

Attitude and Understanding of Artificial Intelligence Among Saudi Medical Students: An Online Cross-Sectional Study

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Purpose: Artificial Intelligence is drastically used nowadays in healthcare, but little is known about the attitude and perception of medical students towards AI in Saudi Arabia. This study aimed to explore undergraduate medical student's views on AI, assessed their understanding of AI, and the level of confidence of using basic AI tools in the future.

Methods: This cross-sectional study invited 303 medical undergraduate students to complete an anonymous electronic survey, which consists of questions related to attitude, understanding and confidence of using basic AI tools. We examined the statistical association between the categorical variables by using Chi-square test.

Results: The results of the study indicate that eighty-seven percent of participants believed that AI will play significant role in healthcare. Thirty-eight percent respondents reported that they have an understanding of the basic computational principle of AI. 71.29% respondents agreed that teaching in AI would be favorable for their career. More than half of the participants were confident in using basic AI tools in the future, Male students ($p = 0.00$), 26–30 years old participants ($p = 0.03$), intern students ($p = 0.00$), and Imam Abdulrahman Bin Faisal University medical students ($p = 0.04$) had positive attitude of artificial intelligence. Male participants ($p = 0.02$), and intern students ($p = 0.00$) had the highest proportion of confidence in using basic healthcare AI tool. Nearly 14% students received training on AI. Participants who received training on AI reported better understanding of AI ($p = 0.03$), develops positive attitude towards teaching in AI ($p = 0.05$), more confidence in using basic healthcare AI tools ($p = 0.05$).

Conclusion: Saudi medical undergraduate students understand the significance of AI and demonstrated a positive attitude towards AI. Medical students training on AI should be expanded and improved to avoid threats for seeking jobs by adapting artificial intelligence.

Keywords: artificial intelligence, attitude, understanding, confidence, medical students, Saudi Arabia

Introduction

Artificial intelligence (AI) has received tremendous attention in recent years and many experts refer to AI as the fourth industrial revolution.^{1–3} Developed countries have invested heavily in artificial intelligence and its implementation in healthcare.⁴ Since the COVID-19 pandemic, the demand for artificial intelligence resources and knowledge in healthcare has increased drastically, with a goal of reducing the workload and diagnostic errors.⁵

Modern medicine and clinical practice are found to benefit greatly from artificial intelligence.⁶ Numerous AI-based applications, including clinical and genomic diagnostics^{7,8} chronic disease management,⁹ block chain technology,¹⁰ and advanced surgical robots,¹¹ have fundamentally changed overall medical practice. Artificial intelligence is still in its infancy, but as it develops it will revolutionize medical science and become a crucial component of healthcare in the future.¹² Despite the fact that artificial intelligence will be a key element of medical education in coming times,¹³ there is dearth of research on the factors that might influence medical student's intention to use artificial intelligence tools.¹⁴

Moreover, little is known about the attitude of medical students towards knowledge and application of artificial intelligence in clinical practice.¹⁵ Therefore, empirical research on medical student's attitudes and perceptions towards artificial intelligence is needed.

Few studies have assessed medical student's intentions to study medicine-related artificial intelligence. As a result, the impact of artificial intelligence medical education and training remains unclear.¹⁶ The accelerated development of artificial intelligence is a big challenge for medical students, and these students feel the threat of being replaced by artificial intelligence.¹⁷ Therefore, medical student's perceptions of artificial intelligence may be influenced by these concerns. However, medical students are not exposed to artificial intelligence in undergraduate medical courses. Some potential explanations for this include the fact that artificial intelligence is not given much weight in current accreditation requirements. Medical colleges are already struggling with a demanding curriculum and are frequently asked to add new topics; they also lack expert faculty to teach these topics.¹⁸ An additional obstacle is that medical students and educators are still unsure about the precise evolving role of physicians in relation to artificial intelligence, which prevents them from developing instructional strategies.¹⁹ Ideally, medical graduates need to be equipped with adequate knowledge about artificial intelligence in medicine and adopt the use of basic artificial intelligence tools. This will enable them to critically apply artificial intelligence technology and support the advancement of artificial intelligence in medicine to improve patient care.¹⁸ A persistent desire to learn about practical terminology depends on several interconnected variables that vary in different situations.

