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Ethical Perceptions and Practices of Artificial Intelligence in Medical Education: A Systematic Review.

Percepciones y prácticas éticas de la inteligencia artificial en la educación médica: una revisión sistemática.

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Abstract.

Objective: Artificial intelligence (AI) is increasingly used in medical education, offering opportunities for learning, research, and academic productivity while raising concerns about academic integrity and responsible use. This systematic review aimed to synthesize empirical evidence on ethical perceptions and practices related to AI use among medical students and educators. **Methodology:** Following PRISMA 2020 guidelines, PubMed and Scopus were searched for English-language studies published between January 2020 and March 2026. Original studies using structured, closed-ended assessments of ethical issues related to AI use in medical education were included. Two reviewers independently screened studies and extracted data. Methodological quality was assessed using the Appraisal Tool for Cross-Sectional Studies (AXIS), and findings were synthesized narratively. **Results:** Eight cross-sectional studies met the inclusion criteria, including six student-focused and two educator-focused studies. Although AI was generally viewed positively, recurring concerns included plagiarism, academic misconduct, misinformation, algorithmic bias, privacy risks, and overreliance on AI. Student-focused studies more frequently highlighted practical educational benefits, whereas educator-focused studies placed greater emphasis on assessment integrity, educational quality, and institutional guidance. However, differences in study populations and assessment methods limited direct comparisons. **Conclusions:** The findings highlight the need for clearer institutional guidance, AI literacy education, and responsible curriculum integration. However, the available evidence is predominantly based on self-reported perceptions and does not establish the effectiveness of specific educational interventions. Further research is needed to examine actual AI-related practices and their ethical and educational implications.

Keywords: artificial intelligence, medical education, ethics, academic integrity

Resumen.

Objetivo: La inteligencia artificial (IA) se utiliza cada vez más en la educación médica y ofrece oportunidades para el aprendizaje, la investigación y la productividad académica, al tiempo que plantea preocupaciones sobre la integridad académica y su uso responsable. Esta revisión sistemática tuvo como objetivo sintetizar la evidencia empírica sobre las percepciones y prácticas éticas relacionadas con el uso de la IA entre estudiantes y docentes de medicina. **Metodología:** Siguiendo las directrices PRISMA 2020, se realizaron búsquedas en PubMed y Scopus de estudios publicados en inglés entre enero de 2020 y marzo de 2026. Se incluyeron estudios originales que utilizaron instrumentos estructurados con preguntas cerradas para evaluar cuestiones éticas

relacionadas con el uso de la IA en la educación médica. Dos revisores realizaron de forma independiente la selección de estudios y la extracción de datos. La calidad metodológica se evaluó mediante la herramienta Appraisal Tool for Cross-Sectional Studies (AXIS), y los hallazgos se sintetizaron de forma narrativa. **Resultados:** Se incluyeron ocho estudios transversales, seis centrados en estudiantes y dos en docentes. Aunque la IA fue valorada generalmente de forma positiva, las preocupaciones recurrentes incluyeron el plagio, las conductas académicas indebidas, la desinformación, los sesgos algorítmicos, los riesgos para la privacidad y la dependencia excesiva de la IA. Los estudios centrados en estudiantes destacaron con mayor frecuencia los beneficios educativos prácticos, mientras que los centrados en docentes prestaron mayor atención a la integridad de las evaluaciones, la calidad educativa y las orientaciones institucionales. Sin embargo, las diferencias entre las poblaciones estudiadas y los métodos de evaluación limitaron las comparaciones directas. **Conclusiones:** Los hallazgos ponen de relieve la necesidad de contar con orientaciones institucionales más claras, formación en competencias relacionadas con la IA y una integración responsable de esta tecnología en los planes de estudio. Sin embargo, la evidencia disponible se basa principalmente en percepciones autodeclaradas y no demuestra la eficacia de intervenciones educativas específicas. Se necesitan más investigaciones para examinar las prácticas reales relacionadas con la IA y sus implicaciones éticas y educativas.

