Knowledge and Attitude of Medical Students towards Artificial Intelligence: A Study of University of Ilorin

Abdulhameed Abiola Dere, Mubarak Jolayemi Mustapha, Kolawole Wasiu Wahab, Khalilat Bello

Submitted to: JMIR Medical Education
on: July 30, 2024

Table of Contents

Knowledge and Attitude of Medical Students towards Artificial Intelligence: A Study of University of Ilorin

Abdulhameed Abiola Dere[1]; Mubarak Jolayemi Mustapha[1]; Kolawole Wasiu Wahab[2]; Khalilat Bello[3]

[1]College of Health Sciences, University of Ilorin Ilorin NG
[2]Division of Neurology, Department of Medicine, University of Ilorin Ilorin NG
[3]Faculty of Chemical and Life Sciences. Department of Energy and Applied Chemistry Sokoto NG

Corresponding Author:
Abdulhameed Abiola Dere
College of Health Sciences, University of Ilorin
P.M.B 1515, Ilorin
Ilorin
NG

Abstract

Background: Artificial intelligence (AI) is revolutionizing various sectors, including healthcare, by enhancing administration, diagnostics, treatment planning, medical education, and more. However, its adoption in developing countries like Nigeria is limited. This study investigates the knowledge and attitude of medical students at the University of Ilorin towards AI in medicine.

Objective: 1. To assess the knowledge level of artificial intelligence among medical students and doctors
2. To determine the attitude of medical students and doctors to artificial intelligence
3. To assess the perception of respondents on their willingness to apply AI in the near future.

Methods: A cross-sectional study was conducted at the University of Ilorin and its teaching hospital, involving 343 medical students. Data were collected using a self-administered questionnaire distributed via social media and class representatives. The questionnaire assessed demographics, knowledge, and attitudes towards AI. Descriptive statistics and chi-square tests were used to analyze the data, with significance set at $p < 0.05$.

Results: The majority (98.8%) of students had heard of AI, but only 76.4% could define it. Most (90.4%) learned about AI through media, and a small percentage (24.1%) from university lectures. Only 9.3% had received AI training. While 63% believed AI would play an important role in healthcare, 63.9% felt it would not render doctors expendable. Almost half (46.3%) felt AI would influence their specialty choice. A significant portion (87.1%) supported including AI in medical education, though 84% acknowledged it would pose new ethical challenges. Gender significantly influenced knowledge of AI ($p < 0.05$), but level of training did not.

Conclusions: Despite limited formal education on AI, medical students at the University of Ilorin exhibit a positive attitude towards its integration into healthcare and education. There is a strong interest in learning more about AI, highlighting the need for its inclusion in the medical curriculum to prepare future doctors for technological advancements in healthcare.

(JMIR Preprints 30/07/2024:64883)
DOI: https://doi.org/10.2196/preprints.64883

Preprint Settings

1) Would you like to publish your submitted manuscript as preprint?

✓ **Please make my preprint PDF available to anyone at any time (recommended).**
Please make my preprint PDF available only to logged-in users; I understand that my title and abstract will remain visible to all users.
Only make the preprint title and abstract visible.
No, I do not wish to publish my submitted manuscript as a preprint.

2) If accepted for publication in a JMIR journal, would you like the PDF to be visible to the public?

✓ **Yes, please make my accepted manuscript PDF available to anyone at any time (Recommended).**

Yes, but please make my accepted manuscript PDF available only to logged-in users; I understand that the title and abstract will remain v
Yes, but only make the title and abstract visible (see Important note, above). I understand that if I later pay to participate in <a href="http

Original Manuscript

KNOWLEDGE AND ATTITUDE OF MEDICAL STUDENTS TOWARDS ARTIFICIAL INTELLIGENCE: A STUDY OF UNIVERSITY OF ILORIN

ABSTRACT

Artificial intelligence (AI) is revolutionizing various sectors, including healthcare, by enhancing administration, diagnostics, treatment planning, medical education, and more. However, its adoption in developing countries like Nigeria is limited. This study investigates the knowledge and attitude of medical students at the University of Ilorin towards AI in medicine. A cross-sectional study was conducted at the University of Ilorin and its teaching hospital, involving 343 medical students. Data were collected using a self-administered questionnaire distributed via social media and class representatives. The questionnaire assessed demographics, knowledge, and attitudes towards AI. Descriptive statistics and chi-square tests were used to analyze the data, with significance set at $p < 0.05$. The majority (98.8%) of students had heard of AI, but only 76.4% could define it. Most

(90.4%) learned about AI through media, and a small percentage (24.1%) from university lectures. Only 9.3% had received AI training. While 63% believed AI would play an important role in healthcare, 63.9% felt it would not render doctors expendable. Almost half (46.3%) felt AI would influence their specialty choice. A significant portion (87.1%) supported including AI in medical education, though 84% acknowledged it would pose new ethical challenges. Gender significantly influenced knowledge of AI ($p < 0.05$), but level of training did not. Despite limited formal education on AI, medical students at the University of Ilorin exhibit a positive attitude towards its integration into healthcare and education. There is a strong interest in learning more about AI, highlighting the need for its inclusion in the medical curriculum to prepare future doctors for technological advancements in healthcare.

