



Perceptions and Opinions of Medical Professionals on Artificial Intelligence in Optimizing the Healthcare Sector

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Authors' contributions

This work was carried out in collaboration among all authors. Author SO conceptualized the research idea, wrote the first manuscript draft and formatted the final work for publication. Author SA analyzed the data and reported findings for discussion. Authors OO and TA edited and proofread the manuscript for critical review. All authors read and approved the final manuscript.

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ABSTRACT

The deployment of artificial intelligence (AI) in the healthcare sector in Nigeria is in an emerging and evolving state. Its use in the medical industry promises many benefits to all; however, AI has been adopted in medical practice primarily in developed countries. The rollout of AI in Nigeria depends on the readiness and level of acceptability of medical/health professionals, public opinion and government readiness to integrate the technology; hence this study is aimed to assess the awareness, level of perception and opinion on AI among Nigerian medical professionals.

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The study was a cross-sectional design conducted among medical professionals across various geopolitical zones in Nigeria using an online Google survey form adapted from a previous study. Data entry, coding and analysis were done using Statistical Package for Social Sciences (SPSS) Version 25.

A total of two hundred and fourteen responses were received with a male-to-female ratio of 1.35:1, and the majority were medical students and interns between the 18–30 year age group. Almost all respondents are aware of AI however only 11.2% had some theoretical training on AI. The most common combined sources of AI awareness were the internet source (87.4%) and social media platforms (86.9%). Overall, 160 (75%) medical professionals showed good perceptions and opinions on AI. There was a significant correlation between the medical cadre and opinion level. Practitioners in the lower cadre have better opinions on AI and those working in private hospitals have better opinions than state and government hospital workers ($p < 0.05$).

The advent of AI among medical professionals is welcoming, which implies their readiness to accept or adopt technological innovation in the medical sphere. More effort is required from the government to vest resources in this direction to actualize and upgrade the healthcare sector to internationally acceptable standards and practices.

Keywords: Artificial intelligence; perception; opinion; awareness; medical professional; Nigeria.

1. INTRODUCTION

“Artificial intelligence (AI) systems are programs that, when faced with a challenging task, act in the digital algorithm data acquisition, interpreting machine learning, making decisions based on prior knowledge, or processing information obtained from this data through supervised or unsupervised learning before determining the optimal course of action. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analyzing how the environment is affected by their previous actions” [1].

“As a scientific discipline, AI includes several approaches and techniques, such as machine learning (of which deep learning and reinforcement learning are specific examples), machine reasoning (which includes planning, scheduling, knowledge representation and reasoning, search, and optimization), and robotics which includes control, perception, sensors, and actuators, as well as the integration of all other techniques into cyber-physical systems” [1].

“A key factor in attaining global sustainable human growth will be via digital technology. With over a billion people, Africa can use digital technologies, such as artificial intelligence (AI), to overcome health concerns, particularly concerning infectious and non-communicable illnesses, maternity and child health, and other related issues” [2].

Nigeria, home to one of the world's greatest youth populations, makes up over half of West

Africa's total population of 202 million and is a significant regional actor in Africa [3]. Nigeria is a regional economic giant with abundant resources and human capital. However, innovation and Artificial Intelligence (AI) adoption has been slow for many reasons; ranging from lack of adequate knowledge about AI to infrastructural issues and lack of access to data.

“According to the Oxford Insight Government AI Readiness, Nigeria ranks 138 globally and 20 in the region, trailing behind South Africa, Kenya and Ghana [4]. The National Center for Artificial Intelligence and Robotics (NCAIR) was established as a digital innovation office of the government tasked with researching and further understanding the application and use of emerging technologies like AI, Deep Learning, Extended Reality (XR-VR/MR/AR), Robotics and Drones, and the Internet of Things (IoT)” [5].

“Nigeria's use of AI in healthcare is still in its infancy and is developing. However, the use of AI in the healthcare sector will significantly improve the standard of care provided to Nigerians. It will have several advantages, such as improved laboratory workflow automation, more accurate diagnosis, personalized treatment plans, effective healthcare operations, early disease detection and prevention, drug discovery, and clinical research [6]. However, the use of AI in healthcare raises a lot of ethical, moral, and social concerns. The potential benefit from AI is substantial, but it comes with its challenges: medical, certainly, but also legal. Some of the legal challenges include issues around regulation, accountability for decisions, bias, data

privacy regulations, and intellectual property rights” [6].