Studies on attitude, understanding and perception of artificial intelligence among medical students are rare due to it being a new and emerging field. A recent study conducted in Saudi Arabia reported that 83.3% medical students agreed that AI would play an important role in healthcare.²⁰ Another study in Saudi Arabia indicated that 84.4% medical students and health professionals believed that AI is essential in medical care.²¹ Given the scarcity of this topic in the Saudi literature, therefore, the present study aimed to understand Saudi medical undergraduate's views on artificial intelligence and assess their understanding and level of confidence in using artificial intelligence tools in the future.

Materials and Methods

Study Design

This cross-sectional study was conducted by distributing a web-based questionnaire using Google Forms between September 2023 and November 2023. The present study was carried out in accordance with the Declaration of Helsinki for research with human participants and was granted ethical approval from the Deanship of Scientific Research, King Faisal University, AlHasa, Saudi Arabia (KFU-REC-2023-SEP-ETHICS1351). All participants were informed of the purpose and goal of the study, and the survey was conducted after all requirements were met.

Study Sample

The participants in this study were medical students studying at different universities in the Eastern Governorate of Saudi Arabia. The participants were recruited using a non-probability convenience sampling technique. The sample size for this study was calculated using Slovin's formula²² with a confidence interval of 95% and margin of error of 0.05. A total of 332 students were selected to participate in this study and 303 participants completed the survey, a 91.26% response rate. Missing data from 31 participants were not included in the study. The inclusion criteria were Bachelor of Medicine and Bachelor of Surgery (MBBS) students in their clinical years and medical interns. Students in their MBBS preclinical years and those who did not consent to participate were excluded from the study.

Data Collection Method

The questionnaire for this study was adopted from previous research studies.²³ Before data collection, a pilot study was conducted with 30 students to confirm the reliability and validity of the questionnaire. The final questionnaire consists of 11 items, in which participants rated their responses to statements related to their current attitude towards artificial intelligence (three items), current understanding of artificial intelligence (three items), attitudes towards teaching on AI (two items), and confidence in using basic artificial intelligence tools (two items) in the future. Respondents were asked

to rate each statement on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total score was derived by adding the scores of items belonging to different areas, and the total scores were obtained for each domain. Dichotomous items were also added to determine whether the respondents had received any sort of training or education on artificial intelligence (one item). In addition, demographic information including age, gender, academic year, and medical school attended was collected using the questionnaire. Each batch of students in the college has its own social network group through which it shares information. We contacted the administration of the social network (WhatsApp) group to inform the batch-mates about the study, and their Email addresses were then obtained. Before data collection, each student was contacted via Email to determine their willingness to participate in the study. After obtaining written consent, the students were asked to complete an electronic survey (Google Form).

Statistical Analysis

Statistical Package for Social Sciences (SPSS) software (version 27.0) was used for statistical analysis. Descriptive statistics, such as the frequency and percentage, were calculated for the demographic variables and all items in the questionnaire. We examined the statistical association between categorical variables using the chi-square test, and the p -value was considered statistically significant at $p < 0.05$.

Results

This study invited 332 medical students from different universities in the Eastern Region of Saudi Arabia. A total of 303 students (174 males and 129 females) completed the questionnaire. The remaining 31 participants who were reluctant to respond to all of the questionnaire items were excluded. Table 1 shows that the majority of the participants (93.73%) were aged between 21 and 25 years. Most participants were fifth-year students (36.64%), followed by fourth-year students (34.98%). The maximum number of students (57.42%) were enrolled at King Faisal University, Al Hasa, and 129 (42.58%) were studying at Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia.

Table 2 presents the results for attitude, understanding, attitude towards teaching in artificial intelligence, and confidence in using basic artificial intelligence tools. Regarding the attitude towards artificial intelligence, the results

