

Artificial Intelligence in Medical Education: A Cross-Sectional Assessment of Knowledge, Attitudes, and Practices Among Second-Year Medical Students

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Abstract:

Background: Artificial intelligence (AI) is increasingly transforming healthcare and medical education. Assessing students' knowledge, attitudes, and practices (KAP) is important for preparing future healthcare professionals for responsible AI use.

Methods: A cross-sectional questionnaire-based study was conducted among second-year medical students at a tertiary care hospital in Gujarat over one year. Data were collected using a structured electronic questionnaire covering sociodemographic characteristics, AI knowledge, attitudes, and practices. Descriptive statistics and the chi-square test were used for analysis.

Results: Among 174 participants, 93.7% had heard of AI and 83.3% were aware of its medical applications. Only 36.2% had received formal AI instruction, and 13.2% had attended AI-related training. AI was used for academic activities by 90.8%, with ChatGPT being the most commonly used tool (93.7%). Overall, 63.8% supported AI education and 60.9% were willing to use AI in future practice.

Conclusion: Students demonstrated high AI awareness and use but limited formal training, highlighting the need for structured AI education in undergraduate medical curricula.

Keywords: Artificial intelligence; Medical students; Medical education; Knowledge; Attitude; Practice; AI literacy.

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Introduction

Artificial intelligence (AI) has emerged as an important technological development in healthcare, with applications extending from diagnostic support and medical imaging to clinical decision-making, drug development, and patient management [1, 2]. The increasing availability of machine learning and generative AI technologies has further expanded the ways in which healthcare professionals can interact with and use AI-based systems [3, 4]. Although these technologies offer opportunities to improve the efficiency and quality of healthcare, their implementation also raises concerns related to accuracy, bias, privacy, accountability, transparency, and the appropriate balance between human and machine decision-making [5]. The World Health Organization has therefore emphasized that the use of AI in healthcare should be guided by ethical principles, human rights, safety, and accountability [6].

The growing incorporation of AI into healthcare has important implications for medical education.

Future physicians will increasingly be expected not only to use AI-assisted technologies but also to understand their underlying principles, clinical applications, limitations, and ethical implications. Consequently, AI literacy is increasingly being considered an important component of undergraduate medical education. Evidence-based reviews have identified areas such as the theory and application of AI, ethics, communication, quality improvement, and attitudes towards AI as important components of AI education for medical students. However, the integration of AI into medical curricula remains variable, and structured educational approaches are still developing across institutions [7, 8].

Studies assessing healthcare students have demonstrated considerable variation in their knowledge and perceptions of AI. A systematic review reported that although many healthcare students expressed positive attitudes towards the use of AI in healthcare, knowledge and practical skills

related to AI were often limited [9]. Similarly, a systematic review and meta-analysis involving medical, dental, and nursing students found that students generally had positive attitudes towards AI, while their level of knowledge was comparatively limited, highlighting the need for appropriate educational interventions [11]. These findings indicate that assessing knowledge alone may not adequately reflect students' preparedness; understanding their attitudes towards AI and their actual exposure or use of AI-based tools is also important. Recent evidence further supports the need to evaluate knowledge, attitudes, and practices together when examining AI preparedness among undergraduate medical students [11].

Second-year medical students constitute an important group for such an assessment because they are at an early stage of undergraduate medical training and are beginning to develop a stronger connection between foundational medical knowledge and its clinical application. Assessing their knowledge, attitudes, and practices regarding AI can help identify existing gaps in AI awareness and exposure before progress of students into clinical training. Such information may also provide a basis for developing appropriate educational strategies and integrating relevant AI competencies into medical education. Therefore, the present study was undertaken to assess the knowledge, attitude, and practice regarding artificial intelligence among second-year medical students in a tertiary care teaching hospital using a cross-sectional survey.

Materials and Methods

Study Design and Setting: This was a cross-sectional, questionnaire-based study conducted among second-year undergraduate medical students in a tertiary care hospital in Gujarat, India. The study was conducted over a period of one year. The study was designed to assess the students' knowledge, attitudes, and practices regarding the use of artificial intelligence (AI) in medical education and healthcare.

