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Artificial Intelligence in Medical Education: Knowledge, Attitudes, and Practices Among Undergraduate MBBS Students

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Abstract

Background & objectives: Artificial intelligence (AI) is rapidly entering medical education, but effective use requires AI literacy, critical appraisal and ethical awareness. This study assessed knowledge, attitudes and practices regarding responsible AI use among undergraduate MBBS students.

Methods: A cross-sectional questionnaire-based survey included 224 undergraduate MBBS students. An anonymous electronic questionnaire assessed demographics, AI knowledge, attitudes towards educational and ethical use, and practical use of AI tools. Knowledge was scored from 12 unambiguous objective items and attitude from ten five-point Likert statements. Descriptive statistics, independent-samples t-test and one-way ANOVA were used; $P<0.05$ was considered significant.

Results: Mean age was 21.50±2.39 years, with equal representation of males and females. Only 16 (7.1%) participants had received formal AI teaching, whereas 218 (97.3%) reported academic AI use. Mean knowledge score was 10.21±1.87/12. Knowledge was higher among students with previous academic AI use (10.43±1.83 vs 8.83±1.95; P=0.003) and differed across MBBS years (P=0.008). Mean attitude score was 43.20±4.81/50. Most supported responsible citation (87.1%), AI-assisted research productivity (94.6%) and AI as a future component of medical practice (92.4%). ChatGPT was the most-used tool (65.2%) and 66.5% reported daily use. Only 20.5% always verified AI-generated information, 37.9% never disclosed AI use when applicable, and 8.5% had received institutional ethical guidance.

Interpretation & conclusions: Students showed good knowledge and favourable attitudes toward AI, but formal education and institutional guidance were limited. Curriculum-integrated training should emphasize verification, citation, privacy, bias, disclosure and human oversight.

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

Introduction

Artificial intelligence (AI) has moved from a largely technical field into routine educational and healthcare environments. Generative AI and large language models can support explanation of complex concepts, summarization, literature exploration, question generation, language assistance and other learning activities. At the same time, these systems can produce inaccurate or fabricated information,

reproduce biases present in training data, create privacy risks and blur boundaries around authorship and academic integrity. Responsible adoption therefore requires more than familiarity with AI tools; students need the ability to critically evaluate outputs and understand when human judgment must remain decisive.

The implications are particularly important in undergraduate medical education. Medical students are future users of AI-supported clinical and research systems, and the habits established during training may influence subsequent professional practice. International guidance emphasizes human oversight, privacy, transparency, accountability and equitable access in health-related AI.[1,2] Educational guidance similarly supports a human-centred approach in which AI complements, rather than displaces, teachers and learners.[3,4] Recent surveys from India and other settings have reported growing student exposure to AI alongside variable levels of formal training and preparedness.[5-8]

However, rapid adoption may occur before institutions have established clear educational or ethical frameworks. Students may use AI frequently for academic work without consistently verifying outputs, identifying limitations or disclosing AI assistance. Understanding this gap is important for designing practical curriculum interventions. The present study assessed knowledge, attitudes and practices concerning the responsible and ethical use of AI among undergraduate MBBS students, with particular attention to formal training, verification behaviour, academic use and institutional guidance.

Materials and Methods

Study design and participants

A cross-sectional questionnaire-based study was conducted among 224 undergraduate MBBS students at a tertiary teaching institution in Mumbai. Participation was voluntary and anonymous. The electronic questionnaire was completed after participants reviewed the study information and provided electronic consent. No names, roll numbers, telephone numbers or email addresses were collected.

Study instrument

The questionnaire comprised demographic items and questions covering three broad domains: knowledge, attitudes and practices related to AI in medical education. Knowledge items addressed basic AI concepts, machine learning, large language models, verification of AI-generated information, applications in pathology, limitations, replacement of doctors, ethical concerns, source checking, international guidance and educational uses. Attitudes were assessed using ten statements on a five-point Likert scale, ranging from 1 to 5. Practice-related items examined AI use, preferred tools, frequency, purposes, verification, use for assignments or reports, disclosure, peer recommendation, institutional guidance and willingness to attend an AI workshop.

Because the item asking participants to identify a generative AI example included both ChatGPT and Gemini as possible selections in the response data, it was retained for descriptive analysis but excluded from the composite knowledge score to avoid ambiguous scoring. The remaining 12 unambiguous objective items were scored as 1 for a completely correct response and 0 otherwise. For multi-response items, all specified correct components had to be selected to receive one point. The resulting knowledge score ranged from 0 to 12, with higher scores indicating better factual knowledge. The ten attitude items were summed to produce a score from 10 to 50, with higher values indicating a more favourable and responsible orientation toward AI.