Keywords: Artificial Intelligence; AI in medicine; Knowledge; Attitude; Medical Education.

INTRODUCTION

The term artificial intelligence (AI) coined by John McCarthy in 1955 refers to “the ability of computers to perform tasks normally requiring human intelligence, but this does not mean they operate in the same way as human thinking and behavior” [1].

Artificial intelligence (AI) has received remarkable attention for a very long time and is sometimes referred to as the fourth industrial revolution [2]. Over the past few decades, artificial intelligence (AI) has grown in popularity, and its application in medicine is expanding on a global scale [3]**.** Finance, law, cyber security, manufacturing, computer science, and other areas have all adopted AI-powered technologies and another being investigated by researchers is the application of AI in medicine. Developed economies have invested a significant amount of money and resources in AI research and its application to healthcare.

The healthcare industry has been given tools to assist with administration, diagnostic making, treatment planning, medical education, medical record mining, drug manufacturing, and triage evaluation using the various types of AI [4]. Despite the widespread use of AI in healthcare in developed countries, developing countries in Africa are still behind in the use, research, education and implementation of AI in healthcare [5], though the prospects look promising, it is however

dependent on a lot of other external factors which Africa is still battling with.

The two major subsets of AI, machine learning and deep learning have major applications in the healthcare fields including radiology [6], gastroenterology [7], dermatology and nephrology [8]. In Nigeria, the use of deep learning, a subset of AI has been reported in electrocardiogram (ECG) readings [9]. Using signal processing and machine learning, the start-up by a Nigerian, Ubenwa is enhancing the diagnosis of birth asphyxia in low-resource areas [10]. Another start-up, RetinaAI is leveraging on the power of computer vision for detection of diabetic retinopathy [11].

AI has been used in medical education for case-based E-learning [12] and virtual standardized patient systems for obtaining histories **(**[13,14] and in the postgraduate medical education for long case questions as well as generating management plans. These resources may transform medical education, especially given that the accuracy of the evaluations from the machine and the three human raters was equivalent [13].

Although it is widely acknowledged that AI will play a significant role in medicine, it is still unclear how this will affect medical students and their future in Nigeria. In some studies, it was opined that students and doctors likewise worry that AI will take the jobs of radiologist and by extension, other specialty physicians in the nearest future [15]. According to some research, it might deter people from choosing a career in medicine in general or from subspecialties like radiology that are seen to be particularly vulnerable to AI [16]**.**

Knowledge of AI and its uses in medicine may have an impact on medical students' attitudes regarding the technology. The study of AI is not frequently discussed in medical school and not addressed enough. Current accreditation standards do not emphasize AI, medical schools are already struggling with a dense curriculum and are frequently asked to add new topics and areas of study, and lack of faculty with the subject matter expertise and technical know-how to teach this topic are few of the potential explanations given in a study [17]**.** At the post-graduate level, doctors are faced with the intricacies of their intended specialties and that does not give room for AI.

In addition, medical schools and instructors are currently unable to design effective teaching methods because they are unsure of the precise coming function of the physician in AI [18] and are probably just leaving it to the future generation of doctors to deal with it.

Since they may already be using AI and machine learning (ML) or will do so in the near future and are expected to play a significant role in its development, testing, and integration into the clinical workflow, physicians, leaders of health systems and medical students should be knowledgeable about the advantages and limitations of these technologies [19].

The knowledge and attitude of medical students as well as doctors about AI from all around the

world, including the Middle East, have been evaluated and assessed in several studies. [3,15,20,21]. It is not unreasonable to infer that the current atmosphere of enthusiasm for AI has an impact on the attitudes and behaviors of medical students and doctors and this is evidenced by previous studies conducted by teams in Canada [20] and Germany [15], where multicenter surveys on medical students from their respective nations were carried out and these findings have particular relevance for radiology.

In a survey conducted in medical school and teaching hospital in Nepal, students felt threatened by the emergence of AI because they felt it is coming to take over their jobs and roles and that it will raise new ethical challenges [22].

Beyond the lack of proper knowledge and understanding which has influenced medical student and doctors' perception towards artificial intelligence, questions that borders on accountability, transparency, ethical challenges, feasibility are areas to be considered too [23]. These and many more are barriers that must be overcome to prevent negative attitude of medical students and doctors towards artificial intelligence.

