

Original Research Article

Are future doctors ready for AI? Artificial intelligence in the field of medicine: perception among medical students in North Karnataka: a cross-sectional study

Shamin Eabenson, M. R. Gudadinni*, M. C. Yadavannavar, Rekha Udgiri, A. M. Rangoli

Department of Community Medicine, BLDE (DU) Shri B. M. Patil Medical College Hospital and Research Centre, Vijayapura, Karnataka, India

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*Correspondence:

Dr. M. R. Gudadinni,

E-mail: drshamin123@gmail.com

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ABSTRACT

Background: Artificial intelligence has revolutionised the world in a short span of time and it has taken the world by storm. Truly a game changer technology than has the ability to transform healthcare sector. Medical students have to be masters in adapting new age technologies to be relevant in this fast-evolving world of healthcare.

Methods: This is a cross-sectional study which enrolled 195 medical students from North Karnataka, India. This study assessed the knowledge, attitudes and practices regarding artificial intelligence in the field of medicine among medical students. Statistical calculations were done and the results were analysed.

Results: In the study 153 (75%) belonged to the age group of 19 to 21 years. Based on gender the majority were females, 119 (61%). Artificial intelligence would improve medical training as opined by the majority 163 (83.5%). Most thought that AI will facilitate information gathering from patients, which accounts to 135 (69.2%). About two third of the participants 132 (67.6%) had never encountered AI tools in their theoretical training. The majority 143 (73.3%) believed that doctors should receive specific training regarding the ethical challenges of AI in healthcare.

Conclusions: Artificial intelligence must be introduced into medical curriculum to transform future doctors into smart doctors who use technology to serve the healthcare need of patients from rural and urban backgrounds. AI can solve the access to healthcare issues, if telemedicine and artificial intelligence tools to augment the skills of doctors are fused together.

Keywords: Artificial intelligence, Medical students, AI, Medical education

INTRODUCTION

Alan Turnings' 1950 work "Computing machinery and intelligence" is credited with giving rise to the idea of artificial intelligence. Later during a two-month workshop in 1955, John McCarthy OF Dartmouth University and his associates formally advanced the idea of AI. Artificial intelligence has been widely applied in domains such as radiology, robotic surgery, cardiology and oncology. The use of food delivery, security, smartphones, wearables and health apps are a few areas of our lives that has been

transformed by AI. Significant strides in robotics and imaging through the use of AI are noteworthy in the healthcare sector.¹

Previous research indicates that medical students view artificial intelligence favorably. They are eager to integrate it into curriculum and educational system, highlighting the importance and use of AI for medical students. Previous research indicates that doctors will use AI more objectively and comprehend it better in the future. In the upcoming years, AI will do a lot of the work

that doctors do, and healthcare services will be delivered more quickly. Therefore, new learning requirements should be taken into account to alter doctors' professional identities in a way that will enable them to participate in emerging technologies and enhance students understanding of clinical issues.²

Oncology is another area where AI plays a significant role in prognosis prediction. In a recent study two groups of colon cancer patients were classified by DNA mismatch repair status and tumour morphology was measured using deep learning algorithms. Risk classification and cancer recurrence prediction were made easier by the study's correlation of these morphological characteristics with clinical outcomes.³

Adoption of AI in healthcare confronts significant obstacles despite its advantages. These include underrepresentation of rare or varied populations in training datasets, lack of algorithmic openness, and data privacy. Unauthorized data gathering, re-identification of anonymized data, and breaches revealing sensitive information can all jeopardize data privacy and confidentiality in the absence of adequate safeguards. Another ethical concern is data bias. AI models that are predominantly trained on a particular population or illness types may not be generalizable in diagnosis and treatment. These restrictions show how important it is to have inclusive and internationally representative data systems.³

Traditional medical education tools have not kept up with advances in the profession, the current medical students, residents and physicians do not have expertise in emerging technologies like artificial intelligence. Some physicians are reluctant to use AI in healthcare, perhaps as a result of deficiency of formal training in this field.⁴