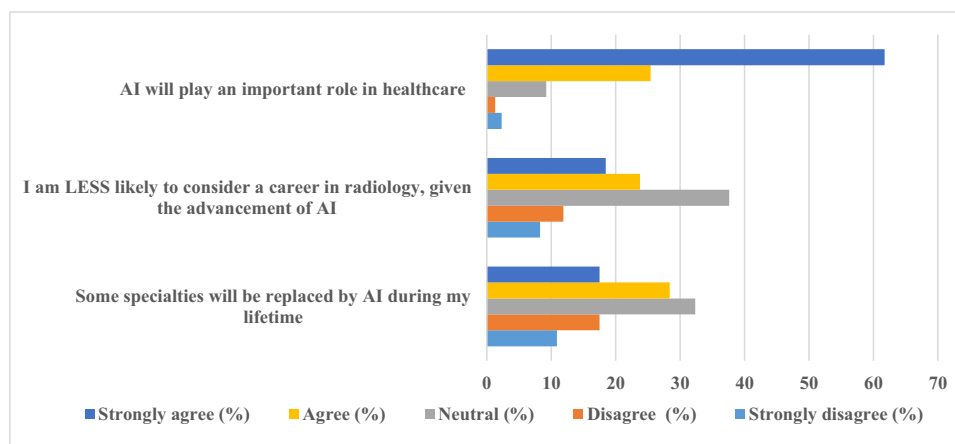
Table 1 Demographics of Survey Participants

Characteristics	N(303)	%
Gender		
Male	174	57.42
Female	129	42.58
Age		
21–25 years	284	93.73
26–30 years	17	5.61
>31 years	2	0.66
Academic year		
4 th year	106	34.98
5 th year	111	36.64
Intern	86	28.38
Medical school attended		
King Faisal University	174	57.42
Imam Abdulrahman Bin Faisal University	129	42.58

Table 2 Descriptive Statistics for Attitude, Understanding, Attitude Towards Teaching in Artificial Intelligence and Confidence in Using Basic Artificial Intelligence Tools Among Medical Students

	Strongly disagree N (%)	Disagree N (%)	Neutral N (%)	Agree N (%)	Strongly agree N (%)
Attitude					
AI will play an important role in healthcare	7 (2.31)	4 (1.32)	28 (9.24)	77 (25.41)	187 (61.72)
I am LESS likely to consider a career in radiology, given the advancement of AI	25 (8.25)	36 (11.88)	114 (37.62)	72 (23.76)	56 (18.48)
Some specialties will be replaced by AI during my lifetime	23 (10.89)	43 (17.49)	98 (32.34)	86 (28.38)	53 (17.49)
Understanding					
I have an understanding of the basic computational principles of AI	37 (12.21)	69 (22.76)	82 (27.06)	70 (23.10)	45 (14.85)
I am comfortable with the nomenclature related to artificial intelligence	28 (9.24)	64 (21.12)	80 (26.40)	88 (29.04)	43 (14.19)
I have an understanding of the limitations of artificial intelligence	17 (5.61)	52 (17.16)	78 (25.75)	109 (35.97)	47 (15.51)
Attitudes towards teaching on AI					
Teaching in artificial intelligence will be beneficial for my career	7 (2.32)	20 (6.60)	63 (20.79)	110 (36.30)	103 (34.99)
All medical students should receive teaching in artificial intelligence	20 (6.60)	31 (10.23)	73 (24.09)	108 (35.64)	71 (23.43)
Confidence in Using Artificial intelligence Tools					
At the end of my medical degree, I will be confident in using basic healthcare AI tools if required	102 (33.66)	83 (27.39)	71 (23.43)	26 (8.58)	21 (6.93)
At the end of my medical degree, I will have a better mastery of the methods used to assess healthcare AI algorithm performance	109 (36.97)	85 (28.05)	65 (21.45)	32 (10.56)	12 (3.96)

shown in Table 2 and graphically displayed in Figure 1 indicate that the majority of participants (87.12%, $n = 264$) believe that artificial intelligence will play an important role in healthcare, expressing their views as either strongly agree (61.72%, $n = 187$) or agree (25.41%, $n = 77$). Approximately 42% of respondents reported they were less likely to consider a career in radiology due to artificial intelligence in comparison to the participants who do not believe in

**Figure 1** Responses to questions about medical students' attitudes towards AI.

radiology as a career due to artificial intelligence (strongly disagree or disagree 20.13%, $n = 61$). An almost similar percentage of participants also felt that some specialties will be replaced by AI during their lifetime (strongly agree/agree 45.87%, $n = 139$; strongly disagree/disagree 21.78%, $n = 66$).

