oncology	4 years	25–35	Christian	Married	No
10	Male	BSUTH	Oncology	13 years as consultant	45–55	Christian	Married	No
11	Male	UCH	Surgical Oncology	> 20 years	55	Christian	Married	Yes
12	Male	UCH	Surgical Oncology	5–10 years	35–45	Islam	Married	No
13	Male	LAUTH	Oncology	8 years	35–45	Christian	Married	No
14	Male	LAUTH	Oncology	6 years	30–40	Islam	Married	Yes
15	Female	LAUTH	Oncology	3 years	25–35	Christian	Married	No

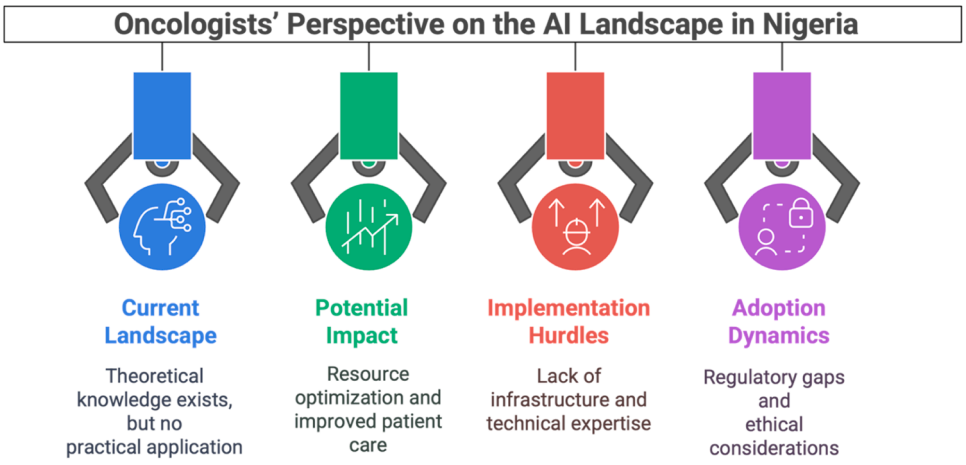

Fig. 2. Major themes highlighting Oncologists' perspective of AI landscape in Nigeria.

Table 2
Current Knowledge and Awareness - Key Findings and Representative Quotes.

Sub-theme	Key Finding	Representative Quote	Participant
Varied Knowledge Levels	Knowledge ranges from poor to fair, with most having limited understanding	"It's poor."	13
		"I would say I have a fair knowledge… we are not using AI services"	1
Theoretical vs Practical	Strong theoretical knowledge exists but practical implementation is absent	"We do not presently have any practical use of AI in my team. So, I would suppose that most of the things we know are maybe things we read about or hear about."	8
Specific Applications	Some awareness of AI in imaging and diagnostic applications	"I know that in terms of imaging, you can actually run it through AI to help you with diagnosis. Also, same thing with histology report."	7
Emerging Technologies	Limited awareness of cutting-edge AI applications despite lack of access	"In oncology, in radiotherapy, there's auto contouring which is AI"	5

Table 3
Perceived Benefits - Key Findings and Representative Quotes.

Sub-theme	Key Finding	Representative Quote	Participant
Improved Efficiency	AI could significantly reduce workload and improve workflow	"I think looking at the shortage of manpower, that is the ratio of doctors to the number of patients and clients we are supposed to service, I think AI has the benefit in reducing that gap of shortage of manpower"	1
Enhanced Diagnostic Accuracy	AI could reduce human error and improve consistency	"I think the benefits are it reduces human error, if AI is calibrated to have certain threshold of detection it will be the same whether it's applied here or in Europe or America"	2
Resource Optimisation	AI could help address severe resource constraints	"We have poor or understaffing of workers. So, it can help to relieve the burden on the workers."	15
Patient-Centered Care	AI could improve patient experience and outcomes	"It's very effective in the sense that you get your work done, you do it well…that's efficiency and then effectively. It makes work move faster. It reduces the burden on the healthcare worker and there's reduction in the waiting time for patients."	5

"I think there is one although, I am not directly involved, I think I know of one in which they are trying to see the use of AI in detecting malignancy" (Participant 3)

"Certainly, every research goes through the ethical review board and they determine if the research does not breach people privacy, any research that requires AI tools for machine learning has to pass through that" (Participant 2)

3.7. Data management and ethical concerns

Table 5 highlights this theme addressing the critical concerns about data privacy, confidentiality, and ethical frameworks stated by the oncologists for AI implementation.

