



Artificial Intelligence (AI) Integration in Medical Education: A Pan-India Cross-Sectional Observation of Acceptance and Understanding Among Students

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Abstract

Background/Aim: From accurate diagnostics to personalised treatment plans, artificial intelligence (AI) has the potential to revolutionise healthcare. The abundance of medical data has led to AI being employed for accurate diagnoses, treatment protocols and patient care. Students' perception of AI integration in medical education is crucial for its successful implementation. This study aimed to assess the acceptance and understanding of AI integration among students in medical education across different regions of India through a cross-sectional observation.

Methods: A pan-India survey was conducted among medical students between 1 August 2023 to 20 August 2023 with a pre-validated questionnaire covering AI awareness and understanding through Google Form, circulated via WhatsApp.

Results: A total of 730 medical students completed the survey of which 58.6 % were males and 41.4 % were females. Most students (80.7 %) knew about AI, but 53.6 % had limited awareness of AI in medicine. Opinions on AI integration was diverse, with 46.8 % in favour. Workshops (45.2 %) and lectures (31.1 %) were preferred learning formats. Students were interested in various AI topics and expect AI to positively impact medicine (45.9 %). Radiology, surgery and general medicine were predicted to be most influenced by AI. Concerns about overreliance on AI (49.2 %) and lack of empathy (43.7 %) were highlighted.

Conclusions: Medical students in India display a keen interest in AI and its integration into medical education. To fully harness AI's potential in healthcare, comprehensive AI curricula and faculty training are needed. Students are aware of the challenges and opportunities, emphasising the importance of balanced AI adoption in medical practice and education.

Key words: Artificial intelligence; Medical education; Survey; pan-India; Medical students; Acceptance.

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Introduction

There is hardly anyone left in society who has never used man-made gadgets and devices, that have made everyday life easier. However, many inventors have tried to create machines with the

intellect of a human brain. Today this is known as artificial intelligence (AI), a term attributed to Sir John McCarthy in the 1950s.¹

In today's world of modern medicine, AI is a life-changing force that drives humans to a new era, from the accuracy of diagnosing patients to personalised treatment plans. AI's integration into practicing medicine has the potential to be a revolutionising force. AI is capable of mimicking mental functions such as recognition of speech, solving problems and strategic reasoning. So, it could transform medicine by performing nearly accurate predictions in various tasks like diagnosing and treating a condition.^{2,3} Presented article delves into the role of AI in college, exploring how it has the potential to revolutionise old-dated learning methods and shape the future of the healthcare education system.

Over time, medical data is becoming increasingly vast and unmanageable for human processing, for this purpose the concept of data feeding into AI has emerged which feeds on the large database and provides us with more accuracy. The greater amount of data leads to increased accuracy when it comes to diagnosis, establishing treatment protocol and providing patient care. AI is improving in assisting physicians to narrow down the probable diagnosis by translating the process of history taking, in which a doctor asks a series of questions and then combines them with symptoms reported, to arrive at a probable diagnosis.³ Some of them are specialised in assessing the symptoms and guiding the patient to better advice on their diagnosis like Buoy Health, which was developed by Harvard medical school.^{4,5} Other platforms like Linus Health focus on the early detection of cognitive function issues through neural pathway analysis.⁶ Radiology has particularly benefited from AI, with improved diagnostic accuracy, faster image analysis and support in differential diagnosis research and data analysis, providing valuable tools for radiologists.^{7,8}

Students should be introduced to AI right from the beginning of their medical education journey to help them become comfortable with its integration into the healthcare and medical education systems, but before that, it must look into the acceptance of AI integration by students as well as their understanding of AI and evaluate what students think in terms of AI integration in the medical healthcare system or if they would appreciate and enjoy learning AI as a part of the formal education. For this purpose, the survey was conducted which allowed to take peek into the perception of students regarding AI in medical education.