Sadly, research on the knowledge and attitude of Nigerian medical students and doctors on AI is still lacking. Hence, this cross-sectional study investigated the knowledge and attitude of medical students at the University of Ilorin towards AI to determine the attitude of medical students to artificial intelligence and assess the perception of respondents on their willingness to apply AI in the near future as a step towards integrating AI teaching in Medical training.

METHODS

This was a cross-sectional study conducted in University of Ilorin and University of Ilorin Teaching Hospital, Ilorin, Kwara State. The target population for this study were medical students at the University of Ilorin of all levels studying at the University of Ilorin Teaching Hospital. Random sampling technique was used in this study as well as the snowballing method via different social media network (Whatsapp, Twitter and Instagram). The link to the form was sent to class-representatives of all the classes in the medical school. The link to the survey was open and accessible for 8 weeks.

The instrument for data collection was an adapted and self-administered questionnaire. The adapted questionnaires were from studies done by Swed et al., (2022) [24].The questionnaire consisted of three sections. Section A was used to obtain the participants' demographic profile; section B contained questions about the general knowledge of AI as well as its application in medicine. Section C was used to determine the attitudinal disposition of the participants towards Artificial Intelligence.

The modified questionnaire consisted of 24 items that cut across the subscales aforementioned. This attitude section had 15 questions which was based on a five point Likert scales: from “strongly agree = 5” to “strongly disagree = 1”. The knowledge section included 5 dichotomous questions where the participants were requested to reply in either of the options provided: 1 = yes; 0 = no and finally the demographic section contained 3 questions on the participant’s demography.

To ensure validity of questionnaire, the measuring instrument used were constructed under the close guidance and supervision and the content validity was measured using appropriate textbooks, internet search and both international and local current journals.

For reliability, it was determined using the test-retest method on participants with similar characteristics to the study population. It was also tested on 10% of the sample size study population. The returned questionnaires were sorted and coded after which data was entered into Statistical Package for Social Science (SPSS) software version 25. Simple descriptive statistics were presented with percentages and frequencies. Chi-square and cross tabulation were used to determine associations between variables with a p-value <0.05 level of significance. Ethical approval was obtained from the ethical committee of the University of Ilorin Teaching Hospital.

RESULTS

SOCIODEMOGRAPHICS

Over a 2-month period, a total of 343 undergraduate medical students in the University of Ilorin participated in the survey. Gender distribution was 212 (61.8%) males and 131 (38.2%) females with a mean age of 22.17. The participants were majorly clinical (year 4 and above) students (75.8%, n=260/343). These are shown in Table 1.

Table 1: Baseline Characteristics of the Study Population

		Frequency	Percentage%
Age	16-20	103	30.1%
	21-25	204	59.5%
	25-30	34	9.3%
	>30	3	1.1%
Gender	Male	212	61.8%
	Female	131	38.2%
Level	Preclinical (100-300)	83	24.2%
	Clinical (400 – 600)	260	75.8 %

KNOWLEDGE OF MEDICAL STUDENTS ON ARTIFICIAL INTELLIGENCE

Majority of the respondents 339 (98.8%) have heard of Artificial Intelligence, however only 262 (76.4%) could define what it is based on their different understanding. Amongst all those who have heard about Artificial Intelligence before, an overwhelming majority stated they heard of it from the media, inclusive of social media (90.4%) and mass media (50.6%). Followed closely to that is from personal readings or research (63.9%) and only a smaller number got to hear about AI during university lectures (24.1%) or from friends and family (3.6%). In contrast, only a very few respondents 4 (1.2%) had never heard anything on AI, but of those who heard of it prior to now, one-third 81 (23.6%) of them has no idea on the definition and its application. Out of the 343 medical students who participated in the survey, only a few 32 (9.3%) have gone through some form training or boot camp on Artificial Intelligence (Table 2). The correlation of Knowledge of AI with different variables is given in Table 4. It was observed that lack of training at the undergraduate level during medical training and gender were significant factors affecting the knowledge of AI with P values of less than 0.05. Males were found to have more knowledge about AI than females. The level in medical training was also a significant factor for the knowledge of applications of AI in medicine with a P-value less than 0.05.