By examining the perception of AI among the medical students of a tertiary healthcare centre in Vijayapura, Karnataka, India, this study seeks to highlight the need for more research in the field of artificial intelligence especially in North Karnataka.⁵ AI applications in the medical industry has grown significantly in recent years. The global AI in healthcare sector was anticipated to be worth \$14.4 billion in the year 2023 and is projected to increase at a compound annual growth rate (CAGR) of around 39.2% between 2024 and 2032, according to Frost & Sullivan.⁶ The need for multidisciplinary research is highlighted by the fact that a recent study carried out in Saudi Arabia found that medical students had a favourable sentiment regarding AI education, despite the study's narrow focus, this calls for multidisciplinary research in this field.⁷

Globally the use of AI in medical education is growing, especially in developed countries where organizations like Emory University, University of Toronto, and European programs like ESMPE provide courses and cutting-edge experience that develop both technical

proficiency and ethical awareness.⁸ The ability of machines to mimic human intellect by displaying characteristics like comprehension, logical reasoning, and problem-solving skills is known as AI.⁹

Focus groups on artificial intelligence for health (FG-AI4H) was created in 2018 by WHO to address challenges surrounding AI in healthcare. In 2023 (WHO) World Health Organisation. (ITU) International telecommunications union and World intellectual property organisation (WIPO) established the global initiative on AI for Health.¹⁰

The study aims to assess the perceptions regarding Artificial Intelligence in the field of Medicine among Medical students in a tertiary healthcare institution in North Karnataka, India. Gap in existing knowledge regarding this subject warrants this study.

METHODS

Study design

Cross sectional study was done among medical students.

Study place

This study was conducted among Medical Students in BLDE (DU) Shri B. M. Patil Medical College and Hospital, Vijayapura district, Karnataka state, India.

Study period

The study was conducted for a period of 3 months from July 2024 to September 2024.

Sample size

The sample size was determined based on a study by Perrier et al with anticipated proportion of knowledge about Artificial intelligence 90%, considering 95 % confidence interval and 5% absolute precision.¹¹ The sample size obtained was 195 participants. Students were selected using systematic sampling technique.

Inclusion criteria

Medical students who were willing to participate were enrolled in this study.

Exclusion criteria

Medical students who were not willing to participate were excluded from the study.

Ethical approval

The study was approved by the Institutional Ethics Committee of BLDE (DU) Shri B M Patil Medical

College and Research Centre, Vijayapura, Karnataka, with reference No. BLDE(DU)/IEC/1108/2024-25

Data collection

Data was collected using a self-administered, semi structured questionnaire, which assessed the knowledge, attitude and practice regarding artificial intelligence in the field of medicine among medical students and the questionnaire was distributed as a Google form. Authors collected data from 195 medical students and the students were selected using systematic sampling technique. Before commencing data collection, the participants were briefed regarding the purpose of the study, objectives, benefits and an informed verbal consent was obtained from each participant who volunteered to be part of this study.

Data analysis

The data was represented using numbers, percentages and chi square tests. The results were presented in tabular form and in figures for clarity and ease of representation. Statistical package for the social sciences (IBM SPSS Statistics for Windows, IBM Corp, Version 26.0) was used in this study for data analysis.

RESULTS

The sociodemographic characteristics of the study participants were analysed and the following results were noted. There were 195 medical students who were part of this study. Of the 195 students, 153 (75%) belonged to 19 to 21 years and 42 (21.5%) belonged to 22 to 24 years. Based on gender there were a majority of females, 119 (61%) and 76 male (39%). There was 167 (85.6%) who came from rural areas, whereas 28 (14.4%) of the participants hailed from urban areas. Religious categorization revealed that the majority 179 (91.8%) were Hindus, followed by Muslims 11 (5.6%), Christians 3 (1.5%) and 2 (1%) belonged to other faiths.

The total family income per annum of the medical students were assessed and we found out that the majority had a per capita income of 1 lakh to 10 lakh rupees, 11 (56.9%) and 39 (20%) had an income between 10 lakhs to 25 lakhs per annum. This was followed by 30 participants (15.4%) had a family income of less than 1 lakh. Just 7.7% (15) had a family income above 25 lakh rupees (Table 1).