For AI to be part of medical education various concerns have arisen, how education would be delivered, what are the topics to be taught, the medium by which they taught, whether is there a need to teach faculty first, is there any technical faculty required, should it be a part of a theory or combined with the practical curriculum.⁹⁻¹¹ Another dimension of concern comes with the ethical issues of AI in healthcare such as privacy and data compromise, informed consent, liability issues, algorithmic fairness and biases, which were main pillars that lead to legal issues.¹² Some of the challenges in medical education include difficulty in creating models, difficulty in assessing the effectiveness of AI and the lack of experienced and knowledgeable content specialists.¹³

Still, many questions are left unanswered but by combining the efforts of AI technology and humans together, which could surpass the issues faced by humans and AI working independently. There is no denying that many institutes have already taken the initiative to integrate AI to train their students in various medical practices.¹⁴ National Yang-Ming Medical University in Taiwan is training interns to do sutures and ligatures via artificial skin which has a monitoring system [WKS-2RII] that assesses the scoring of students' training thus improving their skills.¹⁵

Many administrators and educators, in the field of education are familiar with AI although they may not possess an understanding of its potential applications in medical education or the specific subjects that should be included in their curriculum, for students. Nevertheless, what AI will look like in the field of medical teaching and learning, how it could possibly affect learners and how to best utilise its benefits is still unclear.¹⁶

This study aimed to assess the acceptance and understanding of AI integration among students in medical education across different regions of India through a cross-sectional observation.

Methods

Design

This cross-sectional research study was designed to assess the knowledge of AI among medical college students in India and their attitudes toward integrating AI into the medical curriculum. It

consisted of the following sections: consent, demographic details and a questionnaire consisting of 17 questions that have been pre-validated and tested for accuracy mainly based on topics covering AI awareness and understanding. The study was ethically approved by Swastic Ethics Committee (Decision No ECR/434/Inst./RJ/2013/RR-19, 15 July 2023).

Data collection

A simple random sampling method was used to collect data. Students from different years of study (eg first year, second year, third year and final year) have been considered as strata. Before the main data collection, the questionnaire was pilot-tested on a small group of medical students to identify any ambiguities, inconsistencies or difficulties in comprehension. The feedback from the pilot test has been used to refine the questionnaire.

Table 1: Questionnaire about knowledge and opinions about artificial intelligence

List of questions asked in the survey
1. Do you know what is artificial intelligence?
2. Are you aware of the uses of artificial intelligence in medicine?
3. Where have you learned about artificial intelligence in medicine?
4. Are you familiar with any application(s) currently using artificial intelligence to improve patient care, diagnostic accuracy and treatment planning?
5. Should artificial intelligence be a part of the medical college curriculum?
6. Your preferred format(s) of learning about artificial intelligence in medicine is/are:
7. What is/are the topic(s) in artificial intelligence that you would be most interested in?
8. What is the possible impact of artificial intelligence on medicine in the near future?
9. Which specialties will be most affected by artificial intelligence in the near future?
10. Artificial intelligence in medicine will be helpful as:
a) Supporting physicians in making a clinical diagnosis
b) Supporting physicians in the management protocol
c) Patients diagnosing and treating themselves with the help of artificial intelligence
d) It can improve the cost-effectiveness of medicine
11. Medical students who learn through artificial intelligence have the potential to become better physicians compared to their peers.
12. Possible disadvantage(s) of introducing artificial intelligence in medicine.
13. Possible challenge(s) in introducing artificial intelligence in therapeutics.

The questionnaire (Table 1) has been administered to participants through an online survey platform. The responses have been collected from 1 August 2023 to 20 August 2023. Partici-

pants have been provided with a clear explanation of the study's purpose and procedures and their informed consent has been obtained before participation.

Participant data were anonymised and kept confidential. Only aggregated data has been reported in the final article. The questionnaire was reviewed by a team of medical students and teachers.