Palabras clave: inteligencia artificial, educación médica, ética, integridad académica

1. Introduction

The rapid integration of artificial intelligence (AI) into higher education is transforming the ways we teach, learn, assess, and conduct research. When considering modern education, the use of artificial intelligence can be conceptualized in three interrelated areas: the practical use of AI applications in the operational aspects of teaching and administration, the integration of AI competencies into educational curricula, and the general institutional response to an AI-infused society (1, 2). As AI becomes more integrated into medical education, ensuring its use is aligned with the principles of academic and research integrity is an important challenge (3). Academic integrity is based on the values of honesty, trust, fairness, respect, responsibility, and courage, which together constitute the foundation of ethical educational behaviour (4). Further principles involve research integrity, which includes accountability, transparency, responsibility for proper data management, and adherence to ethical research practices. Violations of research integrity including fabrication, falsification, and plagiarism undermine the validity of scientific evidence and public trust in research (1). Thus, the responsible use of AI in medical education not only implies adequate knowledge of AI technology but also awareness of the related ethical principles and governance framework to guarantee that such technologies do not harm academic and professional standards.

An AI system is a machine-based system that produces some output, such as a prediction, a recommendation, a decision, or content, by making inferences based on the data it receives (5). The use of AI technologies in medical education has expanded rapidly, creating opportunities to improve teaching, learning, assessment, and research while also raising ethical concerns (6, 7). Applications of AI may help in providing personalized learning, assisting academic writing and literature synthesis, performing data analysis, supporting institutional decision-making, and improving simulation-based medical education using virtual and augmented reality technology (8–11).

Despite these potential benefits, the increasing use of AI in medicine raises several important ethical concerns. These include integrity issues, security problems, ethical considerations of algorithms used, transparency and accountability issues, as well as responsible implementation of AI in education and clinical settings (12, 13). The first major issue associated with the utilization of

AI in education is its hallucination capacity, meaning that AI may generate incorrect information but still present it as credible. Thus, AI requires critical evaluation by users (7). Additionally, excessive AI use may hinder the development of critical thinking and clinical reasoning and reduce meaningful interactions between students and faculty, which are important for professional identity formation in medicine. Moreover, differences in access to AI technology and resources in different medical institutions may aggravate existing disparities between resource-rich and resource-limited medical schools (8, 14). Hence, it is necessary to build governance approaches, responsible AI literacy programmes, and novel approaches to assessing AI use in medicine (9, 14).

The adoption of AI in medical education has outpaced faculty development, institutional preparedness, and the development of evidence-based educational frameworks. As a consequence of the rapid pace, AI has found its way into educational practice without any guidelines on appropriate use, ethics of use, and consistency with existing learning theories. Even though AI tools have become readily available, not all medical institutions have created policies, training programmes, and governance on the use of AI tools in an ethical manner (15). The literature has shown significant discrepancies in the integration of AI into the curricula of different institutions due to the absence of standard practices that balance competence and ethical literacy (16). These results show the need for the creation of curricular frameworks aimed at promoting responsible use of AI without undermining the professional values, clinical reasoning and patient care. There is therefore a need to synthesize existing evidence on ethical AI use in medical education and identify the factors that may shape students' and educators' perspectives (17).

Although previous reviews have examined ethical concerns surrounding AI in medical education, particularly ethical principles, potential risks, and curriculum integration (14, 17), a focused synthesis of empirical studies investigating medical students' and educators' ethical perceptions and practices remains valuable. Such a synthesis may also help clarify how factors such as AI literacy, training, and institutional guidance relate to these perspectives.

Accordingly, the present systematic review was conducted in accordance with PRISMA standards to synthesize empirical evidence on ethical concerns related to AI use in medical education, with particular emphasis on academic integrity. It also examined factors that may influence these perspectives, including AI awareness, prior training, and the integration of AI-related education into medical curricula, and compared the perspectives of medical students and educators. By focusing on empirical evidence across stakeholder groups, this review aims to clarify current evidence gaps and inform the development of educational policies, ethics training, and curricular approaches that support responsible AI use in medical education.

2. Methods

2.1 Study Design and Search Strategy.

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 Statement. A literature search was performed in PubMed and Scopus between February 3 and March 29, 2026. Studies published between January 1, 2020, and March 29, 2026, were eligible for inclusion.