The knowledge of the medical students about artificial intelligence was analysed and we came up with the following results. When enquired if they thought that artificial intelligence would improve medical training, an overwhelming majority 163 (83.5%) responded in the affirmative, while 21 (10.7%) were neutral and 11 (5.6%) thought otherwise. The majority thought that AI will facilitate information gathering from patients, which accounts to 135 (69.2%), while 29 (14.8%) did not

subscribe to this view and 11 (5.6%) had a neutral view on this subject. When the question that if they thought that AI would help analyse patients' medical data to come up with potential diagnosis, three fourth of the study population 147 (75.3%) said a resounding yes, while 34 (17.4%) was neutral and 14 (7.1%) did not think so.

When asked if they thought that AI would help in improving healthcare access, particularly where experts are not present, 131 (67.1%) opined that AI would indeed improve healthcare access, while 35 (17.9%) were neutral and 29 (14.8%) thought that AI will not improve access to healthcare.

More than half of the respondents, 114 (58.4%) students opined that AI will improve patient compliance with treatment and follow up, whereas 45 (23.07%) had a neutral view and 36 (18.46%) were opposed to this idea. 143 (73.3%) believed that AI will help analyse patient medical records to assess prognosis, whereas 31(15.9%) had a neutral view and 21 (10.7%) did not think so. Most of the medical students 132 (67.1%) believed that AI will help analyse patient medical data to offer the most appropriate treatment.

Some 45 (23.07%) medical students maintained a neutral view and 18 (9.2%) opposed the majorities view. When asked for their opinion if AI will revolutionize medicine, 130 (66%) subscribed to that view, while 47 (24.1%) chose to be neutral and 18 (9.2%) did not subscribe to that view. 118 (60.5%) were in favour of implementing AI tools in their specialties or future specialties, while 45 (23.07%) chose to be neutral and 32 (16.4%) did not think AI tools should be implemented (Figure 1).

Attitude of medical students towards AI was assessed in detail and we found the following results. When the medical students were asked if they feared regulatory framework for AI use in healthcare, half of the participants 107 (54.8%), said yes, while one fourth 48 (24.6%) choose to be neutral, while 40 (20.51%) said no. Around 126 (64.1%) medical students were afraid that AI might threaten patient data security, an equal number 35 (17.9%) were neutral while 34 (17.4%) did not feel that AI would threaten patient security.

More than half of the study participants 111 (56.9%) saw AI as a threat to human dimension of medicine, while 37 (18.97%) had a neutral view and 47 (24.1%) didn't see AI as a threat to human dimension of medicine. About 82 (42.1%) were fearful to lose their job because of AI, while 36 (18.4%) had a neutral view and 77 (39.4%) were fearless of losing their job on account of AI.

When enquired if the medical students were afraid that doctors would lose some of their skills if AI was implemented in their work flow, more than half 116 (59.4%) replied in the affirmative, while 44 (22.5%) said no and 35 (17.9%) maintained a neutral opinion (Figure 2).