Data analysis

The study utilised descriptive statistics like counts and percentages to summarise information that included details about their demographics (like age, gender, etc), understanding and attitude on the topic. To make sure that there were enough participants in the study for the results to be reliable, the following formula was used to figure out the right sample size for an infinite population¹⁷ as mentioned below:

$$S = Z^2 \times P \times (1 - P) / M^2$$

Where: S = sample size for infinite population, Z² score, P-population proportion (assumed as 50 % or 0.5); M-margin of error, given: Z = 1.960, P = 0.5, M = 0.05 (Have taken the confidence level as 95 % and margin of error as 5 %). Thus, the sample size was calculated to be 384.16.

Result

The total number of responses received was n = 758 from the survey, out of which only n = 730 responses were valid responses. The survey was conducted online through a link generated via Google form and circulated all across medical colleges in India (Figure 1).

A 58.6 % of people participating in the survey were males. The majority of students in the study were in the age group 18 – 23 years old. A majority of participants demonstrated familiarity with AI, with 80.7 % acknowledging a fair understanding of AI, while 14.5 % were unsure and 4.8 % had no knowledge (Figure 2).

A 26.3 % of respondents were well-informed about the applications of AI in medicine, 53.6 % had a superficial understanding and the remaining 20.1 % lacked awareness (Figure 3).

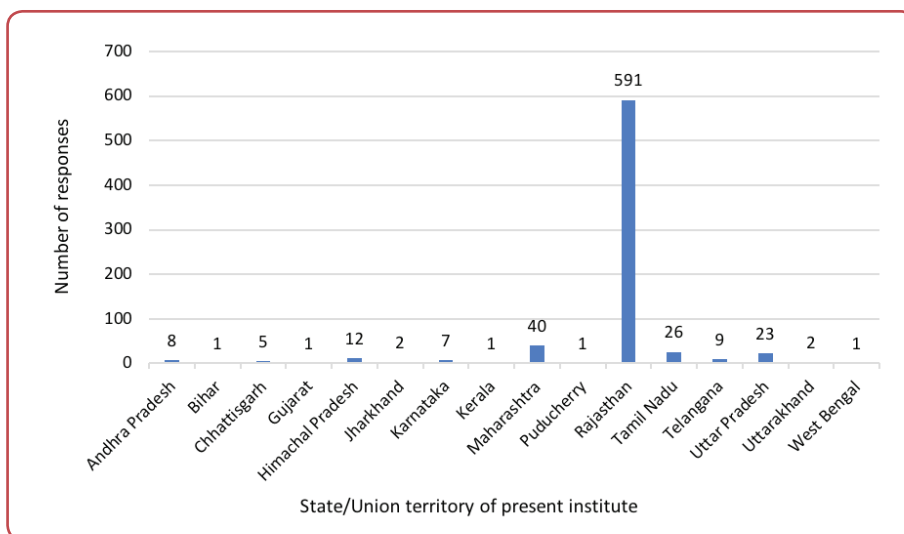


Figure 1: Number of responses from various state/union territory

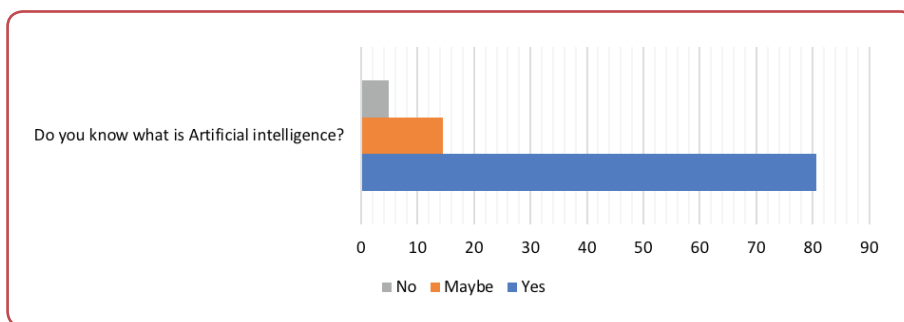


Figure 2: Survey on what is artificial intelligence (AI)