3.8. Trust and adoption readiness

This theme examines oncologists' trust in AI systems and institutional readiness for adoption.

Trust in AI systems was generally conditional on demonstrated performance and gradual implementation. Participants expressed openness to AI adoption but emphasised the need for careful evaluation and evidence of effectiveness before full acceptance.

"To be able to trust this AI you need to see what they can do… We need a rundown test… With time they will come to accept." (Participant 9)

"I believe that we are open minded in terms of adopting AI, but at the same time we also very, very, very cautious of the whole processes." (Participant 7)

3.9. Human-AI interaction and patient dynamics

This theme explores how AI might impact doctor-patient

Table 4
Implementation Barriers - Key Findings and Representative Quotes.

Sub-theme	Key Finding	Representative Quote	Participant
Financial Constraints	High costs are a major impediment to AI adoption	"Financial issue is a major issue. Then maintenance of AI facility will be a major challenge."	13
Infrastructure Challenges	Poor infrastructure severely limits AI implementation potential	"The major problems to highlight are infrastructure based, the power supply to sustain it, it is heavily reliant on it, internet to sustain it because it requires a high-speed internet also the hardware problems."	2
Limited Technical Expertise	Shortage of skilled personnel for AI implementation and maintenance	"The technical know how to… how to manage the systems, how to upgrade the systems, how to incorporate newer additions or newer ideologies into the system requires high level of technical training which I doubt there is availability of such personnel."	14
Cultural and Professional Resistance	Scepticism and fear of job displacement create resistance	"I still see a resistance for now. Because everybody thinks AI is going to take their job."	6
Institutional Readiness	Many institutions lack basic digital infrastructure	"Our hospital has not even started using EMR. Not to mention AI."	6

Table 5
Data Management and Ethics - Key Findings and Representative Quotes.

Sub-theme	Key Finding	Representative Quote	Participant
Data Privacy Concerns	Strong emphasis on protecting patient confidentiality	"The concern that I keep saying is patient's data, keeping them as confidential as possible because what we find is that most AI… My hospital is not ready for AI yet."	4
Data Quality Issues	Poor data quality and availability pose significant challenges	"For any AI systems, you need a lot of data to train the system for the work you want to use it for. So, if there's been no good data keeping and all of that, that may be a challenge to even deploy the system in the first place."	8
Regulatory Framework Gaps	Absence of clear regulatory oversight for AI in healthcare	"I don't know of a body that regulates AI so I don't know how effective they are"	1
Patient Protection Priority	Strong emphasis on balancing innovation with patient safety	"The patient has to be protected."	8

relationships and healthcare delivery.

Participants expressed concerns about AI potentially reducing human contact and empathy in patient care, while acknowledging potential benefits for improving communication and information delivery to patients.

> *"That systemic change in the approach to dissemination of information of the patient can affect slightly the empathetic aspect of care, especially with disclosure of diagnosis, which is a point where patients can go to depression and other issues… It also reduces the shortfalls or the pitfalls that come with having to interpersonally relate with the patient by individuals because that is subjective. " (Participant 14)*

3.10. Future directions and knowledge requirements

Participants identified priority areas for AI implementation, particularly in diagnostic support, radiotherapy planning, and histology interpretation. Essential knowledge requirements include computer literacy, understanding of AI fundamentals, and awareness of ethical considerations.

> *"I think one of the places that. That are very important is. Is that use of AI to interpret histology reports diagnosis" (Participant 7)*

> *"I think doctors actually really need to go into information and technology especially data programming not that they want to run the program themselves so that they can understand what is going on to an extent and a lot of how the AI works." (Participant 4)*

3.11. Resource allocation and infrastructure development

This final theme addresses the substantial resource and infrastructure investments needed for successful AI implementation, including hardware, software, training, and ongoing maintenance costs.