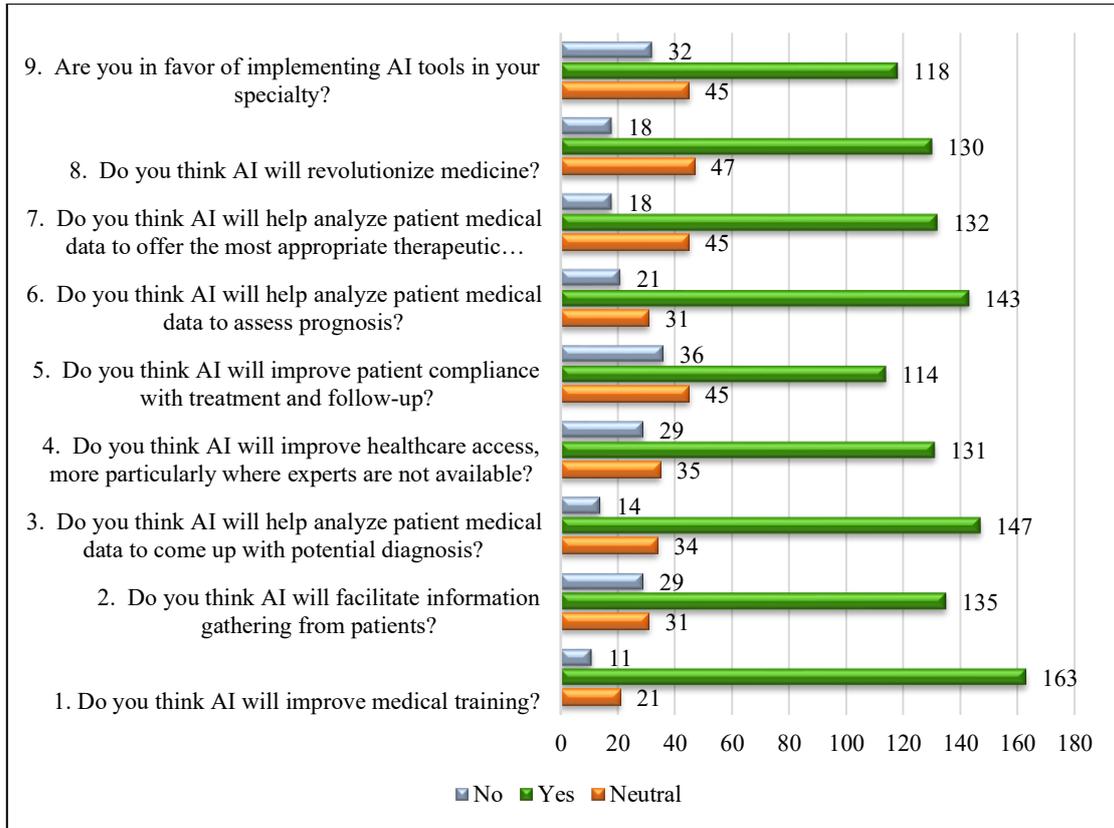


Figure 1: Knowledge about Artificial Intelligence.