In terms of questions related to the current understanding of artificial intelligence, the results presented in Table 2 and graphically displayed in Figure 2 indicate that approximately 38% of respondents reported that they had an understanding of the basic computational principle of artificial intelligence, while nearly 35% of participants expressed a poor understanding of the basic computational principle of artificial intelligence, and the remaining 27.06% ($n = 82$) were neutral. Approximately 43% of participants believed that they were comfortable with the nomenclature related to artificial intelligence, while 30.36% ($n = 92$) selected strongly disagree or disagree, and the remaining 26.40% ($n = 80$) were neutral. More than half of the participants ($n = 156$) selected responses that indicated they had an understanding of the limitations of artificial intelligence, while nearly 23% of respondents strongly disagreed or disagreed (5.61%, $n = 17$; 17.16%, $n = 52$, respectively) and 25.75% ($n = 78$) were neutral.

A large number of participants accepted that teaching in artificial intelligence would be beneficial for their career, the results depicted in Table 2 and graphically displayed in Figure 3 shows that 71.29% of participants rating either strongly agree (34.99%, $n = 103$) or agree (36.30%, $n = 110$), and 20.79% ($n = 63$) of participants expressing a neutral response to this question. However, approximately 9% of students disagreed with this statement. Nearly 60% of participants agreed with the statement that all medical students should receive training in artificial intelligence as part of their medical degree; 23.43% ($n = 71$) and 35.64% ($n = 108$) of participants strongly agreed and agreed, respectively. Neutral responses

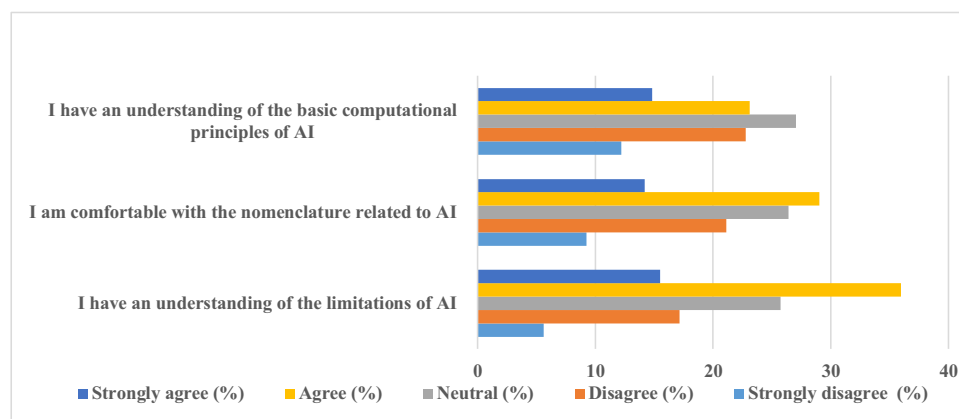


Figure 2 Responses to questions about medical students' understanding of AI.

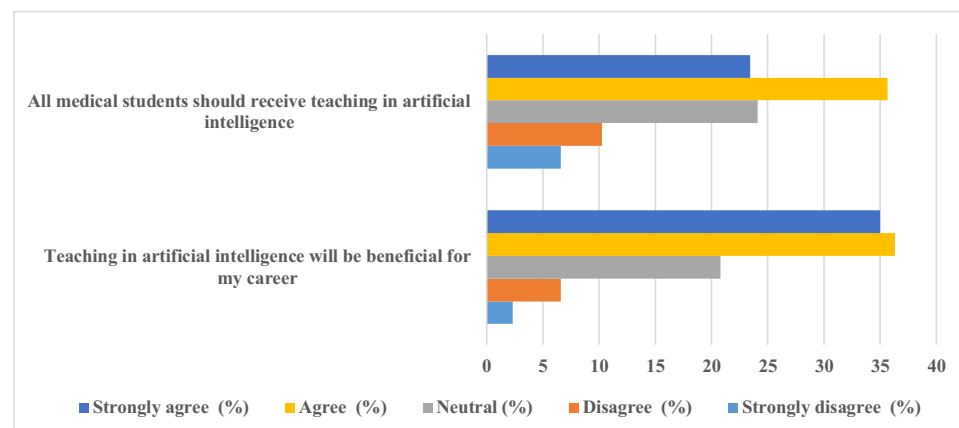


Figure 3 Responses to questions about medical students' attitudes towards teaching AI.