Table 2: Descriptive Statistics for knowledge of Medical Students on Artificial Intelligence

		Frequency	Percentage %
Do you know what artificial intelligence is?	No	4	1.2%
	Yes	339	98.8%
Can you define artificial intelligence?	No	81	23.6%
	Yes	262	76.4%
Have you ever had any form of training on artificial intelligence?	No	311	90.7%
	Yes	32	9.3%
Do you know any application of AI in medicine?	No	219	63.8%
	Yes	124	36.2%

ATTITUDE OF MEDICAL STUDENTS ON ARTIFICIAL INTELLIGENCE

From all the respondents, about two-third 216 (63%) of medical students strongly agreed that AI will play an important role in healthcare. Also, about 219 students (63.9%) agreed that AI will never render human doctor's expendable while about 104 respondents (30.3%) disagreed. In terms of specialty selection, 159 (46.3%) of respondents agreed that AI will impact their choice of specialty, and this is due to fears of AI reducing the workforce of doctors in such areas.

In addition, majority 284 (82.8%) of the respondents have agreed that the development of AI and its applications in medicine has made medicine much more interesting to them, and an overwhelming majority 299 (87.1%) have agreed that AI should be included in the curriculum of medical students because of the immense ability of AI to improve the healthcare delivery.

When responding to questions on certain ethics of AI, majority of respondents 299 (87.1%) have also agreed that AI only serves as physician's aid and cannot be better than the physicians even though about 32 (9.4%) disagreed and believed that AI can eventually become better than AI. In addition, many of the respondents 272 (79.3%) disagreed that AI will be a burden to both the students and doctors, however, majority 288 (84%) equally attested that AI in medicine will raise new ethical challenges in the practice (Table 3). Correlation of attitude towards AI in the medical field with variables like gender and level in the university is given in Table 4 which shows that the lack of curriculum is a significant factor with a P-value of <0.05 and gender has no significant effect on attitude.

Table 3: Attitudes of Medical Students on Artificial Intelligence

	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE	NO OPINION
AI will play an important role in healthcare	216 (63.0%)	127 (37.0%)	0 (0%)	0 (0%)	0 (0%)
AI will never render human-doctors expendable	84(24.5%)	135(39.5%)	92 (26.8%)	12 (3.5%)	8 (2.3%)
AI will/already did impact my	44 (12.8%)	115 (33.5%)	132 (38.5%)	20 (5.8%)	32 (9.3%)

choice of specialty selection					
The developments of AI make medicine more interesting to me	100 (29.2%)	184 (53.6%)	35 (10.2%)	0 (0%)	16 (4.7%)
AI should be included in the curriculum of medical student education and residency training	148 (43.1%)	151 (44.0%)	32 (9.3%)	4 (1.2%)	8 (2.3%)
AI serves as a physician's aid and cannot be better than the physician	175 (51.0%)	124 (36.2%)	28 (8.2%)	4 (1.2%)	12 (3.5%)
AI will be a burden on both students and doctors	44 (12.8%)	20 (5.8%)	228 (66.5%)	55 (16%)	24 (7.0%)
The Nigerian healthcare system is currently well prepared to deal with challenges having to do with AI	16 (4.7%)	24 (7.0%)	179 (52.1%)	96 (28.0)	28 (8.2%)
Formal training is required in medical schools	152 (44.3%)	151 (44.0%)	24 (7.0%)	12 (3.5%)	4 (1.2%)

and hospitals to teach about artificial intelligence and its applications					
I am interested in learning the principles of Artificial Intelligence and its applications in healthcare	188 (54.8%)	143 (41.7%)	8 (2.3%)	0 (0%)	4 (1.2%)
AI in medicine will raise new ethical challenges	124 (36.2%)	164 (47.8%)	28 (8.2%)	15 (4.4%)	12 (3.5%)
Every medical trainee should be required to receive training in AI competencies.	92 (26.8%)	191 (55.7%)	40 (11.7%)	12 (3.5%)	8 (2.3%)

DISCUSSION

The use of algorithms based on human intelligence has transformed the delivery of healthcare, enabling tasks to be accomplished quickly and accurately [25] and the COVID-19 pandemic further worsened the cases of limited resources which necessitated the re-allocation of resources and the need to embrace AI technology [26]. In terms of AI development, Nigeria is still in the early stages of introducing and using AI with little data availability. This study was conducted to assess the knowledge, attitudes, and use of AI in the field of medicine among University of Ilorin medical students. This study advances our knowledge of the perspectives of medical students on the present and future of AI medicine in healthcare.

A total of 343 medical students participated in the study, out of which 61.8% were males and 38.2% were females with a male to female ratio of 1.61. From the 343 participants, 98.8% had a basic

knowledge AI and most of the individuals knowing AI were males and almost 63.8% of the study participants weren't aware of the practical application of AI in medicine. This shows that Unilorin medical students, despite having the basic knowledge of AI, don't know its practical implications as it relates to healthcare. This is similar to another study conducted in Pakistan [27] which reported Pakistani doctors and medical students being deficient in terms of practical application of AI in medicine. Another study in this area, involving 98 health professionals from the NHS trust in London, found that more than 25% of them did not comprehend the subtypes of AI and 79% of them thought it was crucial to healthcare [28], which is consistent with our findings in which 63% strongly agreed and 37% agreed that AI will play an important role in healthcare.