> *"We need to put systems in place and equipment in place to ……" (Participant 8)*

> *"We've not had the infrastructure. But I know that if you're able to have the infrastructure… The institution that will be wholeheartedly involved will be eager to be involved with the AI in its oncology management." (Participant 7)*

4. Discussion

The findings from this study provide valuable insights into Nigerian oncologists' perspectives on AI in healthcare, revealing a complex interplay of awareness, opportunities, barriers, and contextual factors influencing AI adoption in oncology practice. This study represents one of the first comprehensive examinations of oncologists' perspectives on AI in the Nigerian context, offering crucial insights for AI integration in resource-constrained oncology settings.

Our findings reveal limited AI knowledge among Nigerian oncologists, with most participants demonstrating basic theoretical understanding but virtually no hands-on experience. This knowledge gap is more pronounced than trends observed in other studies. For instance, Castagno and Khalifa [36] reported that 64 % of UK healthcare providers had never encountered AI in clinical practice, and 87 % were unaware of distinctions between machine learning (ML) and deep learning (DL). However, a study from Australia found that over 90 % of oncologists were familiar with AI or ML concepts [37], while research from China revealed that younger oncologists showed greater acceptance and trust in AI technologies compared to their older counterparts [38].

The substantial "implementation gap" identified in our study where awareness exists but practical application is virtually absent represents a more severe challenge than reported in high-income settings. This gap is compounded by infrastructure deficits unique to resource-constrained environments, including unreliable power supply, limited internet connectivity, and absence of basic electronic health record systems [25,40,41]. These challenges would likely be even more pronounced in

non-tertiary healthcare facilities and rural settings not represented in our sample.

Within the broader context of global AI development and deployment, our findings highlight important considerations related to AI sovereignty and digital equity in the Global South. The current AI landscape is dominated by technologies developed primarily in high-income countries, raising concerns about digital neocolonialism and the appropriateness of these solutions for African healthcare contexts [42,43]. Nigerian oncologists' cautious optimism about AI adoption must be viewed against this backdrop of technological dependency and the need for locally adapted, culturally appropriate AI solutions.

The governance and data sovereignty implications are particularly significant for Nigeria and other African countries. As AI systems require vast amounts of health data for training and validation, questions arise about who controls this data, where it is stored and processed, and how benefits from AI-driven insights are distributed [44]. The absence of robust regulatory frameworks highlighted by our participants is not merely a technical gap but also a sovereignty issue, as external AI developers and platforms may establish de facto standards before local governance mechanisms are established.

South-South collaboration and technology partnerships offer promising alternatives to traditional North-South technology transfer models. Nigeria's growing tech ecosystem, alongside similar developments in countries like Kenya, South Africa, and Ghana, presents opportunities for developing contextually appropriate AI solutions through regional partnerships [42]. Such collaborations could address both technical and ethical concerns while building local capacity and reducing dependency on external AI systems.

The recognition of specific AI applications, particularly in imaging and diagnostics, among participants correlates with global trends in AI development for oncology. Our findings underscore the urgent need for diagnostic applications of AI in Nigerian oncology services, especially given the severe shortage of radiologists and pathologists in the country. Singh et al. [39] observed that diagnostic applications represent the most advanced and widely recognised use cases of AI in oncology worldwide, with some AI-powered systems operating autonomously.

Despite implementation challenges, participants identified compelling benefits of AI integration, including improved clinical efficiency, enhanced diagnostic accuracy, and resource optimisation. These perceived advantages align with the Artificial Intelligence-Quality Implementation Framework (AI-QIF) proposed by Meyers et al. [45], which emphasises understanding implementation processes to realise AI's potential in healthcare settings. Notably, participants highlighted AI's potential to address workforce shortages—a pressing issue where Nigeria's oncologist-to-patient ratio remains critically low [8]. This perspective underscores hope that AI could serve as both a clinical quality enhancement tool and a strategic response to systemic human resource deficits.

Cultural and professional resistance identified by participants reflects broader global concerns about AI's impact on healthcare professionals' roles and autonomy [36,46,47]. However, the generally positive attitudes toward AI adoption observed among our participants contrast with more pronounced scepticism reported in some high-income settings [48,49], potentially reflecting more pressing needs for technological solutions in resource-constrained environments.

Data-related challenges emerged as critical concerns, with participants emphasising data quality, availability, privacy, and governance issues. These align with findings from other studies expressing medico-legal concerns regarding health data breaches and autonomy [50–52]. The emphasis on patient confidentiality and data protection resonates with Alaran et al.'s [25] analysis of ethical considerations for AI in African healthcare, highlighting universality of these concerns despite different regulatory contexts.