Study Population and Sampling: The study population comprised second-year medical students enrolled at the study institution during the study period. Students who voluntarily participated in the survey and provided informed consent were included. A convenience sampling technique was used, and eligible students available during the study period were invited to participate. A total of 174 completed responses were obtained and included in the analysis.

Ethical Considerations: The study was conducted after obtaining approval from the Institutional Ethics Committee of the study institution. Participation was voluntary, and informed consent was obtained from all participants before administration of the

questionnaire. Participants were informed about the purpose of the study and their right to participate voluntarily. Confidentiality and anonymity of the collected information were maintained throughout the study, and the data were used exclusively for research purposes.

Data Collection: Data were collected using a structured, self-administered electronic questionnaire. The questionnaire was circulated electronically among eligible second-year medical students during the study period. Participants were provided with information regarding the purpose of the survey before completing the questionnaire. Only responses from participants who provided informed consent were included in the study.

Study Questionnaire: The questionnaire consisted of four broad domains: demographic characteristics, knowledge and awareness of AI, attitudes towards AI, and practices related to AI use.

Demographic Characteristics: The demographic section collected information on age, gender, and place of residence (hostel or home).

Knowledge and Awareness: Knowledge and awareness of AI were assessed through questions regarding familiarity with the term AI, understanding of the differences between AI, machine learning, and deep learning, awareness of applications of AI in medicine, participation in AI-related workshops or training programmes, and exposure to formal AI instruction during undergraduate medical education. Participants were also asked whether they recognized that AI technologies require large datasets for training and development.

Attitude: Attitudes towards AI in medical education and future professional practice were assessed using statements addressing the need for teaching AI fundamentals to healthcare students, the anticipated importance of AI in the students' future profession, and awareness of ethical concerns related to AI. Responses were recorded on a five-point Likert scale, ranging from strongly disagree to strongly agree.

Practice: The practice domain assessed participants' actual use of AI-based tools for educational or academic activities. Participants were asked to identify the AI tools they had used, with multiple responses permitted. The questionnaire also assessed the frequency of AI use, the major purposes for which AI tools were used, the frequency with which AI-generated information was cross-checked against textbooks or scientific sources, and participants' willingness to use AI technologies in their future clinical practice.

Data Analysis: The collected data were compiled and analyzed using appropriate statistical software.

Categorical variables were summarized as frequencies and percentages, while quantitative variables were summarized using appropriate measures of central tendency and dispersion. Responses to the Likert-scale items were presented as frequencies and percentages for each response category. For multiple-response questions concerning AI tools and purposes of AI use, each response option was analyzed separately. Where applicable, associations between selected categorical variables were assessed using the Chi-

square test. A p-value <0.05 was considered statistically significant.

Results

Among the 174 participants, 91 (52.3%) were male and 83 (47.7%) were female. Most participants were aged 18–20 years (125, 71.8%), followed by those aged 21–23 years (46, 26.4%). The majority of students resided in hostels (153, 87.9%), while 21 (12.1%) resided at home (Table 1).

Table 1: Sociodemographic characteristics of study participants (N = 174)

Characteristic	Category	n (%)
Age (years)	18–20	125 (71.8)
	21–23	46 (26.4)
	≥24	2 (1.1)
Gender	Male	91 (52.3)
	Female	83 (47.7)
Residence	Hostel	153 (87.9)
	Home	21 (12.1)

Most participants had heard of AI (163, 93.7%) and were aware of its applications in medicine (145, 83.3%). Familiarity with the differences between AI, machine learning, and deep learning was reported by 113 (64.9%) participants, while 63 (36.2%) had received formal instruction on AI during their undergraduate medical education. Only 23 (13.2%) had participated in an AI-related workshop, course, or training programme; this was

significantly associated with gender ($p = 0.014$). Regarding attitudes, 111 (63.8%) agreed or strongly agreed that healthcare students should be taught the fundamentals of AI, while an equal proportion considered AI likely to play an important role in their future profession. Furthermore, 129 (74.1%) agreed or strongly agreed that students should be aware of ethical concerns related to AI (Table 2).