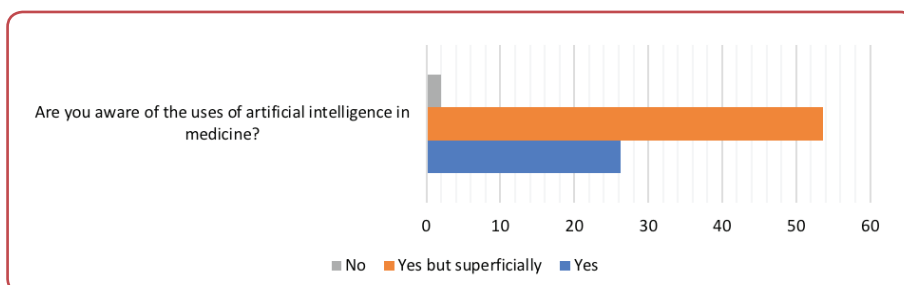


Figure 3: Survey on awareness of uses of artificial intelligence (AI) in medicine

Respondents believed that the main sources of their knowledge about AI in medicine were media (55.8 %), friends (28.1 %) and movies or TV series (34.2 %), which made them familiar with the advancements in newer technologies, while AI education in medical college (15.9 %) and online courses (8.2 %) also contributed to it (Figure 4).

Emerging AI-powered healthcare applications like PharmEasy, HealthifyMe and PathAI were recognised by respondents, highlighting the growing visibility of AI in medical practice (Figure 5).

Opinions were diverse regarding AI integration into medical education, as 46.8 % agreed that AI

should be part of the curriculum, 25.8 % were neutral, 15.9 % strongly agreed and smaller percentages disagreed or strongly disagreed (Figure 6).

Workshops (45.2 %), lectures (31.1 %), online resources (33.7 %) and extracurricular activities (32.1 %) were preferred learning formats for AI in medicine (Figure 7).

Medical students demonstrated a keen interest in various AI topics, including its direct application in medical practice (56.4 %), contributions to medical research (49 %), recent innovations (34.9 %) and potential effects on the roles of physicians (37.7 %).

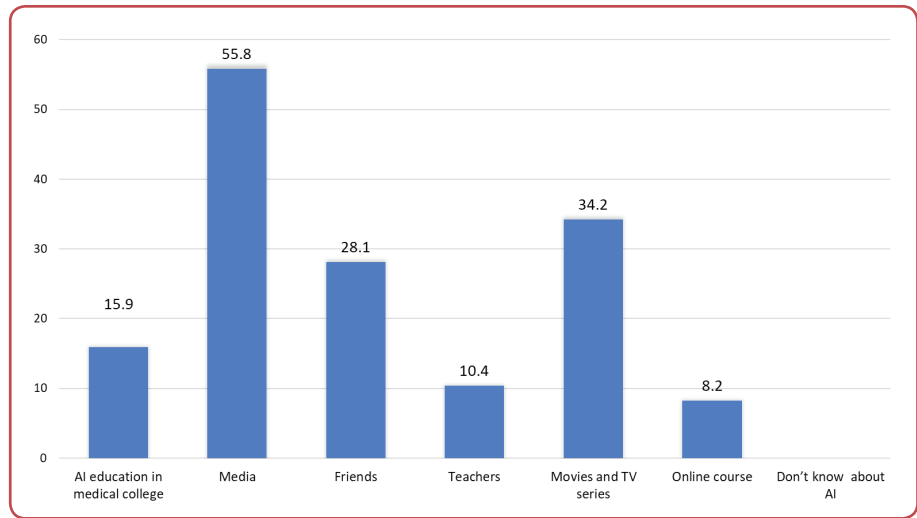


Figure 4: Survey on sources of knowledge about artificial intelligence (AI) in medicine