Statistical analysis

Categorical variables were summarized as frequencies and percentages. Continuous variables were summarized as mean and standard deviation. Independent-samples t-tests were used to compare mean scores between two groups, and one-way analysis of variance was used for comparisons across MBBS years. Pearson correlation was used to examine the relationship between knowledge and attitude scores. A two-sided P value <0.05 was considered statistically significant.

Results

Participant characteristics (Table 1)

A total of 224 students were included. The mean age was 21.50±2.39 years (range, 19–27 years), with equal representation of males and females (112 each). Second-year students constituted the largest group (108, 48.2%), followed by Third MBBS Part I students (70, 31.2%), interns (26, 11.6%) and first-year students (20, 8.9%). Only 16 participants (7.1%) reported receiving formal teaching or training on AI.

Table 1. Participant characteristics

Characteristic	n	%
Age, mean ± SD (years)	21.50 ± 2.39	—
Male	112	50.0
Female	112	50.0
First MBBS	20	8.9
Second MBBS	108	48.2
Third MBBS – Part I	70	31.2
Internship	26	11.6
Formal AI teaching/training: Yes	16	7.1
Formal AI teaching/training: No	208	92.9

Knowledge of AI (Table 2)

The mean composite knowledge score was 10.21±1.87 out of 12. Eighty-eight students (39.3%) achieved the maximum score, while 149 (66.5%) scored at least 10. Basic understanding was strong: 192 (85.7%) correctly identified the meaning of AI, 174 (77.7%) identified machine learning as the branch that enables computers to learn from data, and 191 (85.3%) correctly identified the primary purpose of large language models. Almost all respondents recognized the need to verify AI-generated information (222, 99.1%) and rejected the proposition that AI could completely replace doctors (220, 98.2%).

Knowledge was less consistent for nuanced ethical and technical issues. Although 176 (78.6%) selected all three specified applications of AI in pathology, only 130 (58.0%) identified all listed limitations—bias in training data, incorrect information and privacy concerns. Similarly, 176 (78.6%) selected all three specified ethical concerns. WHO was identified as the organization that had published ethical guidance on AI in healthcare by 154 (68.8%) participants.

Students who reported previous academic use of AI in an earlier questionnaire item had higher mean knowledge scores than those who did not (10.43±1.83 vs 8.83±1.95; P=0.003). Knowledge also differed significantly across MBBS years (P=0.008 by one-way ANOVA), with the highest mean scores among second- and third-year students. Formal AI teaching was not associated with a significant difference in

knowledge score (10.13±1.71 among trained students vs 10.22±1.89 among untrained students; P=0.844).

Table 2. Key knowledge findings

Finding	n (%)
Recognized AI correctly	192 (85.7)
Recognized need for verification	222 (99.1)
Recognized AI limitations	130 (58.0)
Recognized AI cannot replace doctors	220 (98.2)
Recognized ethical concerns	176 (78.6)

Attitudes toward AI (Table 3)

The mean attitude score was 43.20±4.81 out of 50, indicating an overall favourable orientation toward AI. Agreement (Likert score 4 or 5) was particularly high for the statements that AI could improve research productivity (94.6%), would become an essential component of future medical practice (92.4%), may increase academic dishonesty if misused (90.6%), should be used responsibly with proper citation (87.1%), and should supplement rather than replace traditional teaching (85.3%). Most participants also supported formal AI training during MBBS (84.8%) and believed that AI could help students understand difficult concepts (83.9%).

The comparatively weaker areas were confidence and curricular integration. Agreement that AI should be included in the MBBS curriculum was 61.6%, while 62.9% agreed that they felt confident using AI tools for academic purposes. The knowledge and attitude scores were not significantly correlated (r=-0.051, P=0.451), suggesting that favourable attitudes were not simply a function of higher factual knowledge.

Table 3. Key attitude findings

Attitude	n (%)
AI improves learning	184 (82.1)
AI should supplement teaching	191 (85.3)
AI may increase academic dishonesty	203 (90.6)
AI improves research productivity	212 (94.6)
Wants formal AI training	190 (84.8)

Practices and patterns of AI use (Table 4)

On the practice item asking about use of AI tools such as ChatGPT, Gemini or Copilot for academic purposes, 218 students (97.3%) reported use. ChatGPT was the most frequently used tool (146, 65.2%), followed by Gemini (55, 24.6%) and other tools (23, 10.3%). AI use was frequent: 149 students (66.5%) reported daily use and 69 (30.8%) weekly use.

Studying was the most commonly selected purpose (208, 92.9%), followed by summarizing notes (166, 74.1%), research writing (94, 42.0%), literature searching (46, 20.5%) and translation (42, 18.8%). A total of 167 students (74.6%) reported using AI to write assignments or reports.

Despite widespread use, verification practices were inconsistent. Only 46 students (20.5%) reported always verifying AI-generated information, whereas 124 (55.4%) did so often and 54 (24.1%) rarely.