Majority of students agreed that AI should be taught at medical schools because it will transform medical practice, make it more exciting, and improve some areas of healthcare and this is consistent with findings from other studies [15,29] who had similar results.

A very important aspect of this questionnaire was on whether AI will replace physicians, our study showed that two-third (64%) responded in negation, meaning that they do not believe AI will replace physicians. This is similar to report from other studies [23,30] However, reports from [29] indicated that the respondents were neutral and reports from study done in Nepal [22] revealed that a little more than half of the respondents thought that AI will make fewer jobs available to them.

In general, students indicated the impression that some specialties will be more significantly impacted by AI than others, which is consistent with their perceptions of AI's capabilities and their opinions on how AI will change the landscape of medical professionals. Interestingly, we discovered that these notions were actively influencing some students' career planning. Our study reported that almost half (46.3%) of students thought that AI would or has already influenced their choice of medical specialty and this is similar to another study [23] conducted in Canada with about a quarter having preconceived choices of specialty based on how much AI is likely to affect such specialty. While our survey did not ask which specialties the threat of AI made less desirable, a 2020 study conducted among medical students in the United States revealed that about half of the respondent were less inclined to seek radiology as an area of expertise because of their worries about how AI may affect radiology practice [21].

While we recognize the benefits that are accrued to AI and its application in medicine, our study also aimed at understanding challenges that might arise from this. Our findings revealed that 36.2% and 47.8% strongly agreed and agreed respectively that AI in medicine will raise new ethical challenges. This is consistent with all other findings [15,21–23,30]. The results indicate how well students comprehend AI in regard to ethical considerations. Ethics concerns with AI, such as accountability,

transparency, permission, and privacy, have been viewed as a key barrier to its use in healthcare.

In terms of knowledge acquisition of AI in medical school, our study revealed that 92 (26.8%) that every medical trainee should be required to receive training in AI competencies. This is similar to study conducted in three German universities by Pinto dos Santos, 2019 which revealed that majority of the respondents belived in the inclusion of AI into their medical education.This is the same finding in the study conducted in Pakistan [3]**.** Expert criticism has been the extent of academic debate on the subjects covered in the AI curriculum for medical schools [4]. Their views concur that the purpose of medical AI education in undergraduate medical training should be to lay a foundation that provides graduates with a fundamental grasp of the technology underlying AI, their limitations, and associated ethical and legal concerns. Additionally, they agree that people who want to actively develop and lead innovations connected to AI should have opportunity to improve their expertise and that the bulk of medical students may not require as much subject understanding as those who want to later on spearhead the innovative AI course in medical practice [31]. Our study revealed that about half 188 (54.8%) of the medical students in the University of Ilorin strongly agreed and another 143 (41.7%) students indicated their interest to learn about AI and its role in medicine.

Finally, a significant proportion of our respondents 179 (52.1%) disagreed that the Nigerian government is currently well positioned and prepared to deal with challenges having to do with AI. This in itself might be a limiting factor to the adoption of AI in many medical settings all over Nigeria.

The strength of this study was that it provided a basic understanding of the knowledge and attitude of medical students towards AI with a view of providing evidenced-based reports on its subsequent adoption and more importantly, its usage. However, we had some limitations. There are certain restrictions on the population of this study, and these findings might not be applicable to other nations or medical schools. Additionally, since we only looked at undergraduate medical students' knowledge and attitudes, it may be postulated that postgraduate students or even more experienced doctors do not share the students' somewhat upbeat viewpoints. Investigating these other groups as well would be a potentially fascinating topic for more research, in order to also address their unique issues. Additionally, it could be interesting to particularly investigate whether those who are less certain about how AI will affect radiology have a propensity to steer clear of radiology training.

In addition, the method of sample collection involved the social media. This made it difficult to do much randomization and selective bias can easily affect such results gotten. In addition, the response rate was low, which might make generalization of this results quite difficult.

In conclusion, despite their general lack of in-depth knowledge of AI and its uses in healthcare, the

majority of the medical students had a favorable opinion of it and were eager to put it into practice. More funding must be set aside for planning, integrating AI into the medical curriculum, and teaching physicians how to use AI in their daily practices. This study has discovered a generally positive attitudes on AI's role in healthcare and a desire to develop AI skills starting in undergraduate medical education. In order to continue creating qualified physicians who can provide top-notch patient care, medical education must change as AI-enabled technologies are increasingly integrated into healthcare.