Table 2: Knowledge and attitudes towards artificial intelligence among study participants (N = 174)

Variable	Response	n (%)	p-value*
Heard of artificial intelligence	Yes	163 (93.7)	0.641
	No	11 (6.3)	
Familiar with differences between AI, machine learning and deep learning	Yes	113 (64.9)	1.000
	No	61 (35.1)	
Aware of applications of AI in medicine	Yes	145 (83.3)	0.342
	No	29 (16.7)	
Participated in AI-related workshop/course/training	Yes	23 (13.2)	0.014
	No	151 (86.8)	
Received formal AI instruction during undergraduate medical education	Yes	63 (36.2)	0.262
	No	111 (63.8)	
AI requires large datasets for training and development	True	130 (74.7)	—
	False	10 (5.7)	
	Not sure	34 (19.5)	
Healthcare students should be taught AI fundamentals	Agree/Strongly agree	111 (63.8)	—
	Neutral	47 (27.0)	
	Disagree/Strongly disagree	16 (9.2)	
AI will play an important role in future profession	Agree/Strongly agree	111 (63.8)	—
	Neutral	45 (25.9)	
	Disagree/Strongly disagree	18 (10.3)	
Students should be aware of ethical concerns related to AI	Agree/Strongly agree	129 (74.1)	—
	Neutral	33 (19.0)	
	Disagree/Strongly disagree	12 (6.9)	

AI use for educational or academic activities was reported by 158 (90.8%) participants. Daily AI use

was reported by 67 (38.5%) participants, followed by occasional use (56, 32.2%) and weekly use (39,

22.4%). ChatGPT was the most commonly used AI tool (163, 93.7%), followed by Google Gemini (124, 71.3%). Studying was the most frequently reported purpose of AI use (152, 87.4%), followed by research activities (67, 38.5%) and clinical learning (59, 33.9%). Only 50 (28.7%) participants reported always cross-checking AI-generated information, whereas 105 (60.3%) did so sometimes. Overall, 106

(60.9%) participants expressed willingness to use AI technologies in their future professional practice. The associations of gender with AI use for academic activities ($p = 0.945$), frequency of AI use ($p = 0.879$), cross-checking of AI-generated information ($p = 0.527$), and willingness to use AI in future practice ($p = 0.674$) were not statistically significant (Table 3).

Table 3: Practices and use of artificial intelligence among study participants (N = 174)

Variable	Category	n (%)	p-value*
Used AI for educational/academic activities	Yes	158 (90.8)	0.945
	No	16 (9.2)	
Frequency of AI use	Daily	67 (38.5)	0.879
	Weekly	39 (22.4)	
	Occasionally	56 (32.2)	
	Rarely	11 (6.3)	
	Never	1 (0.6)	
Cross-checks AI-generated information	Always	50 (28.7)	0.527
	Sometimes	105 (60.3)	
	Never	19 (10.9)	
Willingness to use AI in future practice	Yes	106 (60.9)	0.674
	Maybe	46 (26.4)	
	No	22 (12.6)	