“There are no regulations in place in Africa or anywhere else in the world that specify who is accountable for unfavourable consequences that may arise from the use of artificial intelligence (AI) in healthcare, which is highly possible given the ways and places in which AI may be used in this field. The application of current laws may be the most likely answer, however many situations and places are not expected or addressed by current legislation. In many African nations, this will have legal ramifications for patients and users” [7].

“In recent times, the healthcare application of AI in Africa has only seen a few pilots and test cases. For example, in South Africa, a multinomial logistic classifier-based system is being applied to human resource planning, especially to predict how long health workers might stay in public service. A partnership comprising researchers and a social enterprise has been developing an AI planning application for optimizing the scheduling of community health workers (CHWs) in African communities” [2].

Bellemo et al [8] conducted a study using AI to diagnose diabetic retinopathy in Zambia which showed significant and promising results when compared with human assessments. It showed clinically acceptable performance in detecting referable diabetic retinopathy. “The Delft Institute's CAD4TB software has been employed in pilot studies examining the use of a computer-aided diagnosis of pulmonary tuberculosis from chest radiographs in Tanzania and Zambia [9] The results are exciting as the performance of CAD4TB compared well, or even better than that of human experts. In Nigeria, Ubenwa is a start-up machine learning system that uses signal processing and machine learning to improve the diagnosis of birth asphyxia through automated analysis of the infant cry in low-resource settings” [10].

Artificial intelligence (AI) in the medical industry promises many benefits; however, AI has been adopted in medical practice primarily in developed countries. The rollout of AI in Nigeria depends on the readiness and level of acceptability of doctors and the public about the technology, hence this study aimed to assess the level of perception and opinion on AI among Nigerian medical professionals.

2. METHODOLOGY

2.1 Study Design

The study was a cross-sectional design conducted using an online Google survey form. It included medical professionals such as medical students, medical interns, medical officers, residents and consultants across various geopolitical zones in Nigeria.

2.2 Study Instrument

The questionnaire for the study was developed by adapting validated instruments from a previous study [11]. It is composed of 3 sections,

Section 1: included the consent page and biodata such as age, sex, cadre, geopolitical zone, name of institution/type/location etc.

Section 2: Regarding perceptions towards AI, it comprised 15 questions. One point per question was rewarded if the question was answered correctly.

Section 3: Assessed the opinions on artificial intelligence using a three-point Likert scale assessment tool consisting of 7 variables.

The mean positive perceptions score towards AI was prepared for the perception items. The mean score was prepared by assigning a score of ‘1’ for the correct answers and a score of ‘0’ for the wrong answers. By computing the total items, the mean score was prepared.

2.3 Study Procedure

A convenient sampling method was used. The study included all medical professionals at all cadres across various hospitals in the country. This was done by leveraging the association advantage, various association chapters were contacted and the Google survey link was sent via a member/representative to their general Whatsapp group. A weekly reminder with the survey link was also done continuously for eight weeks.

2.4 Data Analysis

Data entry, coding and analysis were done using Statistical Package for Social Sciences (SPSS) Version 25. Data were analyzed using descriptive statistics of mean, frequencies and percentages,

and inferential statistics. Categorical variables were summarized using frequencies and percentages while quantitative variables were summarized using means and standard deviation. Pearson correlation was used for the measure of association between categorical variables. All results are presented using tables and charts.

3. RESULTS

A total of two hundred and fourteen responses were received with a male-to-female ratio of 1.35:1, and the majority were medical students and interns between 18–30year age group (Table 1).

Almost all respondents are aware of AI, however, only 11.2% had some theoretical training on AI. The most common combined sources of AI awareness were the internet 87.4% and social media platforms 86.9%. Respondents had more than one source of awareness (Table 2).

The majority had a perception that AI: Facilitates medical professionals’ access to information (mean = 4.25 SD 0.745), Reduces errors in medical practice, (mean = 3.87 SD 0.918), Facilitates patient education (mean = 3.87 SD 0.776), Facilitates patients’ access to the service (mean = 0.805), Healthcare professionals will be better with the widespread use of artificial intelligence (mean = 3.84 SD 0.912), The choice of specialization Field will be influenced by how artificial intelligence is used in that Field (mean = 3.61 SD 0.941), Enables more accurate decision makings (mean 3.81 SD 0.852) etc while few others perceived that AI: Devalues the medical profession (mean = 2.41 SD 0.949), Negatively affects the relationship between healthcare medical professionals and the patient (mean = 2.8 SD 0.965), Damages the trust which is the basis of patient-healthcare professional’s relationship (mean = 2.7 SD 0.986, Will replace medical professionals in the healthcare system (mean = 2.39 SD 1.136) etc. (Table 3).