In addition, the findings from this study also serves as a recommendation to the Nigerian government of the need to begin to look into AI adoption in healthcare and medical practice as it promises a good future. In this era of increasing technological advancement, it is important for medical students to be given the opportunity to explore AI during their undergraduate study as this will prepare them well ahead in terms of specialty decision and even career progression. The role of AI in healthcare cannot be underestimated and it is bound to continue, hence, the front runners of healthcare should not be left out of the loop of AI knowledge.

Table 4: Correlation of Knowledge and Attitude of Artificial Intelligence with different variable

Factors (Gender)		**Male**	**Female**	**P-value**
Knowledge about AI	Yes	212 (61.8%)	127 (37.0%)	0.010
	No	0 (0.0%)	4 (1.2%)	
Definition of AI	Yes	167 (48.7%)	95 (27.7%)	0.185
	No	45 (13.1%)	36 (10.5%)	
Training on AI	Yes	28 (8.2%)	4 (1.2%)	<0.001
	No	184 (53.6%)	127 (37.0%)	
Applications of AI	Yes	153 (44.6%)	99 (28.9%)	<0.001
	No	59 (17.2%)	32 (9.3%)	
Development of AI make medicine more interesting	Strongly agree	84 (25.1%)	16 (4.8%)	<0.001
	Agree	88 (26.3%)	96 (28.7%)	
	Disagree	28 (8.4%)	7 (2.1%)	
	Strongly disagree	8 (2.4%)	8 (2.4%)	
	No opinion	0 (0.0%)	0 (0.0%)	
AI serves as physician’s aid and cannot be better than them	Strongly agree	116 (34.3%)	59 (17.5%)	<0.001
	Agree	68 (20.1%)	56 (16.6%)	
	Disagree	24 (7.1%)	4 (1.2%)	
	Strongly disagree	0 (0.0%)	7 (2.1%)	

	No opinion	0 (0.0%)	4 (1.2%)	
AI should be included in the curriculum of medical students	Strongly agree	100 (29.5%)	48 (14.2%)	0.055
	Agree	88 (26.0%)	63 (18.6%)	
	Disagree	16 (4.7%)	16 (4.7%)	
	Strongly agree	0 (0.0%)	0 (0.0%)	
	No opinion	4 (1.2%)	4 (1.2%)	
The Nigerian healthcare system is currently well prepared for AI inclusion	Strongly agree	8 (2.4%)	8 (2.4%)	0.056
	Agree	20 (6.0%)	4 (1.2%)	
	Disagree	108 (32.4%)	71 (21.3%)	
	Strongly agree	64 (19.2%)	34 (10.2%)	
	No opinion	8 (2.4%)	8 (2.4%)	

Factors (Academic Level)		**Pre-clinicals**	**Clinicals**	**P-value**
Knowledge about AI	Yes	256 (74.6%)	83 (24.2%)	0.440
	No	4 (1.2%)	0 (0.0%)	
Definition of AI	Yes	196 (57.1%)	66 (19.2%)	0.256
	No	64 (18.7%)	17 (5.0%)	
Training on AI	Yes	32 (9.3%)	0 (0.0%)	<0.001
	No	228 (66.5%)	83 (24.2%)	
Applications of AI	Yes	184 (53.6%)	68 (19.8%)	<0.001
	No	76 (22.2%)	15 (4.4%)	
Development of AI make medicine more interesting	Strongly agree	84 (25.1%)	16 (4.8%)	<0.001
	Agree	140 (41.8%)	44 (13.1%)	
	Disagree	24 (7.2%)	11 (3.3%)	
	Strongly disagree	0 (0.0%)	0 (0.0%)	
	No opinion	4 (1.2%)	12 (3.6%)	
AI serves as physician’s aid and cannot be better than them	Strongly agree	124 (36.7%)	51 (15.1%)	<0.001
	Agree	104 (30.8%)	20 (5.9%)	
	Disagree	24 (7.1%)	4 (1.2%)	
	Strongly disagree	3 (0.9%)	4 (1.2%)	
	No opinion	0 (0.0%)	4 (1.2%)	
AI should be	Strongly agree	124 (36.6%)	24 (7.1%)	<0.001

included in the curriculum of medical students	Agree	108 (31.9%)	43 (12.7%)	
	Disagree	24 (7.1%)	8 (2.4%)	
	Strongly disagree	0 (0.0%)	0 (0.0%)	
	No opinion	0 (0.0%)	8 (2.4%)	
The Nigerian healthcare system is currently well prepared for AI inclusion	Strongly agree	12 (3.6%)	4 (1.2%)	0.033
	Agree	20 (6.0%)	4 (1.2%)	
	Disagree	124 (37.2%)	55 (16.5%)	
	Strongly disagree	78 (23.4%)	20 (6.0%)	
	No opinion	16 (4.8%)	0 (0.0%)	