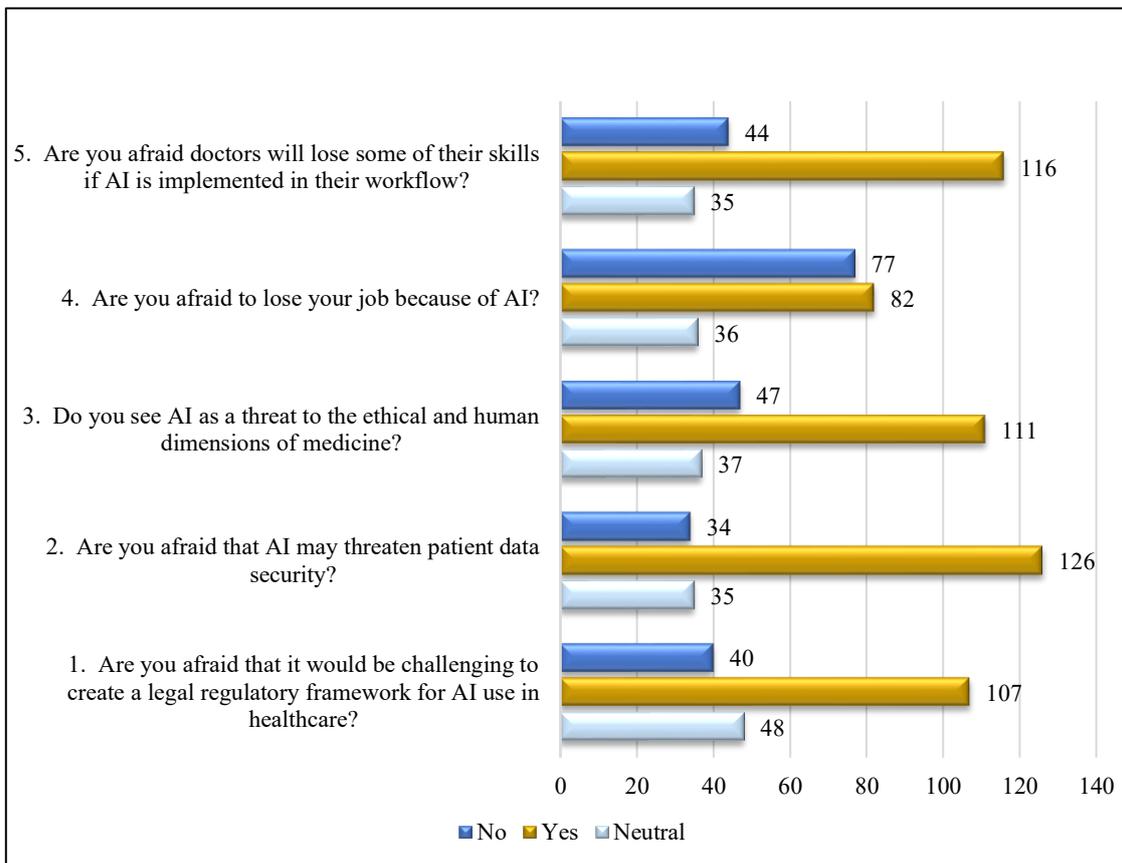


Figure 2: Attitude towards Artificial Intelligence.

This study focused on the practice aspects regarding AI. Three fourths of the medical students 146 (74.87%) were never offered training in AI, while one fourth 49 (25.1%) were offered specific training in AI. About two third of the participants 132 (67.6%) had never come across AI tools in their training, while 63 (32.3%) encountered AI tools in their theoretical training. Only 73 (37.4%) medical students were using AI through specific or nonspecific training. While 122 (62.5%) did not ever receive similar training. Only 57 (29.2%) had ever

encountered AI tools in their medical practice, whereas 138 (70.7%) had prior initiation with AI tools in their medical career. Around 141 (72.1%) medical students were of the opinion that doctors should receive training on the use of AI tools in healthcare, 41 (21.02%) had a neutral view and 13 (6.6%) did not think that specific training was needed. The vast majority 143 (73.3%) believed that doctors should receive training regarding the societal and ethical challenges of AI in healthcare (Table 2).

Table 1: Sociodemographic characteristics of the participants (n=195).

Demographic variables	No. of students	%
Age (in years)		
19-21	153	78.5
22-24	42	21.5
Gender		
Female	119	61
Male	76	39
Residence		
Rural	28	14.4
Urban	167	85.6
Religion		
Christian	3	1.5
Hindu	179	91.8
Muslim	11	5.6
Others	2	1
Course		
MBBS 1st year	39	20
MBBS 2nd year	40	20.5
MBBS 3rd year	38	19.5
MBBS 4th year	37	19
Interns	41	21
Total family income per annum		
< 1 lakh	30	15.4
> 25 lakh	15	7.7
1 Lakh-<10 lakh	111	56.9
10 Lakh-<25 lakh	39	20

Table 2: Practice regarding Artificial Intelligence.

Practice regarding AI			
Question	No	Yes	Neutral
Were you ever offered specific training in AI during medical school?	146	49	0
Have you ever encountered AI tools in your theoretical training?	132	63	0
Have you ever been in contact with AI through specific or non-specific training?	122	73	0
Have you ever encountered AI tools in your medical practice?	138	57	0
Do you think that doctors should receive specific training on the use of AI tools in healthcare?	13	141	41
Do you think that doctors should receive specific training regarding the societal and ethical challenges of AI in healthcare?	13	143	39

DISCUSSION

In the study of the 195 students, 153 (75%) belonged to of 19 to 21 years. Based on gender there were a majority of females, 119 (61%) and 76 male (39%). In a similar study done among medical students in Syria by Hanifa et al there were 564 participants, majority of the participants were male (57.6%), 20-year-old (20.6%) and enrolled in the basic academic years (53.3%).¹² In a study done by Ziapour et al on the 800 first to fifth year medical students who took part in the study 449 (56.13%) were males and 351 (43.88%) were females.² In a study done by AlZaabi et al the questionnaire was completed by 84 out of 115 students (73.04%) response rate. Of these 39 (46.43%) were men and 45 (53.57%) were women.⁴ In the study, when enquired if they thought that artificial intelligence would improve medical training, an overwhelming majority 163 (83.5%) responded in the affirmative. The majority thought that AI will facilitate information gathering from patients, which accounts to 135 (69.2%). AI would help analyse patients' medical data to come up with potential diagnosis, three fourth of the study population 147 (75.3%) said a resounding yes. 67.1% opined that AI would indeed improve healthcare access. About two third of the participants 132 (67.6%) had never encountered AI tools in their theoretical training. The vast majority 143 (73.3%) believed that doctors should receive specific training regarding the societal and ethical challenges of AI in healthcare.