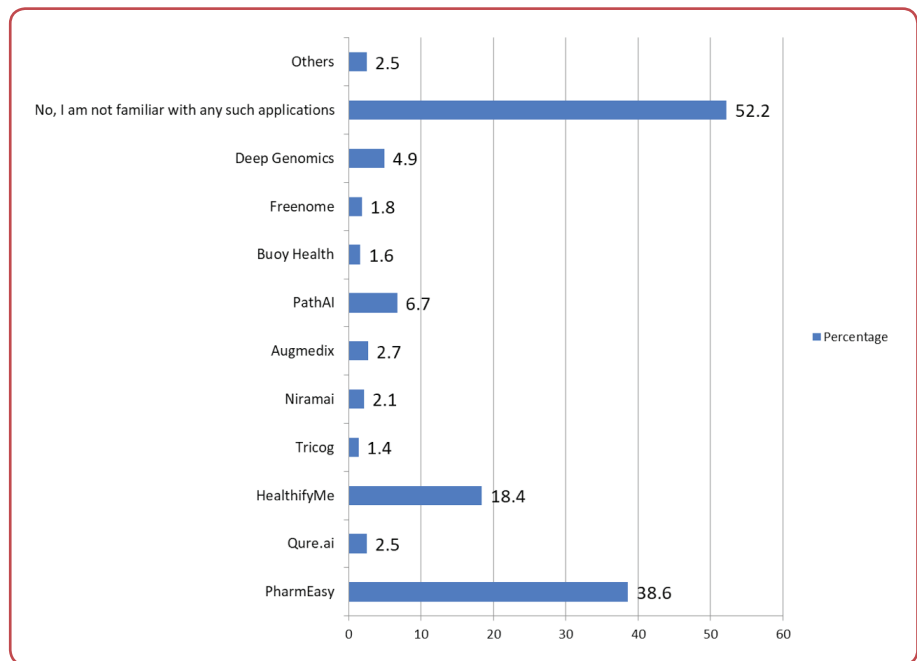


Figure 5: Healthcare applications recognised by respondents

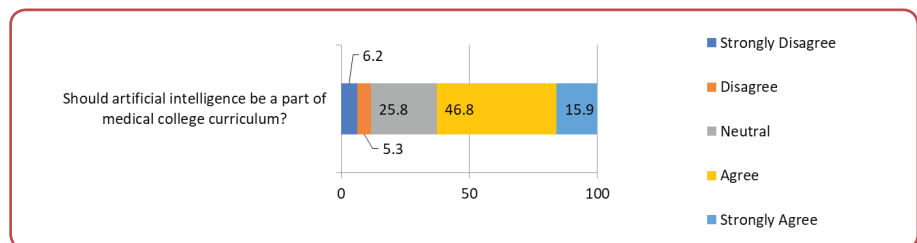


Figure 6: Views on artificial intelligence (AI) as a part of medical curriculum

Challenges to introducing AI in medical colleges encompassed resource availability (56 %), faculty expertise (45.8 %) and potential impact on student's clinical skill development (35.6 %) (Figure 8).

General medicine (42.7 %), surgery (42.5 %) and radiology (39.7 %) (Figure 9) emerged as the top specialties which were projected to be more significantly influenced by AI integration in the near future.

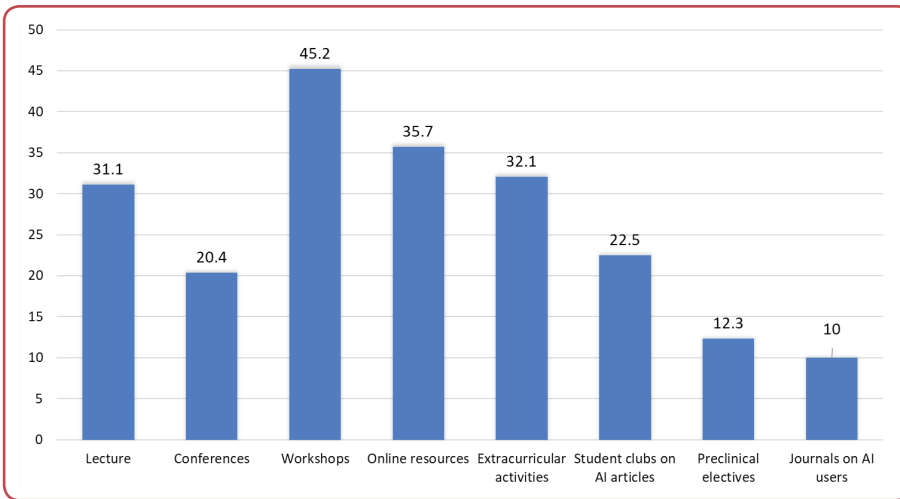


Figure 7: Survey on preferred format of learning about artificial intelligence (AI) in medicine