The regulatory landscape represents a significant implementation barrier. Nigeria currently lacks centralised regulatory authority specifically focused on AI governance in healthcare [25,53]. This regulatory vacuum poses substantial barriers to safe, ethical, and effective AI integration in oncology practice, highlighting urgent needs for coordinated policy development and regulatory oversight.

Our findings reveal several unique contextual factors influencing AI adoption in Nigerian oncology practice:

1. Severity of resource constraints: The combination of extreme workforce shortages, infrastructure deficits, and financial limitations creates a more challenging implementation environment than typically described in high-income settings.
2. Implementation priorities: Participants emphasised basic diagnostic support applications as initial priorities, reflecting current healthcare delivery challenges rather than advanced AI applications.
3. Collaborative implementation approach: Strong emphasis on gradual, collaborative implementation with extensive training and support reflects collective decision-making culture and risk-averse approach to new technologies.

4.1. Digital equity and AI diplomacy considerations

The integration of AI in Nigerian oncology practice must be critically examined through the lens of digital equity and AI diplomacy in the Global South. Current AI development is heavily concentrated in high-income countries, with major technology corporations and research institutions primarily located in North America, Europe, and East Asia [54]. This geographic concentration of AI expertise and resources raises important questions about technology sovereignty and the risk of perpetuating global health inequities through AI adoption.

For Nigeria and other African countries, uncritical adoption of externally developed AI systems may inadvertently strengthen technological dependencies and limit opportunities for indigenous innovation. The perspectives shared by our participants, while cautiously optimistic, must be contextualised within broader discussions about fair and equitable AI development that respects local healthcare contexts, cultural values, and economic realities.

Data governance represents a particularly critical dimension of AI sovereignty. As highlighted by several participants, patient data privacy and security are paramount concerns. However, these concerns extend beyond individual privacy to encompass questions of national data sovereignty and the potential exploitation of African health data for the benefit of external entities. Developing robust, locally appropriate data governance frameworks is essential not only for ethical AI implementation but also for ensuring that the benefits of AI development accrue to Nigerian patients and healthcare systems [55].

South-South collaboration emerges as a promising pathway for addressing these challenges. Regional partnerships among African countries, or broader collaboration among Global South nations facing similar healthcare challenges, could facilitate the development of contextually appropriate AI solutions while building local technical capacity. Such partnerships could also strengthen collective bargaining power in negotiations with global technology providers and create opportunities for knowledge sharing and joint innovation.

5. Implications for practice and policy

Our findings have several important implications for practice and policy in Nigeria and similar resource-constrained settings, as shown below and in the readiness pyramid (Fig. 3):

I. Context-Specific AI Development: AI solutions for Nigerian oncology practice must be specifically adapted to address unique challenges including extreme workforce shortages, infrastructure limitations, and resource constraints. Simply transferring AI applications developed for high-resource settings will be insufficient without substantial local adaptation. Furthermore, these

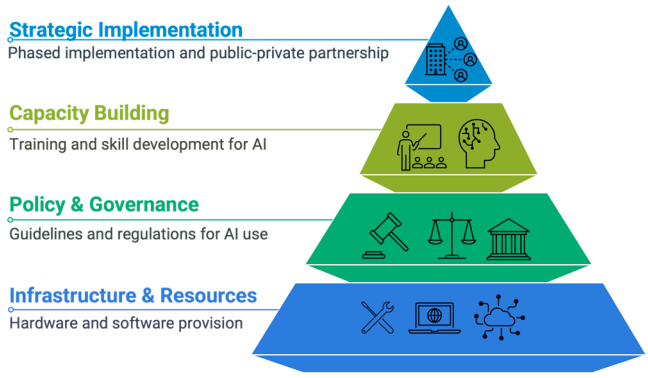

Fig. 3. AI implementation readiness pyramid for resource-constrained settings.

solutions should be developed through participatory approaches that include perspectives from rural and peripheral healthcare facilities, not just urban tertiary centres.

II. Infrastructure Investment Priorities: Successful AI implementation requires foundational digital infrastructure investments as prerequisites. Reliable power supply, internet connectivity, and basic electronic health record systems must be established before advanced AI applications can be successfully implemented [42]. This infrastructure development should prioritise equitable distribution across Nigeria's diverse healthcare landscape, ensuring that rural and underserved areas are not left behind in the digital transformation.