Table 1. Biodata of respondents

Variable	Categories	Frequency	Percent (%)
Age	18 - 24	77	36
	25 - 30	76	35.5
	31 - 35	23	10.7
	36 - 40	25	11.7
	> 41	13	6.1
Gender	Male	123	57.5
	Female	91	42.5
Medical Cadre	Medical Student	77	36
	Medical Intern	53	24.8
	Medical Officer	22	10.3
	Resident	41	19.2
	Consultant	21	9.8
Institution	Private owned	14	6.5
	State government owned	158	73.8
	Federal government owned	42	19.6
Geographical Region	Northcentral	9	4.2
	Northeast	16	7.5
	South-south	3	1.4
	Southwest	186	86.9

Table 2. Awareness of Respondents on AI

Question	Option	Frequency	Percentage %
Aware of Artificial Intelligence (AI)?	No	3	1.4
	Yes	211	98.6
Had theoretical training in Artificial Intelligence (AI)	No	165	77.1
	Somewhat	25	11.7
	Yes	24	11.2
Source of awareness about AI*	Internet	187	87.4
	Local news	61	28.5
	Medical school	92	43.0
	Seminars/conference	85	39.7
	Social media	186	86.9
	Journal/publications	67	31.3

(*) option with multiple response

Table 3. Perception of Medical professionals of AI

Questions	SA (%)	A (%)	UN (%)	D (%)	SD (%)	Mean	SD
Devalues the medical profession	5 (2.3)	25 (11.7)	53 (24.8)	101 (47.2)	30 (14.0)	2.41	0.949
Reduce errors in medical practice	52 (24.3)	106 (49.5)	36 (16.8)	17 (7.9)	3 (1.4)	3.87	0.918
Facilitates patients' access to the service	36 (16.8)	126 (58.9)	37 (17.3)	13 (6.1)	2 (0.9)	3.85	0.805
Facilitates medical professionals' access to information	81 (37.9)	115 (53.7)	12 (5.6)	3 (1.4)	3 (1.4)	4.25	0.745
Enables more accurate decision makings	41 (19.2)	109 (50.9)	50 (23.4)	11 (5.1)	3 (1.4)	3.81	0.852
Increases Patient's confidence in medicine	20 (9.3)	92 (43)	59 (27.6)	36 (16.8)	7 (3.3)	3.38	0.98
Facilitates patient education	36 (16.8)	128 (59.8)	38 (17.8)	10 (4.7)	2 (0.9)	3.87	0.776
Negatively affects the relationship between healthcare medical professionals and the patient	12 (5.6)	33 (15.4)	82 (38.3)	74 (34.6)	13 (6.1)	2.8	0.965
Damages the trust which is the basis of patient-healthcare professional's relationship	9 (4.2)	42 (19.6)	50 (23.4)	101 (47.2)	12 (5.6)	2.7	0.986
Reduces the humanistic aspect of the medical profession	54 (25.2)	71 (33.2)	40 (18.7)	44 (20.6)	5 (2.3)	3.58	1.142
Increase the violations of professional confidentiality	13 (6.1)	53 (24.8)	51 (23.8)	83 (38.8)	14 (6.5)	2.85	1.06
Increase patient's control over their health	10 (4.7)	110 (51.4)	41 (19.2)	46 (21.5)	7 (3.3)	3.33	0.972
Will replace medical professionals in the healthcare system	3 (1.4)	45 (21)	42 (19.6)	66 (30.8)	58 (27.1)	2.39	1.136
Healthcare professionals will be better with the widespread use of artificial intelligence	49 (22.9)	106 (49.5)	34 (15.9)	25 (11.7)	0	3.84	0.912
The choice of specialization Field will be influenced by how artificial intelligence is used in that Field	34 (15.9)	105 (49.1)	45 (21)	27 (12.6)	3 (1.4)	3.65	0.941

Overall, 160(75%) medical professionals showed a good perception of AI while 54(25%) had a poor perception (Fig. 1).

The majority 187(87.4%) thought that knowledge and skills in Artificial intelligence should be included in healthcare services, 184 (84%) opined that training to prevent and solve ethical problems that may arise with AI applications should be included, also 185 (86.4%) opined that simplified lecture on AI, Computer use, Coding, or Python language should be included also, 187(87.4%) opined its use in scientific research and 190(88.8%) opined that AI should be included in Medical curriculum (Table 4).

Overall, 75% had good opinions while 25% opinions were poor (Fig. 2).