The following search strategy was used:

("generative AI" OR "large language model" OR LLM OR "artificial intelligence")
AND
("medical education" OR "health professions education")
AND

("academic integrity" OR plagiarism OR cheating OR "academic misconduct" OR "academic honesty")

2.2 Eligibility Criteria.

Studies were included if they met all of the following criteria:

- included medical students and/or medical educators, either exclusively or within mixed health professions samples;
- were published in English;
- reported ethical outcomes related to AI use in medical education, particularly academic integrity, plagiarism, cheating, or academic misconduct;
- employed structured questionnaires or other closed-ended assessment tools; and
- were original research articles.

Studies were excluded if they:

- were non-original publications, such as reviews, editorials, commentaries, or letters;
- did not investigate ethical aspects of AI use in medical or health professions education;
- relied exclusively on open-ended questionnaires or interview-based methodologies without structured, closed-ended assessments;
- did not include medical students and/or medical educators as participants; or
- were published in languages other than English.

The population of interest comprised medical students and medical educators represented in the eligible studies. Studies involving mixed health professions samples were considered when medical students and/or medical educators were included in the study population.

2.3 Study Selection.

All retrieved records were exported, and duplicate records were removed prior to screening. Two reviewers independently screened the titles and abstracts of all remaining records according to the predefined eligibility criteria. Studies considered potentially eligible subsequently underwent full-text assessment using the same criteria. Any disagreements during the study selection process were resolved through discussion and consensus.

2.4 Data Extraction.

Data extraction was performed independently by two reviewers using a standardized data extraction form. Extracted information included study characteristics, geographical setting, participant characteristics and sample size, study design, assessment instruments, and findings related to the ethical use of artificial intelligence in medical education. The main variables of interest included ethical perceptions and practices related to AI use, particularly academic integrity, plagiarism, cheating, academic misconduct, misinformation, fabricated references, bias, privacy and data security, originality, and overreliance on AI, when reported in the included studies. Information on factors potentially influencing these perceptions, such as previous AI use, AI awareness or training, and institutional guidance, was also extracted when available. Any inconsistencies in data extraction were resolved through discussion and consensus.

2.5 Data Synthesis.

Given the variability in study methodologies, participant populations, and outcome measures, a narrative synthesis was performed. The findings were categorized according to the perspectives of medical students and educators and the ethical concerns reported in the included studies.

Similarities and differences in the ethical concerns identified across student-focused and educator-focused studies were examined. Interpretation of the results also took into account differences in the populations studied, geographic locations, and assessment methods. Differences among the studies, however, limited direct comparisons of their results. Because the included studies used heterogeneous assessment instruments and reported outcomes that were not directly comparable, quantitative synthesis was not considered appropriate. The findings were therefore presented narratively and in tabulated form.

2.6 Quality Assessment.

The methodological quality of the included cross-sectional studies was independently assessed by two reviewers using the Appraisal Tool for Cross-Sectional Studies (AXIS) checklist (18). Responses to each checklist item were recorded as "Yes", "No", or "Do not know" (DK) and interpreted individually. Since the AXIS tool does not provide a numerical scoring system or standardized quality categories, no overall quality score or category was assigned. Any disagreements were resolved through discussion and consensus.

2.7 Ethical Considerations.

Ethical approval and informed consent were not required for this systematic review because it involved the analysis and synthesis of previously published studies and did not involve the direct recruitment of human participants, the collection of identifiable personal data, or access to non-public datasets.

3. Results

3.1 Study Selection.

A total of 180 records were identified through database searching (PubMed, n = 68; Scopus, n = 112). After removal of fifty-six duplicate records, 124 records underwent title and abstract screening. Ninety-seven records were excluded, leaving twenty-seven studies for full-text assessment. Nineteen studies were subsequently excluded for predefined reasons, resulting in eight studies being included in the final review (Figure 1).

3.2 Medical Students' Perspectives.

Of the eight included studies, six examined medical students' perspectives on the ethical use of AI in medical education (Table 1). The studies were conducted in Malaysia, the United States (US), China, Saudi Arabia, and Ukraine. Students generally had positive attitudes towards AI, but their knowledge of AI and the ethical issues examined differed across studies.