III. Comprehensive Capacity Building: Capacity building programmes must address both technical skills and ethical frameworks for AI use. This includes basic computer literacy, understanding of AI fundamentals, data management skills, and awareness of ethical considerations [43]. These programmes should be designed to reach healthcare workers across all levels of the healthcare system, from tertiary centres to primary healthcare facilities.

IV. Regulatory Framework Development: Nigeria urgently needs comprehensive governance frameworks for AI in healthcare addressing ethical standards, data protection, accountability mechanisms, and quality assurance. These frameworks should be developed through collaborative processes involving healthcare professionals, technology experts, and policymakers [25,56]. Additionally, these frameworks should incorporate principles of data sovereignty and protection against digital exploitation while fostering innovation and appropriate technology transfer.

V. Phased Implementation Strategy: A gradual, phased approach beginning with diagnostic support applications in imaging and pathology is recommended. This approach allows for trust-building, skill development, and infrastructure strengthening before advancing to more complex AI applications. Implementation strategies should account for the diverse resource levels across Nigeria's healthcare system, with differentiated approaches for tertiary, secondary, and primary care settings.

VI. Public-Private Partnership Models: Given significant resource requirements, successful AI implementation will likely require innovative public-private partnerships to address funding, technical support, and ongoing maintenance needs. These partnerships should be structured to ensure knowledge transfer, local capacity building, and long-term sustainability rather than creating permanent dependencies on external providers.

VII. Enhanced Geographic Representation: Future AI implementation efforts should ensure broader geographic and institutional representation, including perspectives and needs assessment from rural healthcare facilities, secondary hospitals, and primary health centres that serve the majority of Nigeria's population.

6. Limitations

This study has several limitations that should be acknowledged:

I. Sample Size and Generalisability: The study included 15 participants from nine institutions, which may limit generalisability across Nigeria's diverse healthcare landscape. However, theoretical saturation was achieved, and participants represented major teaching hospitals across different regions.

II. Institutional and Geographic Bias: A significant limitation of this study is the predominant focus on tertiary referral centres in urbanised areas. Our sample, while geographically distributed across different zones, exclusively included major teaching hospitals that represent the more resourced segments of Nigeria's healthcare ecosystem. This institutional bias likely overestimates AI readiness and underestimates implementation barriers that would be more pronounced in secondary hospitals, primary health centres, and rural healthcare facilities where the majority of Nigerians receive care. The perspectives and needs of oncologists working in these peripheral settings, where infrastructural challenges are most acute and digital divides most pronounced, remain largely unexplored.

III. Potential Selection Bias: Purposive sampling may have introduced selection bias toward participants more interested in or knowledgeable about AI technologies. This could potentially overestimate overall awareness and positive attitudes toward AI.

IV. Social Desirability Bias: Participants may have provided socially desirable responses regarding AI adoption and implementation readiness. We attempted to minimise this through anonymity and neutral questioning approaches.

V. Limited Scope: The study focused specifically on oncologists' perspectives and did not include other healthcare professionals, administrators, or patients whose views are also crucial for successful AI implementation. Additionally, the study did not capture perspectives from rural healthcare workers or those in lower-tier facilities who may face fundamentally different challenges and opportunities related to AI adoption.

VI. Temporal Limitations: Given the rapidly evolving nature of AI technology and healthcare policy, findings may become outdated relatively quickly. Regular follow-up studies will be needed to track changing perspectives and implementation progress.

VII. Healthcare System Representation: The participating institutions, while prestigious and well-established, may not adequately represent the full spectrum of Nigeria's heterogeneous healthcare system, particularly the resource constraints and operational challenges faced by facilities serving rural and underserved populations.

7. Conclusion

This study explored perspectives of Nigerian oncologists regarding artificial intelligence applications in oncology practice, revealing a complex landscape characterised by cautious optimism, significant challenges, and context-specific considerations. Through comprehensive interviews with 15 oncologists from various institutions across Nigeria, we identified nine key thematic areas providing valuable insights into current state and future directions of AI integration in Nigerian oncology practice.

Our findings highlight a substantial knowledge-implementation gap among Nigerian oncologists, where basic theoretical awareness exists but practical application is virtually absent. This gap reflects broader systemic challenges including financial constraints, infrastructure limitations, and technical expertise deficits characterising the Nigerian healthcare context. These challenges would likely be even more pronounced in non-tertiary healthcare settings, suggesting that a more comprehensive understanding of AI adoption barriers requires broader

geographic and institutional representation.