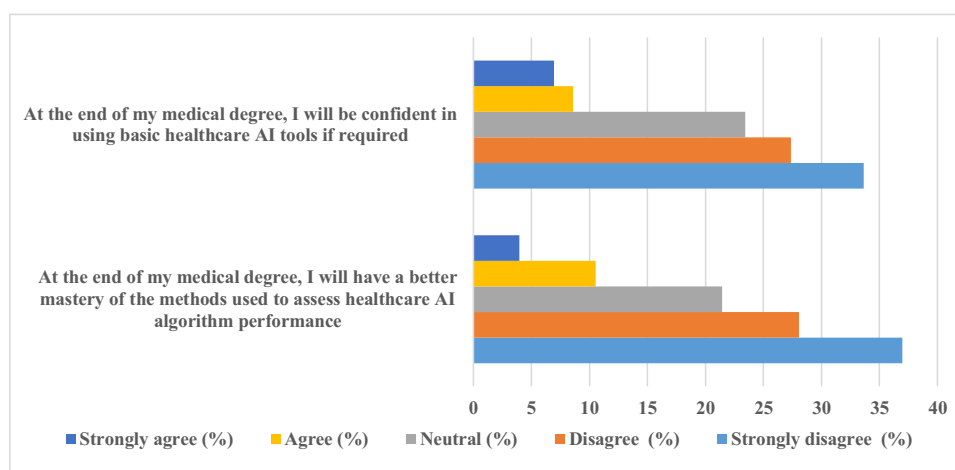


Figure 4 Response to questions regarding confidence in using Artificial intelligence Tools.

were reported by 24.09% of students, and nearly 17% of students did not believe that all medical students should receive training in artificial intelligence.

Regarding confidence of using AI tools, results presented in Table 2 and shown in Figure 4 indicate that 60.05% of the participants ($n = 185$) reported that they were not confident about using artificial intelligence tools, and nearly 15.51% responded either strongly agree or agree with being confident about using basic artificial intelligence tools in the future. However, 23.43% of the students submitted a neutral response to this question, and almost the same number of students believed that they would not have better mastery of the methods used to assess healthcare artificial intelligence algorithm performance at the end of their medical degree. Approximately 14.52% of respondents strongly agreed or agreed with this statement, and nearly 21.45% of participants expressed their responses as neutral.

Table 3 demonstrates how attitudes, understanding, attitudes towards teaching in artificial, and confidence in using artificial intelligence tools can differ depending on the baseline variables. Regarding attitudes towards artificial intelligence, the results clearly indicated that gender, age, academic year, and medical school attended were significantly different in terms of the proportion of positive attitudes. For the statistical analysis, neutral, disagree, or strongly disagree was scored 0, agree or strongly agree was scored 5, and positive attitude was scored higher than 5 points. The majority of male students ($n = 122$) had a positive attitude towards artificial intelligence compared to their female counterparts ($n = 70$). Regarding age, individuals aged 26–30 years had the highest proportion of positive attitudes compared with the other age groups. In terms of academic year, intern students had a more positive attitude towards artificial intelligence (94.19%) compared to the fifth-year (56.60%) and fourth-year (45.95%) students. More medical students enrolled at Imam Abdulrahman Bin Faisal University (69%) reported a positive attitude towards artificial intelligence than did King Faisal University medical students (59.20%).

In terms of understanding of artificial intelligence, the obtained results show that the academic year and medical school attended significantly differ in proportions of good understanding. For statistical analysis, neutral, disagree, or strongly disagree was scored 0, agree or strongly agree was scored 5, and good understanding was scored higher than 5 points. Nearly 83% of intern students ($n = 71$) reported a good understanding of artificial intelligence as compared to fifth-year (57.66%) and fourth-year (40.57%) students. A higher 68.22% of medical students from Imam Abdulrahman Bin Faisal University showed good understanding in artificial intelligence than did students from King Faisal University (51.72%).

Regarding the questions related to attitudes towards teaching in artificial intelligence, the results clearly indicate that gender significantly differs in proportion to positive attitudes. For the statistical analysis, neutral, disagree, or strongly disagree was scored 0, agree or strongly agree was scored 5, and positive attitude was scored higher than 5 points. More than 60% of the female participants showed a positive attitude towards teaching in artificial intelligence compared to

Table 3 Attitude, Understanding, Attitude Towards Teaching in Artificial Intelligence and Confidence in Using Basic Artificial Intelligence Tools Based on Gender, Age, Academic Year and Medical School Attended