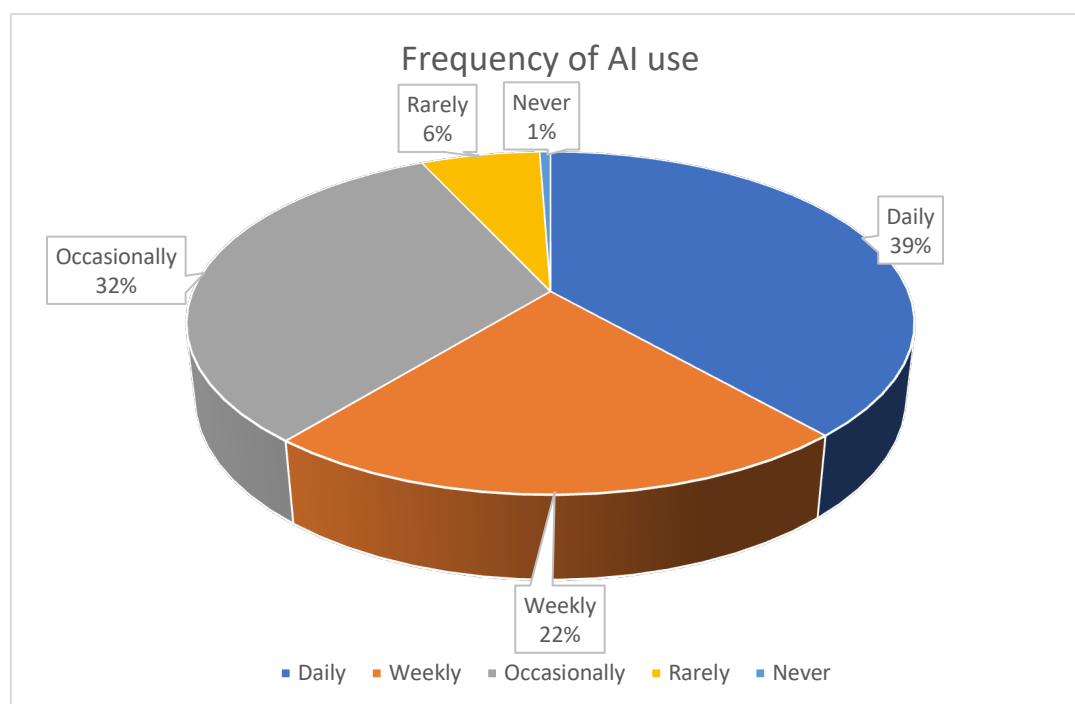


Figure 1: Frequency of Artificial Intelligence Use Among Second-Year Medical Students