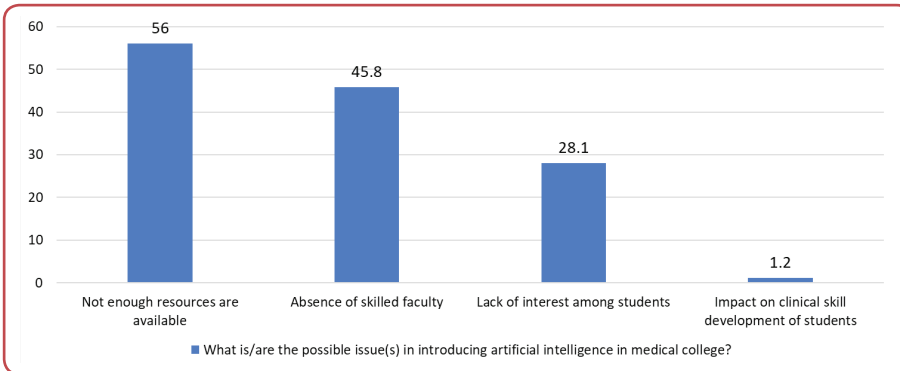


Figure 8: Survey on possible issues in introducing artificial intelligence (AI) in medical college

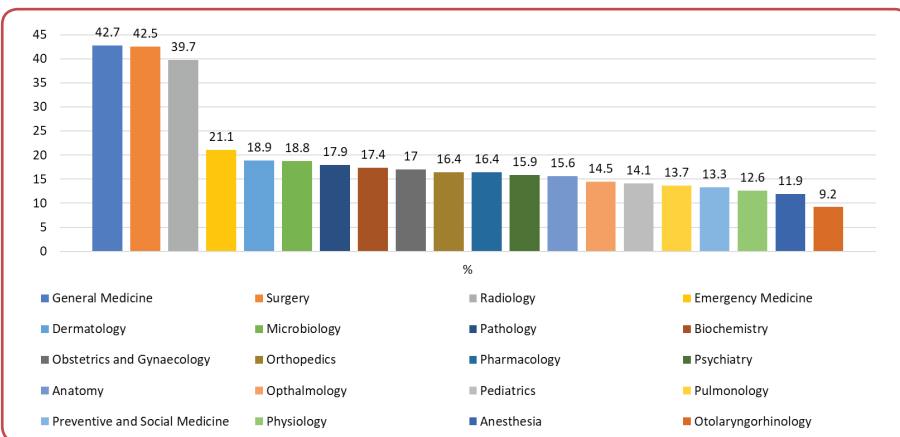


Figure 9: Survey on specialties presumed to be most affected by artificial intelligence (AI) in future