Attitude towards Artificial intelligence				
		Negative	Positive	P value
		N (%)	N (%)	
Gender	Male	52 (29.88)	122 (70.12)	0.00
	Female	59 (45.74)	70 (54.26)	
Age	21–25 years	108 (38.03)	176 (61.97)	0.03
	26–30 years	2 (11.76)	15 (88.23)	
	>31 years	1 (50.0)	1 (50.0)	
Academic Year	4 th year	60 (54.05)	51 (45.95)	0.00
	5 th year	46 (43.40)	60 (56.60)	
	Intern	5 (5.81)	81 (94.19)	
Medical school attended	King Faisal University	71 (40.80)	103 (59.20)	0.04
	Imam University	40 (31.0)	89 (69.00)	
Understanding of Artificial Intelligence				
		Poor	Good	
Gender	Male	67 (38.51)	107 (61.49)	0.26
	Female	58 (44.96)	71 (55.04)	
Age	21–25 years	121 (46.60)	163 (53.40)	0.12
	26–30 years	3 (17.65)	14 (82.35)	
	>31 years	1 (50.0)	1 (50.0)	
Academic Year	4 th year	63 (59.43)	43 (40.57)	0.00
	5 th year	47 (42.34)	64 (57.66)	
	Intern	15 (17.44)	71 (82.56)	
Medical school attended	King Faisal University	84 (48.28)	90 (51.72)	0.01
	Imam University	41 (31.78)	88 (68.22)	
Attitude towards Teaching in Artificial Intelligence				
		Negative	Positive	
Gender	Male	92 (52.87)	82 (47.13)	0.02
	Female	51 (39.53)	78 (60.47)	
Age	21–25 years	137 (48.24)	147 (51.76)	0.32
	26–30 years	5 (29.41)	12 (70.59)	
	>31 years	1 (50.0)	1 (50.0)	

(Continued)

Table 3 (Continued).

Academic Year	4 th year	55 (51.89)	51 (48.11)	0.18
	5 th year	43 (38.74)	68 (61.26)	
	Intern	45 (52.33)	41 (47.67)	
Medical school attended	King Faisal University	86 (49.43)	88 (50.57)	0.37
	Imam University	57 (44.19)	72 (55.81)	
Confidence in Using basic Artificial intelligence Tools				
		Less	More	
Gender	Male	79 (45.40)	95 (54.60)	0.02
	Female	76 (58.91)	53 (41.09)	
Age	21–25 years	148 (52.11)	136 (47.89)	0.24
	26–30 years	7 (41.18)	10 (58.82)	
	>31 years	0 (0.00)	2 (100.0)	
Academic Year	4 th year	68 (64.15)	38 (35.85)	0.00
	5 th year	68 (61.26)	43 (38.74)	
	Intern	19 (22.09)	67 (77.91)	
Medical school attended	King Faisal University	87 (50.0)	87 (50.0)	0.64
	Imam University	68 (52.71)	61 (47.29)	

Note: $p < 0.05$.

their male counterparts (47.13%). Table 3 demonstrates how confidence in using basic healthcare artificial intelligence tools can differ depending on different baseline variables. Gender and academic year significantly differed in the proportion of confidence in using basic healthcare artificial intelligence tools. Male participants (54.60%) had the highest proportion of confidence in using basic healthcare artificial intelligence tools compared with female participants (41.09%). Moreover, the intern students (77.91%) reported more confidence in using basic healthcare artificial intelligence tools than the fifth-year (38.74%) and fourth-year (35.85%) students.

Table 4 shows the impact of AI training in artificial intelligence on attitude, understanding, attitude towards teaching in artificial intelligence, and confidence in using artificial intelligence tools. Of 303 medical students, only 42 (13.86%) received some form of training on artificial intelligence. Significant differences were observed in the scores for understanding AI, attitudes towards teaching AI, and confidence in using basic healthcare artificial intelligence tools. Regarding the understanding of artificial intelligence, the results clearly indicated that participants who received training in artificial intelligence reported a better understanding of artificial intelligence ($p = 0.03$) than those who did not receive any training in artificial intelligence. In terms of attitudes towards teaching in AI, the surveyed respondents reported that training in artificial intelligence developed a positive attitude towards teaching in artificial intelligence ($p = 0.05$). Similarly, the participants who received some form of training in artificial intelligence showed more confidence in using basic healthcare artificial intelligence tools than those who did not receive any form of AI training in artificial intelligence ($p = 0.05$).