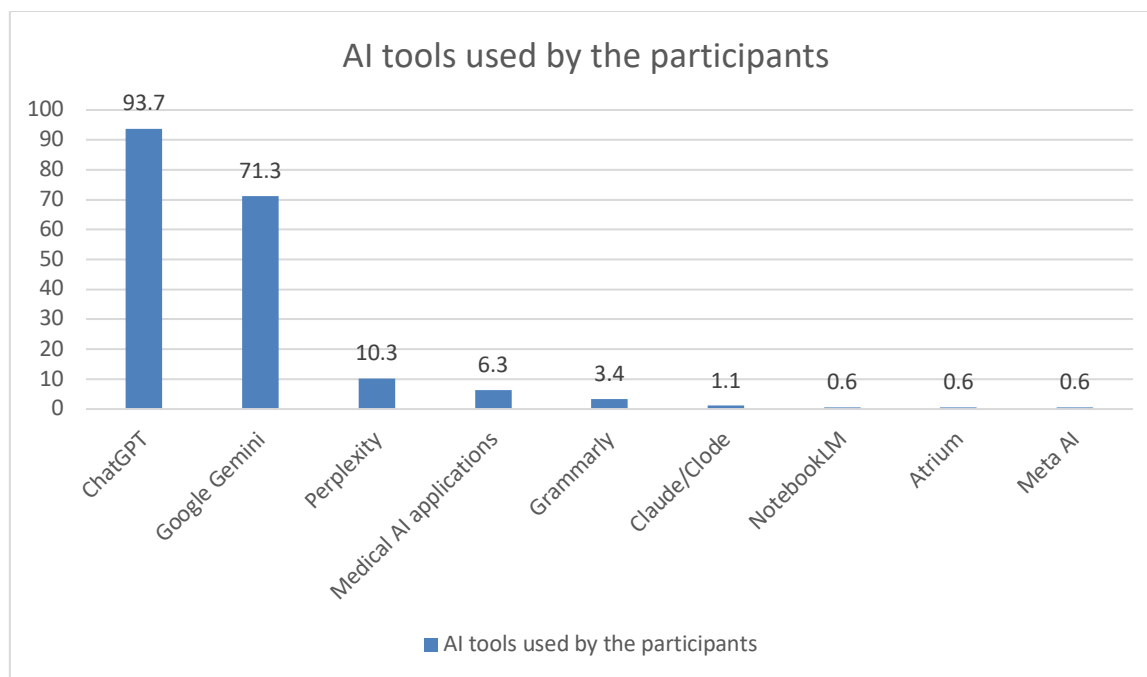


Figure 2: Artificial Intelligence Tools Used by Second-Year Medical Students

Discussion

The present study assessed the knowledge, attitudes, and practices regarding artificial intelligence (AI) among 174 second-year medical students in a tertiary care teaching institution in Gujarat. The findings indicate a high level of general awareness of AI, with 93.7% of participants having heard of AI and 83.3% being aware of its applications in medicine. However, more specific understanding appeared comparatively limited, as only 64.9% reported familiarity with the differences between AI, machine learning, and deep learning. This pattern is consistent with systematic reviews showing that healthcare students generally demonstrate positive perceptions of AI but have variable or moderate levels of knowledge. A systematic review by Mousavi Baigi et al. reported that healthcare students generally had positive attitudes towards AI, although knowledge and practical skills related to AI were limited [9]. The limited formal exposure to AI observed in the present study is consistent with findings from a systematic review by Pupic et al., which reported a paucity of AI-specific education in medical schools and highlighted the need for evidence-based integration of AI into undergraduate medical curricula [7].

An important finding of the present study was the limited formal exposure of students to AI education. Only 36.2% reported receiving formal instruction on AI during their undergraduate medical education, while just 13.2% had participated in an AI-related workshop, course, or training programme. Despite this limited educational exposure, 63.8% of students agreed or strongly agreed that healthcare students should be taught the fundamentals of AI. This

finding is in agreement with previous evidence indicating that medical students generally support the inclusion of AI within undergraduate medical education, even though structured curricular integration remains limited. A systematic review of AI education for medical students identified theory and application, ethics, communication, collaboration, quality improvement, and attitudes as important domains for curriculum development [7]. Similarly, a review of existing AI educational programmes found that formal programmes and curriculum frameworks remain relatively limited and heterogeneous [8].

The practice findings demonstrate that AI has already become part of students' academic activities despite the limited formal curricular exposure. In the present study, 90.8% of participants reported using AI for educational or academic purposes, with ChatGPT being the most frequently used tool (93.7%), followed by Google Gemini (71.3%). Studying was the predominant purpose of AI use (87.4%), followed by research activities (38.5%) and clinical learning (33.9%). However, only 28.7% reported always cross-checking AI-generated information against other sources, while 60.3% did so only sometimes. This finding is particularly relevant because the usefulness of AI-generated information does not eliminate the need for critical appraisal, particularly in medical education and future clinical practice. Recent literature emphasizes that AI competencies for medical students should extend beyond basic technical knowledge to include critical appraisal of AI outputs, clinical applications, ethics, professionalism, and responsible human-AI collaboration [11, 15-18].

The study also demonstrated a generally positive orientation towards the future use of AI. Nearly two-thirds of participants (63.8%) believed that AI would play an important role in their future profession, while 74.1% agreed or strongly agreed that students should be aware of ethical concerns related to AI. Furthermore, 60.9% expressed willingness to use AI technologies in their future professional practice. These findings are consistent with previous reviews reporting generally positive attitudes towards AI among healthcare students [13-15]. At the same time, the relatively low level of formal training and inconsistent verification of AI-generated information suggest that positive attitudes should be accompanied by structured AI literacy and ethical education. The World Health Organization has emphasized that AI in healthcare should be implemented with attention to autonomy, safety, transparency, accountability, equity, and human rights [6]. Therefore, the findings of the present study support the need for appropriately designed AI education within undergraduate medical training, particularly education that combines foundational concepts with practical application, critical evaluation of AI outputs, and ethical and professional considerations.

Limitations

This study was limited by its cross-sectional design, single-centre setting, and convenience sampling, which may limit the generalisability of the findings. The use of a self-reported questionnaire may also have introduced recall and response bias. Additionally, the study included only second-year medical students, limiting comparison across different years of medical education.

Conclusion

The present study demonstrates that second-year medical students had high general awareness and frequent use of artificial intelligence, particularly for academic and educational purposes, but their formal exposure to AI education was limited. Although students generally showed positive attitudes towards incorporating AI into medical education and future clinical practice, gaps were evident in their structured knowledge and consistent verification of AI-generated information. These findings highlight the need for integrating structured AI education into undergraduate medical curricula, with emphasis on fundamental concepts, practical applications, critical appraisal of AI-generated information, and ethical considerations, to promote responsible and effective use of AI in future medical practice.

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