Despite these challenges, participants expressed generally positive attitudes toward AI adoption, recognising its potential to address critical challenges in Nigerian oncology practice, particularly workforce shortages, diagnostic delays, and treatment planning complexities. Perceived benefits of improved efficiency, enhanced diagnostic accuracy, and resource optimisation were consistently emphasised, suggesting AI is viewed as a potential solution to some of the most pressing challenges in cancer care delivery.

From a global health diplomacy perspective, our findings underscore the importance of developing contextually appropriate AI solutions through South-South collaboration and technology partnerships rather than uncritical adoption of externally developed systems. The governance and data sovereignty concerns expressed by participants reflect broader questions about digital equity and the need for locally controlled AI development that serves Nigerian healthcare priorities while building indigenous technical capacity.

However, participants identified significant implementation barriers requiring comprehensive, multi-faceted approaches addressing both technological and non-technological aspects of AI integration. Financial constraints, inadequate infrastructure, insufficient technical expertise, and concerns about data quality and governance emerged as primary challenges.

Ethical and regulatory considerations represent important themes, with participants expressing concerns about patient privacy, data security, and absence of clear governance frameworks. These findings highlight needs for policy development and ethical guidelines specific to the Nigerian context to ensure responsible and equitable AI implementation. Such frameworks should address not only technical and ethical standards but also questions of data sovereignty and protection against digital exploitation.

The study revealed important insights about implementation priorities and approaches, with participants suggesting phased implementation strategies beginning with smaller, focused applications to build trust and demonstrate value before expanding to more comprehensive AI systems. Diagnostic support, particularly in imaging and pathology, emerged as high-priority areas for initial AI implementation.

Moving forward, successful AI integration in Nigerian oncology practice will require coordinated efforts addressing infrastructure development, capacity building, regulatory framework establishment, and sustainable funding mechanisms. A collaborative approach involving healthcare professionals, technology developers, policymakers, and international partners will be essential for realising AI's potential to transform cancer care delivery in resource-constrained settings. However, such collaboration must be grounded in principles of equity, sovereignty, and mutual benefit rather than technological dependency.

Future research should prioritise broader geographic and institutional representation, including perspectives from rural healthcare facilities, secondary hospitals, and primary health centres. Understanding how AI adoption opportunities and challenges differ across Nigeria's diverse healthcare landscape is essential for developing inclusive implementation strategies that serve all segments of the population.

The insights generated from this study contribute to the limited evidence base on healthcare providers' perspectives on AI in LMICs and provide a foundation for developing context-specific strategies for AI integration in oncology practice. These findings may be particularly relevant to other African countries and similar resource-constrained settings facing comparable challenges in cancer care delivery.

Future research should focus on developing and evaluating context-specific AI solutions, assessing implementation outcomes of pilot projects, and exploring perspectives of other stakeholders including patients, healthcare administrators, and technology developers. Critically, future studies should ensure broader representation across Nigeria's healthcare hierarchy, from tertiary centres to primary health facilities, to develop a more comprehensive understanding of AI adoption potential and barriers. Longitudinal studies tracking changes in knowledge, attitudes, and implementation progress over time will also be valuable for informing policy and practice decisions.

Ultimately, this study reinforces that while AI holds significant promise for transforming oncology care in Nigeria, realising this potential will require sustained commitment, strategic planning, and collaborative efforts to address the multifaceted challenges identified. Such efforts must be grounded in principles of digital equity, technology sovereignty, and inclusive development that ensures AI benefits all segments of Nigeria's population, not just those served by well-resourced urban tertiary centres. With appropriate support and careful implementation, AI has the potential to significantly improve cancer care outcomes and address some of the most pressing challenges facing Nigerian oncology practice.

CRediT authorship contribution statement

David B. Olawade: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Iyanuoluwa O. Ojo:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis. **Emmanuel O. Oisakede:** Writing – review & editing, Validation, Methodology, Investigation. **Victor Idowu Joel-Medewase:** Writing – review & editing, Methodology, Investigation. **Ojima Z. Wada:** Writing – review & editing, Writing – original draft, Methodology, Validation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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