Disclosure of AI use was also variable: 106 (47.3%) reported disclosure sometimes, 85 (37.9%) never disclosed use when applicable, and only four (1.8%) reported always disclosing it. Institutional guidance was uncommon; only 19 students (8.5%) reported having received guidance on ethical AI use. Nevertheless, 168 (75.0%) would attend a workshop on AI in medical education, while a further 53 (23.7%) were undecided.

Table 4. AI use and responsible practices

Practice	n (%)
Academic AI use	218 (97.3)
Daily AI use	149 (66.5)
Uses AI for studying	208 (92.9)
Always verifies AI output	46 (20.5)
Never discloses AI use when applicable	85 (37.9)
Received institutional AI guidance	19 (8.5)

Discussion

This study demonstrates a clear contrast between widespread practical adoption of AI and limited formal educational support. Almost all participants reported academic use of AI, and two-thirds used it daily, yet only 7.1% had received formal AI teaching and 8.5% reported institutional ethical guidance. This pattern suggests that students are developing AI-related practices largely through self-directed exposure rather than structured curricular preparation.

The overall knowledge score was good, with a mean of 10.21 out of 12. Students showed particularly strong recognition of the need to verify AI-generated information and of the continuing role of doctors. However, knowledge declined when questions required recognition of multiple limitations or ethical dimensions. This distinction is important: recognizing AI as useful is not equivalent to understanding the conditions under which it can be used safely. Bias, hallucinated or incorrect information, privacy and data security require explicit teaching because these risks may not be obvious during routine use.

The association between previous academic AI use and higher knowledge scores is noteworthy. Familiarity may encourage students to acquire basic concepts through experience, but the cross-sectional design does not establish causality. Students with greater baseline interest in technology may both use AI more often and perform better on knowledge questions. The significant difference across MBBS years also suggests that exposure to academic work and increasing clinical or research responsibilities may influence AI literacy. In contrast, the absence of a significant association between formal teaching and knowledge should not be interpreted as evidence that formal education is unnecessary. Only 16 students reported such training, limiting the statistical power to detect an effect, and the survey did not assess the content, duration or quality of that training.

Attitudes were strongly favourable. Most students viewed AI as an aid to learning and research rather than a replacement for traditional education or doctors. The high agreement that AI should supplement rather than replace traditional teaching is particularly encouraging because it reflects an understanding of the complementary role of technology. The relatively lower confidence in using AI, despite favourable attitudes, indicates an educational opportunity: students may be willing to use AI but remain uncertain about how to use it appropriately.

The practice findings highlight the most important gap. Students frequently used AI, but verification was not universal. This is consistent with concerns raised in the educational literature about the reliability and responsible use of large language models.[9] Only one in five always verified AI-generated information, and nearly one quarter rarely did so. This is clinically relevant because errors introduced during medical learning may later influence clinical reasoning. Large language models can produce fluent but unsupported statements, making surface-level plausibility an unreliable indicator of accuracy. Therefore, AI literacy should include source verification, recognition of uncertainty, cross-checking against authoritative literature and awareness of model limitations.

Academic integrity represents another concern. Nearly three-quarters of participants had used AI to write assignments or reports, but 37.9% reported never disclosing AI use when disclosure was applicable. This finding does not necessarily indicate misconduct, because institutional policies differ and some uses may not require disclosure. Nevertheless, the result demonstrates the need for clear institutional definitions of acceptable and unacceptable AI assistance, along with transparent expectations for attribution and disclosure.

The results are broadly consistent with recent surveys showing positive student attitudes toward AI but substantial gaps in formal education and preparedness. Studies among medical students in India and internationally have similarly reported high interest in AI and a desire for more structured teaching.[5-8] The present study adds a practical dimension by demonstrating that frequent use coexists with limited institutional guidance and inconsistent verification behaviour.

The implications for curriculum design are straightforward. Undergraduate medical education should introduce AI literacy as a longitudinal competency rather than a single optional workshop. Core content should include basic AI concepts, generative AI and large language models; strengths and limitations; bias and fairness; privacy and data protection; source verification; citation and disclosure; academic integrity; responsible prompting; and human oversight. Practical exercises could involve comparing AI-generated explanations with standard textbooks or guidelines, identifying fabricated references, evaluating biased outputs and documenting appropriate AI use in academic assignments. Institutional policies should complement teaching by defining permitted uses and disclosure requirements.

Conclusion

Undergraduate MBBS students in this study demonstrated good factual knowledge and strongly favourable attitudes toward AI in medical education, accompanied by very high levels of practical use. However, formal teaching and institutional ethical guidance were markedly limited, and important gaps were evident in verification and disclosure practices. Medical curricula should therefore move beyond introducing AI tools and explicitly teach critical appraisal, responsible use, academic integrity, privacy, bias, citation, disclosure and human oversight. Structured institutional guidance, combined with practical AI-literacy training, may help ensure that the rapid adoption of AI translates into educational benefit without compromising professional standards.

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