CONCLUSION

This study highlights the current state of knowledge and attitudes towards artificial intelligence (AI) among medical students at the University of Ilorin. The findings reveal a high level of awareness about AI but also underscore significant gaps in understanding its practical applications in healthcare. Despite these gaps, there is a strong inclination among students to learn more about AI and its potential benefits in medical practice. The positive attitude towards AI integration into medical education and practice reflects an eagerness to embrace technological advancements that can enhance healthcare delivery. However, the study also indicates the need for formal AI training within the medical curriculum to bridge the knowledge gap and prepare future healthcare professionals for the evolving landscape of medicine. Moreover, the concerns about ethical challenges and the impact of AI on job security, particularly in specific specialties, emphasize the need for a balanced approach in AI education. This should include discussions on ethical implications, accountability, and the complementary role of AI alongside human physicians. The findings of this study serve as a call to action for medical schools in Nigeria and similar developing countries to invest in AI education and training. By doing so, they can equip future doctors with the necessary skills and knowledge to leverage AI technologies effectively, ensuring improved patient care and healthcare outcomes. In conclusion, integrating AI education into the medical curriculum is essential for preparing the next generation of healthcare professionals. It is crucial for educational institutions and policymakers to address the existing gaps and facilitate the adoption of AI in healthcare to fully realize its potential in transforming medical practice.

REFERENCES

[1] Webster CS. Artificial intelligence and the adoption of new technology in medical education. Med Educ 2021;55:6–7. https://doi.org/10.1111/medu.14409.

[2] Abid S, Awan B, Ismail T, Sarwar N, Sarwar G, Tariq M, et al. ARTIFICIAL INTELLIGENCE: MEDICAL STUDENT S ATTITUDE IN DISTRICT PESHAWAR PAKISTAN. Pakistan Journal of Public Health 2019;9:19–21. https://doi.org/10.32413/pjph.v9i1.295.

[3] Ahmed Z, Bhinder KK, Tariq A, Tahir MJ, Mehmood Q, Tabassum MS, et al. Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Pakistan: A cross-sectional online survey. Annals of Medicine & Surgery 2022;76. https://doi.org/10.1016/j.amsu.2022.103493.

[4] Davenport T, Kalakota R. The potential for artificial intelligence in healthcare. Future Healthc J 2019;6:94–8. https://doi.org/10.7861/futurehosp.6-2-94.

[5] Owoyemi A, Owoyemi J, Osiyemi A, Boyd A. Artificial Intelligence for Healthcare in Africa. Front Digit Health 2020;2. https://doi.org/10.3389/fdgth.2020.00006.

[6] Waymel Q, Badr S, Demondion X, Cotten A, Jacques T. Impact of the rise of artificial intelligence in radiology: What do radiologists think? Diagn Interv Imaging 2019;100:327–36. https://doi.org/10.1016/j.diii.2019.03.015.

[7] Alagappan M, Brown JRG, Mori Y, Berzin TM. Artificial intelligence in gastrointestinal endoscopy: The future is almost here. World J Gastrointest Endosc 2018;10:239–49. https://doi.org/10.4253/wjge.v10.i10.239.

[8] Niel O, Bastard P. Artificial Intelligence in Nephrology: Core Concepts, Clinical Applications, and Perspectives. American Journal of Kidney Diseases 2019;74:803–10. https://doi.org/10.1053/j.ajkd.2019.05.020.

[9] Musa N, Gital AY, Aljojo N, Chiroma H, Adewole KS, Mojeed HA, et al. A systematic review and Meta-data analysis on the applications of Deep Learning in Electrocardiogram. J Ambient Intell Humaniz Comput 2023;14:9677–750. https://doi.org/10.1007/s12652-022-03868-z.

[10] Onu CC, Lebensold J, Hamilton WL, Precup D. Neural Transfer Learning for Cry-Based Diagnosis of Perinatal Asphyxia. Interspeech 2019, ISCA: ISCA; 2019, p. 3053–7. https://doi.org/10.21437/Interspeech.2019-2340.

[11] U-M Kellogg Eye Center. (n.d.). Kellogg Annual Report. Issuu. https://issuu.com/u-mkelloggeyecenter/docs/kellogg_annual_report/s/11709347 n.d.

[12] Khumrin P, Ryan A, Judd T, Verspoor K. Diagnostic Machine Learning Models for Acute Abdominal Pain: Towards an e-Learning Tool for Medical Students. Stud Health Technol Inform 2017;245:447–51.

[13] Maicher KR, Zimmerman L, Wilcox B, Liston B, Cronau H, Macerollo A, et al. Using virtual standardized patients to accurately assess information gathering skills in medical students. Med Teach 2019;41:1053–9. https://doi.org/10.1080/0142159X.2019.1616683.