Correlation between Biodata and theoretical knowledge shows that Age has a significant positive association, $p = 0.034$ $r = -0.145$, showing younger respondents having more theoretical knowledge of AI. There is a significant correlation between the medical cadre and opinion; practitioners in the lower cadre have better opinions on AI compared to their seniors. Also, on institutions; those working at private hospitals have better opinions on AI compared to state and government hospital workers ($p < 0.05$) (Table 5).

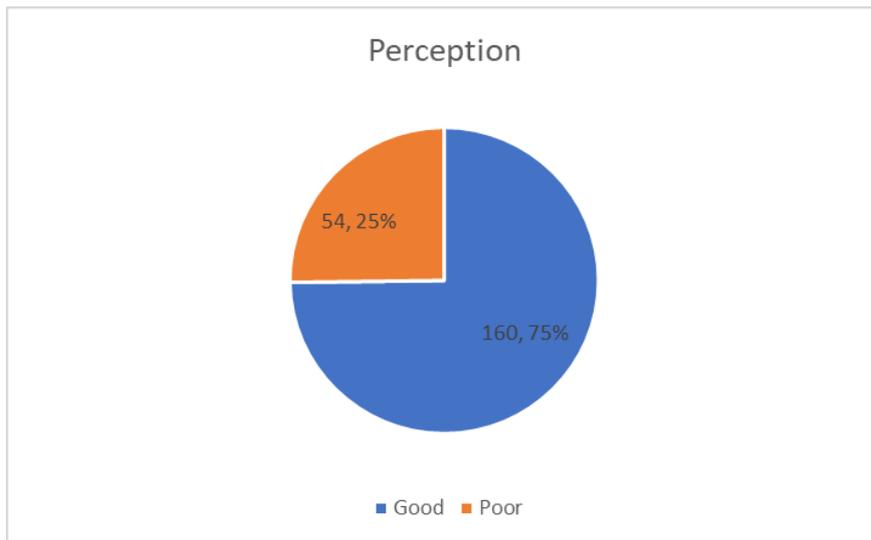


Fig. 1. Level of Perception of Medical Professionals of AI

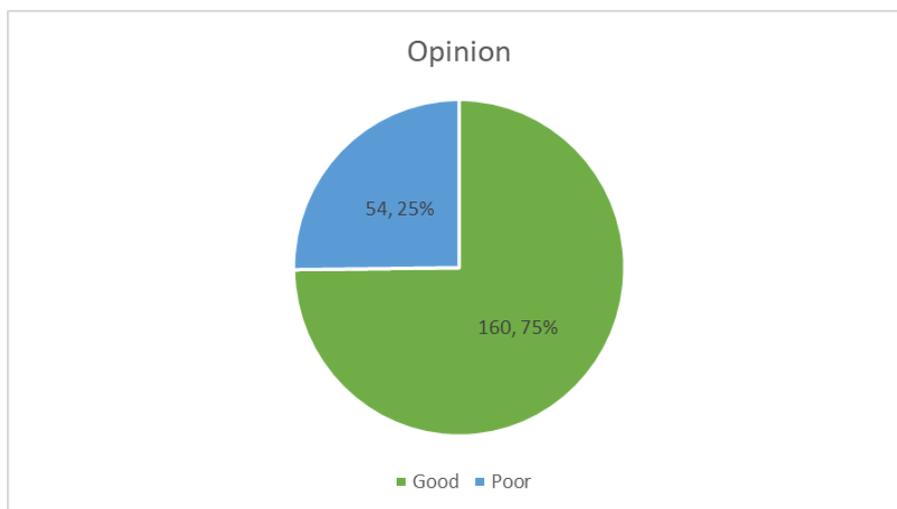


Fig. 2. Opinion of respondents on AI

Table 4. Opinion of Medical professionals on inclusion of AI in healthcare service

Opinion	Should be included	Not Sure	Should not be included	Mean	SD
Knowledge and skills in Artificial intelligence	187 (87.4)	22 (10.3)	5 (2.3)	2.85	0.418
AI as an application for reducing medication errors	160 (74.8)	38 (17.8)	16 (7.5)	2.68	0.609
Training to prevent and solve ethical problems that may arise with AI applications	184 (86)	12 (5.6)	18 (8.4)	2.79	0.586
A simplified lecture on AI, Computer use, Coding, or Python language	185 (86.4)	13 (6.1)	16 (7.5)	2.8	0.563
Applications that will increase patients' control over their health	152 (71)	37 (17.3)	25 (11.7)	2.6	0.691
In scientific research	187 (87.4)	10 (4.7)	17 (7.9)	2.8	0.569
Medical curriculum	190 (88.8)	9 (4.2)	15 (7)	2.82	0.539