Pallivathukal et al. (19) surveyed 443 undergraduate students from medicine, dentistry, and basic sciences. Most students had positive attitudes towards ChatGPT, although they raised concerns about inaccurate information, academic ethics, and excessive reliance on AI. Only 47.6% reported checking the accuracy of ChatGPT-generated information, and 23.7% had received guidance on its ethical use from their teachers or institutions. Academic use of ChatGPT differed significantly by educational programme ($p = 0.002$) and year of study ($p < 0.001$).

In the US, Ganjavi et al. (20) conducted a survey of 415 medical students from at least 28 medical schools, representing different years of medical education. It was determined that 96% of medical students were familiar with ChatGPT, whereas 52% had employed ChatGPT in their medical studies. There were significant differences between ChatGPT use among academic years (p

= 0.048), especially among first-year students, who used ChatGPT the most (59.0%). The most prevalent issues related to the ethics of ChatGPT include confidentiality of patient information (87.4%), plagiarism (81.9%), lack of human oversight (77.4%), and algorithmic biases (75.9%).

Hu et al. (21) surveyed 1,133 medical students in China, including undergraduate, postgraduate, and PhD students. In this study, it was revealed that 90.1% of medical students were aware of ChatGPT, whereas 62.9% had used ChatGPT in their medical studies. Misinformation (76.9%), issues related to plagiarism or inability to detect plagiarism (65.4%), and fabrication of research or disinformation (63.2%) were some of the major issues identified in their study. Among those who had never used ChatGPT, reliance on AI (42.4%), lack of originality in academic work (42.4%), and plagiarism (41.2%) were some of the major reasons for non-use. Despite having these concerns, 60.7% of the participants exhibited positive attitudes toward ChatGPT in the future use in medicine.

In another study conducted by Alfahl (22) on 189 medical students at six consecutive academic years from Taibah University in Saudi Arabia, even though 53.97% of respondents claimed to be familiar with the basics of AI, only 11.21% received any sort of formal training in AI during their undergraduate studies. Moreover, even though 74.60% of respondents expected AI to transform education entirely, 71.48% of them appreciated the significance of the ethical aspect of AI creation and use. Furthermore, AI replacing human instructors was mentioned by 41.91% of respondents as one of the problems with AI. Other issues related to cheating (56 responses), ethical aspects and privacy (44 responses), and lack of AI knowledge (46 responses) also stood out as problems.

Lymar et al. (23) surveyed 244 participants at a university in Ukraine, including 183 medical students, six interns, and 55 PhD students. Most participants (84%) used AI for academic purposes, mainly to search for information (70%). Some (14%) also reported using AI to write essays. Views on whether AI use was academically acceptable varied. While 36% considered it academic misconduct, 26% found it acceptable, and 38% were unsure.

Liu et al. (24) conducted a multicenter study involving 788 medical students from five universities in Shandong Province, China, showing high engagement in AI tools for learning and research. These individuals were worried about decreased critical thinking (61.93%), academic integrity (55.84%), AI algorithm biases or misinformation (54.44%), and data privacy (48.48%). Moreover, 59.26% of these respondents believed that current ethical principles used for AI in the context of education are insufficient. Ethical concern scores increased across academic years ($p < 0.001$), being the highest among fifth-year students. However, no difference was found in ethical concern scores between universities ($p = 0.806$).

In conclusion, the six studies had revealed generally favorable opinions towards AI in addition to continued worries regarding academic honesty, accuracy of information, privacy, and dependence on AI. Differences in educational levels, AI knowledge, academic disciplines, and survey methods made direct comparisons between studies difficult.