A South Korean study by Kim et al shows that practical and clinical AI applications are highly valued by both instructors and students. In particular they prioritized practical use cases and interpretation abilities over technological advancements, which reflect the necessity of a practical application focused approach to medical AI education.¹³ A study by Syeda et al findings showed a reasonable level of AI expertise with notable variations among disciplines. 11.8% of the students had received official AI training, despite the fact that the majority (77%) attended seminars about AI. 73.6 % of respondents said that AI could help with patient documentation and 68.7% supported the use in choosing medical interventions. The influence of AI on employment displacement, ethical issues and viability in underdeveloped nations was brought up. 82.2% favoured AI training as a component of medical school. 78.8% supported AI incorporation into medical curriculum.¹⁴ A study conducted in Egypt by Ghanem et al revealed that of the total number of students almost two thirds (61.5%) had enough knowledge of generative AI and 44.7% had an opposite view. Compared to women, men showed noticeably more expertise.¹⁵

In a study done by Gopidesi et al in rural Andhra Pradesh in India among 210 medical students, 84.5% (169/210) of the survey participants used at least one AI tool in medical research. According to the findings. Approximately 61.4% of research participants were well informed on the use of AI techniques in medical research.

It was shown that 93.8% of the research participants had a favourable opinion of the application of AI tools in the medical field. Only four AI tools were utilized by 89.5% of them, with powerpoint presentation preparation being the most popular use (34%). In descending order, the most popular AI tools were ChatGPT, Open AI, Meta AI, Snap AI, and Google Gemini.¹⁶ In a study conducted by Sreeram et al among undergraduate and postgraduate medical students, of the 200 participants 106 (53%) were post graduates and 94 (47%) were undergraduates. Overall, 61 (30.5%) had good knowledge, and 190 (95%) had a positive attitude. Undergraduates lacked the expertise and experience of postgraduates.¹⁷ In a study conducted by Prasad et al at AIIMS Nagpur, India, there were 188 (59.3%) undergraduates and 129 (40.7%) postgraduates among the 317 medical students that took part in the study. Few had formal training, but most had a fundamental understanding of AI. The majority of attitudes were favourable, with a high level of knowledge of ethical concerns and support for integrating AI into medical education. Students reported using AI for research, study and brainstorming more often than for career counselling.¹⁸

Limitations

Artificial intelligence is an evolving concept and it has not fully permeated the minds of budding doctors, so responses might be based on hearsay, incomplete information gained and biases regarding use and misuse of artificial intelligence. Social media and electronic media articles might also impact the understanding about AI among medical students. Generalizability of the results can be debatable considering the relatively small sample size and the data was not obtained from multiple centres. Further research on this topic conducted among large sample size in multiple medical colleges is recommended to improve the generation of data regarding this topic.

CONCLUSION

More than half of the participants 60.5% were in favour of implementing AI tools in their specialities or future specialities. Around 72.1% medical students were of the opinion that doctors should receive specific training on the use of AI tools in healthcare. Around 64.1% medical students were afraid that AI might threaten patient data security. Artificial intelligence must be introduced into medical curriculum to transform future doctors into smart doctors who use technology to serve the healthcare need of patients from rural and urban backgrounds. AI can solve the access to healthcare issues, if telemedicine and artificial intelligence tools to augment the skills of doctors are fused together.

Recommendations

Artificial intelligence should be introduced in the medical curriculum from first MBBS onwards. Practical training

and CME sessions should be conducted frequently to enlighten the medical students on the relevance of AI in future healthcare. AI tools and their ethical use should be inculcated in the minds of future doctors. Faculty members in medical colleges should be adequately trained to employ AI in healthcare. Governments should allocate adequate funds to pursue further research in the use of AI in healthcare. Safeguard to ensure data privacy and protection should be implemented by the legal systems of the nation of the world. Rural patients should benefit from the extensive use of AI in healthcare in far-flung areas of Rural India by integrating telemedicine and artificial intelligence. The misuse of AI tools in healthcare by quacks should be prevented by strict enforcement via legislative measures.

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