Table 5. Correlation between Biodata and perception and opinion

Variables	Perception		Opinion	
	Pearson correlation	R	Pearson correlation	R
Age	0.619	0.034	0.019	-0.160
Gender	0.534	0.043	0.314	0.069
Medical Cadre	0.152	0.098	0.000*	-0.241
Institution	0.513	0.045	0.024*	-0.154

(*) statistically significant $P = <0.0$

4. DISCUSSION

A total of two hundred and fourteen responses were received with a male-to-female ratio of 1.35:1, and the majority were medical students and interns between 18–30 years of age while others included medical officers, resident doctors and consultants. This is similar to findings in a report from a similar study [12].

This study revealed that almost all respondents are aware of AI. This gross level of awareness is not surprising because it could be said that most respondents have previously utilized AI programs, with grammar checkers and other dedicated AI software such as ChatGPT Bing AI, Dall-E, Midjourney, BALD, Quilbox, etc, and are conscious of the fact that these are artificial intelligence tools.

However, only 11.2% had some theoretical training on AI, similar to several reported studies [12–15]. This suggests a lack of institutional and governmental support for AI training, which could be a major limitation in integrating AI in medical education and practice.

The most common combined sources of AI awareness were the internet and social media platforms although respondents had more than one source of awareness, which is in consonant with similar studies where it was reported that the most common medium of awareness was the internet [16] and/or social media [12].

Overall, on perception, this study observed that 75% of medical professionals showed a good perception of AI while 25% had a poor perception. The majority had a perception that AI facilitates medical professionals' access to information, reduces errors in medical practice, and facilitates patient education and access to health services. It also opines that healthcare professionals will be better with the widespread use of artificial intelligence and that the choice of specialization field will be influenced by how artificial intelligence is used in such field and will also enable more accurate decision making.

Moreover, as noted from similar reports [12,14,15] few others perceived that AI devalues the medical profession, negatively affects the relationship between healthcare medical professionals and the patient, damages the trust that is the basis of the patient-healthcare professional relationship and that it will replace medical professionals in the healthcare system.

Overall, on opinion, 75% had good opinions while 25% had poor opinions. The majority opined that knowledge and skills in Artificial intelligence should be included in healthcare services, opined that training to prevent and solve ethical problems that may arise with AI applications should be included. Also, the majority opined that simplified lectures on AI, Computer use, Coding, or Python language should be included as well in scientific research and that AI should be included in the medical curriculum.

Furthermore, the study showed that age has a significant association with theoretical knowledge because younger respondents (mainly medical students) have more theoretical knowledge of AI. Also, there is a significant negative correlation between the medical cadre and opinion; practitioners in the lower cadre have better opinions on AI compared to their seniors. This is in tandem with a similar report where it was noted that the younger generations are more exposed to AI through social media and other digital platforms, and are more inquisitive than the older population. It is however fascinating that medical students had a greater knowledge of AI than their elders in the medical profession [12]. Also, on institutions, those working at private hospitals have better opinions on AI compared to state and government hospital workers.

5. CONCLUSION

The advent of AI has changed the world's perception and processing of information in almost all spheres of life, of which healthcare is not an exception and has consequently thus surpassed human intelligence in multiple-folds. AI is revolutionizing the healthcare delivery system, including aspects of doctor–patient interactions, accurate & rapid clinical diagnosis, laboratory workflow automation, laboratory AI-assisted interpretative machine learning algorithms, personalized treatment of patients, AI-powered disease outbreak surveillance, and tracking of new antimicrobial-resistant genes and massive ground-breaking research publications through 'big data' database. Its application in the health industry has therefore been of immense contribution to improving the quality of healthcare delivery in drug discovery, rapid diagnosis and overall patient management.

However, as much as massive AI revolutions are taking place in the digital space in the Western world, the good perception and great potential of

AI data analytics in Nigeria are being hampered by the reduced rate of medical training on AI which is a fallout of limited institutional and governmental support for the use, deployment, and training on AI and machine learning in the healthcare industries.

While very few medical institutions in Nigeria, are beginning to deploy the use of AI machine learning models and algorithms for their laboratory information system and workflow, it is hoped that the government and other non-governmental organizations will embrace and encourage more widespread use of this emerging innovative technological advancement by formulating policies in this regard, backed up by trainings and financial support for the already willing various medical institutions to ensure this.

CONSENT

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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