Discussion

This study aimed to investigate undergraduate medical student's views on AI, assess their understanding, and explore their confidence levels for using basic artificial intelligence tools in the future. There is currently a dearth of research on

Table 4 Impact of Training in Artificial Intelligence on Attitude, Understanding, Attitude Towards Teaching and Confidence in Using Basic Healthcare Artificial Intelligence Tools Among Medical Students

Received Training in Artificial Intelligence			
	No	Yes	P value
Attitude towards AI	N (%)	N (%)	
Negative	95 (36.40)	16 (38.09)	0.83
Positive	166 (63.60)	26 (61.90)	
Understanding of AI			
Poor	114 (43.68)	11 (26.19)	0.03
Better	147 (56.32)	31 (73.80)	
Attitude towards Teaching in AI			
Negative	129 (49.42)	14 (33.33)	0.05
Positive	132 (50.58)	28 (66.67)	
Confidence in using AI			
Less	139 (53.26)	16 (38.10)	0.05
More	122 (46.74)	26 (61.90)	

Note: $p < 0.05$.

Saudi undergraduate medical student's attitudes, understanding, and confidence in using AI tools in healthcare; however, many studies have reported that practicing artificial intelligence is important among healthcare providers.^{24–32} This piece of work could improve attitudes, understanding, and confidence in using artificial intelligence in the medical fraternity and enable more advanced delivery to patients in Saudi Arabian communities and clinical settings. This study also serves as a reliable source for future research.

The results of the study showed that the majority (87.12%) of respondents believed that AI would play an important role in healthcare. This is consistent with the findings of a study conducted in Saudi Arabia²⁰ United Kingdom,²³ Malaysia,³³ Jordan³⁴ where 88%, 87.36%, 83.3%, 89% respectively, of respondents acknowledged the essential role of artificial intelligence in the field of medicine. Another study demonstrated that 84.4% medical students and health professionals believed that AI is important in medical care.²¹

Approximately, 42% of participants believed that they were less likely to consider a career in radiology due to the perceived success of artificial intelligence, which is slightly higher than the percentage reported by Tung and Dong's (2023) study on Malaysian medical students (32.55%).³³ Another study conducted by Gong et al, reported that one-sixth of the participants were less interested in radiology because of the influence of artificial intelligence. This Canadian study observed that medical students were more worried about the potential impact of AI on workforce demand.³⁵ In our sample, 45.87% of participants reported that some specialties would be replaced by artificial intelligence. These findings corroborate the study conducted by Sit et al (2020), which found that nearly half of the medical students believed that certain specialties would be replaced by AI.²³ According to Zhang et al, healthcare professionals believed that AI would eventually replace humans in some tasks and these professionals were worried about losing their job due to AI.³⁶ Another study found that implementing artificial intelligence in healthcare could reduce the workforce in medical specialties.³⁷

This study also sheds light on the understanding of artificial intelligence among Saudi undergraduate medical students, which is an important aspect in considering the impact of artificial intelligence on the healthcare sector. This study explored medical student's understanding and knowledge of artificial intelligence. Three domains were identified as

important in understanding the basics of artificial intelligence: fundamental comprehension of AI principles, basic understanding of related terminology, and the current limitations of artificial intelligence. The results of this research revealed that 38% of respondents understood the basic computational principle of artificial intelligence, which is lower than the figure reported in Sit et al's study on UK medical students.²³ and Buabbas et al's study of Kuwait medical students,³⁸ and slightly higher than the number reported in Pinto dos Santo's (2019) study on German medical students.¹⁵ Moreover, a Canadian study reported that the majority of medical students had a good understanding of artificial intelligence; however, the same study objectively measured students' understanding of AI using true/false questions that included AI facts and fallacies, and concluded that a noticeably smaller percentage usually understood it.³⁵ Fewer than half of the participants stated that they were unfamiliar with the terminology related to artificial intelligence, which could explain the uncertainty associated with working with artificial intelligence.²³ It is not surprising that the majority of students in the current study believed that teaching in artificial intelligence would be beneficial to their careers. This result is consistent with the findings of previous studies.^{15,23} Furthermore, the findings of the present study demonstrated that Saudi medical students have a passion to receive training in artificial intelligence. More than half of the participants agreed that all medical students should receive training in artificial intelligence as part of their medical degree. This finding aligns with the results from Germany, UK, and Kuwait medical students, where students believed that learning or training in artificial intelligence should be part of the medical programme.^{15,23,38} Our study found that the majority of the participants reported that they were not confident in using artificial intelligence tools at the end of their medical degree, and almost the same number of students believed that they would not have better mastery of the methods used to assess healthcare artificial intelligence algorithm performance at the end of their medical degree. The results of this study are similar to those of previous studies investigating attitudes and perceptions among medical students.²³