[14] Randhawa GK, Jackson M. The role of artificial intelligence in learning and professional development for healthcare professionals. Healthc Manage Forum 2020;33:19–24. https://doi.org/10.1177/0840470419869032.

[15] Pinto dos Santos D, Giese D, Brodehl S, Chon SH, Staab W, Kleinert R, et al. Medical students' attitude towards artificial intelligence: a multicentre survey. Eur Radiol 2019;29:1640–6. https://doi.org/10.1007/s00330-018-5601-1.
[16] Park CJ, Yi PH, Siegel EL. Medical Student Perspectives on the Impact of Artificial Intelligence on the Practice of Medicine. Curr Probl Diagn Radiol 2021;50:614–9. https://doi.org/10.1067/j.cpradiol.2020.06.011.
[17] Kolachalama VB, Garg PS. Machine learning and medical education. NPJ Digit Med 2018;1:54. https://doi.org/10.1038/s41746-018-0061-1.
[18] Singh RP, Hom GL, Abramoff MD, Campbell JP, Chiang MF. Current Challenges and Barriers to Real-World Artificial Intelligence Adoption for the Healthcare System, Provider, and the Patient. Transl Vis Sci Technol 2020;9:45. https://doi.org/10.1167/tvst.9.2.45.
[19] Pucchio A, Eisenhauer EA, Moraes FY. Medical students need artificial intelligence and machine learning training. Nat Biotechnol 2021;39:388–9. https://doi.org/10.1038/s41587-021-00846-2.
[20] Gong B, Nugent JP, Guest W, Parker W, Chang PJ, Khosa F, et al. Influence of Artificial Intelligence on Canadian Medical Students' Preference for Radiology Specialty: ANational Survey Study. Acad Radiol 2019;26:566–77. https://doi.org/10.1016/j.acra.2018.10.007.
[21] Sit C, Srinivasan R, Amlani A, Muthuswamy K, Azam A, Monzon L, et al. Attitudes and perceptions of UK medical students towards artificial intelligence and radiology: a multicentre survey. Insights Imaging 2020;11:14. https://doi.org/10.1186/s13244-019-0830-7.
[22] Jha N, Shankar PR, Al-Betar MA, Mukhia R, Hada K, Palaian S. Undergraduate Medical Students' and Interns' Knowledge and Perception of Artificial Intelligence in Medicine. Adv Med Educ Pract 2022;Volume 13:927–37. https://doi.org/10.2147/AMEP.S368519.
[23] Mehta N, Harish V, Bilimoria K, Morgado F, Ginsburg S, Law M, et al. Knowledge and Attitudes on Artificial Intelligence in Healthcare: A Provincial Survey Study of Medical Students. MedEdPublish 2021;10. https://doi.org/10.15694/mep.2021.000075.1.
[24] Swed S, Alibrahim H, Elkalagi NKH, Nasif MN, Rais MA, Nashwan AJ, et al. Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Syria: A cross-sectional online survey. Front Artif Intell 2022;5. https://doi.org/10.3389/frai.2022.1011524.
[25] Laï M-C, Brian M, Mamzer M-F. Perceptions of artificial intelligence in healthcare: findings from a qualitative survey study among actors in France. J Transl Med 2020;18:1–13.
[26] Guo J, Li B. The application of medical artificial intelligence technology in rural areas of developing countries. Health Equity 2018;2:174–81.
[27] Ahmed Z, Bhinder KK, Tariq A, Tahir MJ, Mehmood Q, Tabassum MS, et al. Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Pakistan: A cross-sectional online survey. Annals of Medicine and Surgery 2022;76:103493. https://doi.org/10.1016/j.amsu.2022.103493.
[28] Castagno S, Khalifa M. Perceptions of artificial intelligence among healthcare staff: a qualitative survey study. Front Artif Intell 2020;3:578983.
[29] Wood EA, Ange BL, Miller DD. Are We Ready to Integrate Artificial Intelligence Literacy into Medical School Curriculum: Students and Faculty Survey. J Med Educ Curric Dev 2021;8:238212052110240. https://doi.org/10.1177/23821205211024078.
[30] Kansal R, Bawa A, Bansal A, Trehan S, Goyal K, Goyal N, et al. Differences in Knowledge and Perspectives on the Usage of Artificial Intelligence Among Doctors and Medical Students of a Developing Country: A Cross-Sectional Study. Cureus 2022. https://doi.org/10.7759/cureus.21434.
[31] McCoy LG, Nagaraj S, Morgado F, Harish V, Das S, Celi LA. What do medical students actually need to know about artificial intelligence? NPJ Digit Med 2020;3:86. https://doi.org/10.1038/s41746-020-0294-7.