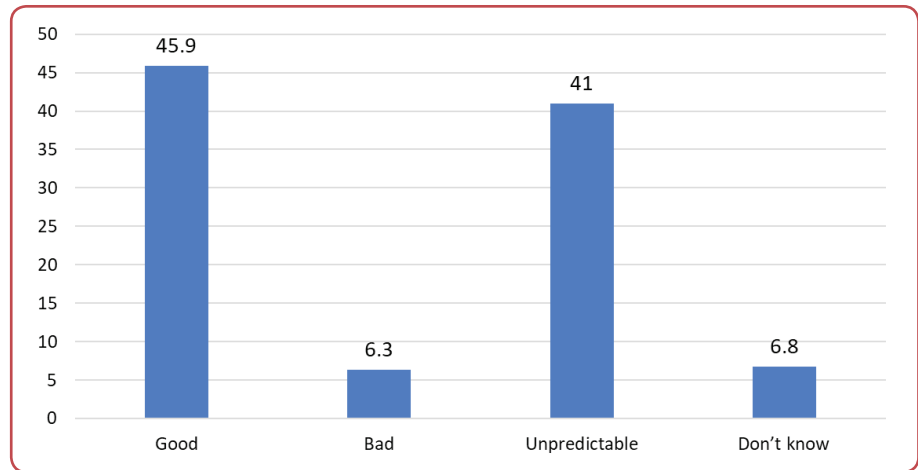


Figure 10: Survey on possible impact of artificial intelligence (AI) on medicine's future

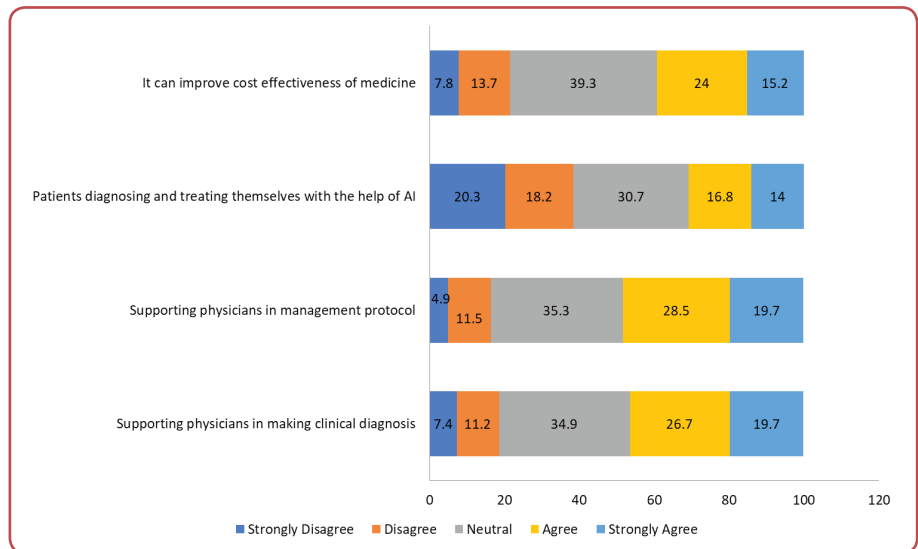


Figure 11: Survey on artificial intelligence (AI)'s potential role in healthcare services

In terms of AI's impact on medicine's future, 45.9 % perceived it as positive, 41 % deemed it unpredictable and smaller proportions viewed it negatively or were uncertain (Figure 10).

Medical students exhibited varying degrees of agreement on AI's roles, such as supporting clinical diagnosis (46.1 % agreement), aiding in management protocols (48.2 % agreement), potential for patient self-diagnosis and treatment (30.8 % agreement) and improving cost-effectiveness (39.3 % agreement) (Figure 11).

Respondents highlighted potential drawbacks to AI integration of which overreliance on AI (49.2 %) was the number one drawback followed by a perceived lack of empathy (43.7 %) and concerns about patient privacy (37 %). Regarding AI in therapeutics, respondents emphasised challenges such as resource scarcity (44.9 %), physicians' insufficient knowledge (37.5 %), high implementation costs (54 %) and the need for high-quality data (48.2 %).

Discussion

The result of this study is in line with previous studies. The majority of students in the study are familiar with AI. A 53.6 % of respondents demonstrated only a limited understanding of AI's applications in medicine, which is quite close to 51.6 % in a study done by Pucchio et al.¹⁸ Contrarily, in a study done by McLennan et al¹⁹ 64.3% of participants expressed that they did not feel adequately informed about AI. This unfamiliarity is mainly due to a lack of education, awareness and interest among students. Even teachers are not well equipped with the knowledge of AI applications. Thus, it is important to prioritise training for teachers first so they can effectively convey the knowledge to the students.