Based on demographic factors, the findings of this study provide insight into medical students' attitudes, understanding, and confidence regarding AI. The results revealed that gender, age, academic year, and medical school attended significantly differed in the proportion of positive attitudes, with males, intern students, those aged 26–30 years, and students enrolled in Imam Abdulrahman Bin Faisal University having higher attitude scores than others. These results are in line with those of previous studies examining attitudes towards artificial intelligence based on gender, qualification, and age.^{31,39} A good understanding was observed among intern students and students enrolled in Imam Abdulrahman Bin Faisal University. In contrast, a study conducted in Syria reported that fifth-year medical students had excellent knowledge.³⁹ It is necessary to understand medical students' confidence in using basic healthcare artificial intelligence tools. Gender and academic year significantly differed in the proportion with more confidence in using basic healthcare artificial intelligence tools, where male students and intern students were more confident in using basic healthcare artificial intelligence tools. This is similar to the study by Sit et al which demonstrated that a large proportion of students in the taught group reported a lack of confidence and understanding needed for the use of basic artificial intelligence tools in the future.²³

Interestingly, our study found a great impact of training in artificial intelligence on understanding, attitude towards teaching in artificial intelligence, and confidence in using basic artificial intelligence tools in the future. However, the results of our study revealed that only a small number of students had received some form of training in artificial intelligence. The logical reason for most students not receiving training or teaching in AI could be that artificial intelligence programs are not available in most medical colleges in the Kingdom of Saudi Arabia. This demonstrates that academic institutions lack a formal source of artificial intelligence instruction, thus emphasizing the necessity of integrating AI concepts into the medical curriculum. The present study revealed that medical students who received training in artificial intelligence reported better understanding, showed higher attitudes towards teaching, and were more confident in using basic healthcare artificial intelligence tools in the future. Previous findings reported that students who were exposed to artificial intelligence were more confident in understanding the basic principles of AI and had a tendency to use artificial intelligence in clinical practices.^{17,23,33,38}

This study had certain limitations. First, this research is subject to selection bias, as the respondents were recruited from medical colleges in the Eastern Governorate of Saudi Arabia. Therefore, the generalizability of this study needs to be carefully discussed. Second, the data were obtained using self-reported measures that might have suffered from reporting bias, as students might have exaggerated their answers with respect to their understanding of artificial intelligence. Therefore, we recommend that future researchers include objective evaluations using true/

false questions. Third, the study included only clinical-year medical students, and the results might not be generalizable to medical students studying in other medical colleges or to medical students in preclinical years. Finally, the results of this study are limited in their generalizability as a convenient sampling technique was applied.

Conclusion

This study aimed to evaluate Saudi undergraduate medical students' attitudes towards and understanding of artificial intelligence, and their confidence in using basic AI tools in the future. The results of this study provide a comprehensive overview of the current level of understanding, attitude, and confidence in using AI technology after completing undergraduate courses. The findings of this study indicated that medical students who received training on artificial intelligence reported better understanding, showed higher attitudes towards teaching, and were more confident in using basic healthcare artificial intelligence tools. Therefore, the present study recommends that medical schools in Saudi Arabia start incorporating artificial intelligence teaching and training into undergraduate medical programs, not only to enhance knowledge of AI but also to help students' understanding and confidence in using artificial intelligence tools in healthcare delivery.

Institutional Review Board Statement

This study was conducted in accordance with the Declaration of Helsinki and approved by the Deanship of Scientific Research King Faisal University, Saudi Arabia. (KFU-REC-2023-SEP-ETHICS1351)

Data Sharing Statement

Data that support our findings can be found by directly asking the corresponding author.

Informed Consent Statement

Informed consent was obtained from all of the participants involved in the study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas, took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; agreed on the journal to which the article was submitted; and agreed to be accountable for all aspects of the work.

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Disclosure

The authors declare no conflicts of interest in this work.

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