In the study, 62.7 % of respondents agreed with the integration of AI in medical curricula and acknowledge its potential to revolutionise medicine in the near future. However, in studies conducted by Pucchio et al¹⁸ and Ejaz et al,²⁰ higher percentages of 78 % and 92 %, respectively, shared this perspective.

A study by Ejaz et al²⁰ found radiology among the top specialties thought to be most affected by AI in the near future while in a study done in Georgia¹¹ also highlighted medical genetics along with radiology. However, medical students in this survey believe medicine, surgery and radiology will be most affected by AI.

Traditional healthcare methods have numerous advantages, particularly in terms of their interactive nature. However, access to healthcare services is unevenly distributed across the country, mainly affecting the rural areas. And there are many services that are not accessed by the whole population due to the high cost of treatment which is not affordable to the patients of low to lower-middle-class families. In this study, it was found that AI's assistance in clinical diagnoses yielded an agreement rate of 46.4 %, whereas the study conducted by McLennan et al¹⁹ reported a higher agreement rate of 62.6 %. Likewise, in terms of supporting physicians in the development of management protocols, presented study

showed an agreement rate of 48.2 %, while McLennan et al¹⁹ observed a slightly higher agreement rate of 54.4 %.

German and Canadian studies have also revealed that AI will improve the cost-effectiveness of medicine. In this survey, 39.2 % of students agreed to it and a substantial proportion remained neutral as they could not judge because of lack of knowledge about the matter.

A study conducted by Gong et al²¹ and Sit et al²² showed participants' concern about the replacement of radiologists by AI in the future, thus causing anxiety in medical students considering radiology specialties. But in contrast, this study showed that students are not concerned about the replacement of physicians by AI which is also observed in other studies by Pucchio et al¹⁸ and Ejaz et al.²⁰ What if the physicians lose touch with the use of excessive technologies or what if they over-rely on AI for their work, these are the critical questions along with the ethical issues that arise in the minds of students. These questions can only be answered with time as doctors start to work with AI. But for now, AI is being used for better purposes in the healthcare sector like robots in surgery, apps in medicine, electronic health records in hospitals, etc.

Many challenges have been observed that lie ahead but most medical professionals agree that AI promises a good impact in every field of our healthcare system. However, the widening knowledge gap could potentially hinder the effective utilisation of AI in the field of medicine which is why a well-organised AI curriculum should be planned in colleges that can equip all medical students with the knowledge needed to use these techniques competently to fully harness the potential of advancing technologies as shown in an article by Ötleş et al.²³ So far students have gained information through their peers, media or research papers. Therefore, the inclusion of a formal medical curriculum becomes necessary to enhance their comprehension and proficiency in this field.

Limitations

This survey only included the medical students, potentially excluding opinions from other healthcare professionals or educators, thus creating sampling bias. The survey was conducted online through Google Forms, which may introduce selection bias ie, people having easier access to the internet could have responded in large quantities. The form was delivered to nearly all states of the country but the students of only a few states responded to the survey which may not be sufficient to consider the opinion of the students of all medical colleges in the country. It is possible that only the students who were interested in the topic were the only ones participating in the survey. The survey was conducted in the English language, which may have limited the access to students who understand English potentially excluding non-English speakers.

Conclusion

The survey was designed to determine the level of interest among medical students regarding AI. This study revealed that students have a genuine interest in acquiring knowledge about AI and emerging technologies, as well as a strong inclination toward incorporating AI into their future medical careers. This signifies a positive outlook among students when it comes to integrating AI within the medical field. As AI keeps changing the way healthcare works, it is necessary to ensure that students are ready for these changes and can use AI effectively in their medical careers. To do this, it is important to make sure that students learn about AI properly. To create an awareness of AI and newer technologies, there is a demand for improvement in the current medical curriculum by introducing certain courses during their medical journey. Moreover, findings from this survey indicate that students are not only open to the benefits of AI but are also aware of the potential challenges and risks associated with its implementation. This perspective reflects a balanced understanding of the technology, acknowledging both its advantages and the need for caution.

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Conflict of interest

None.

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