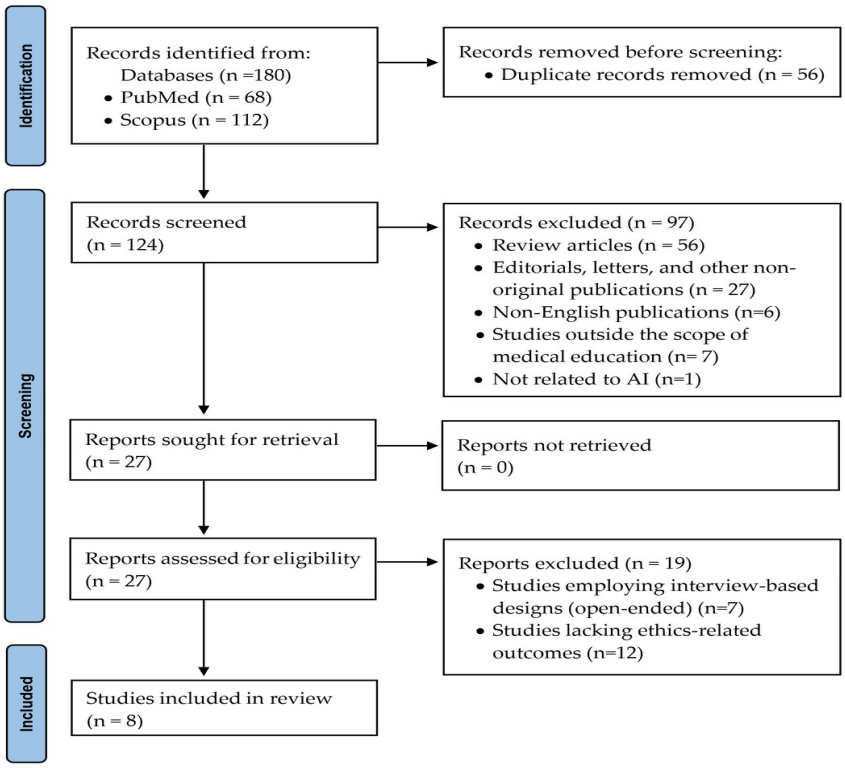


Figure 1. Prisma 2020 flow diagram.

Table 1. Characteristics and ethical findings of studies investigating medical students' perspectives on AI in medical education.

Study / Country	Participants and educational background	AI experience / Assessment	Main ethical findings
Pallivathukal (19) Malaysia	443 undergraduate students: medicine (215), dentistry (161), science (67)	Questionnaire; ChatGPT knowledge and academic use	Plagiarism, misinformation, overreliance, reduced originality
Ganjavi (20) USA	415 medical students; years 1–4	Online survey; ChatGPT awareness and use	Plagiarism, privacy, bias, misinformation
Hu (21) China	1,133 medical students; undergraduate to doctoral levels	20-item questionnaire; 90.1% AI awareness	Misinformation, plagiarism, falsification
Alfahl (22) Saudi Arabia	189 medical students; years 1–6	Questionnaire; 11.21% formally trained in AI	Cheating, plagiarism, privacy concerns
Lymar (23) Ukraine	244 participants: students (183), interns (6), PhD students (55)	Online questionnaire; 84% AI use	Academic misconduct, overreliance, reduced critical thinking
Liu (24) China	788 medical students; years 1–5	Online questionnaire; AI familiarity and use	Academic integrity, bias, privacy, reduced critical thinking

AI: artificial intelligence. AI-related awareness, previous use, and formal training were reported using different measures across studies. Percentages should therefore not be interpreted as directly comparable estimates.

3.3 Medical Educators' Perspectives.

Two of the eight included studies investigated educators' perspectives on AI use in medical education (Table 2). In the first study, Cervantes et al. (25) conducted a survey among 48 educators who worked at allopathic and osteopathic medical schools in a university in the US. The second study was carried out by Al Zahrani et al. (26) and included 293 faculty members from disciplines of medicine, nursing, applied health sciences, and pharmacy in Saudi Arabia.

According to Cervantes et al. (25), 85% of the teachers were aware of generative AI, but 42% had not used them before. Some of the advantages that faculty members mentioned were the efficiency of research as well as the automation of routine tasks. However, they also raised concerns about cheating in homework and assessments (97%), inaccurate or misleading information (95%), lack of contextual understanding (86%), and reduced human interaction during feedback (83%).

Al Zahrani et al. (26) reported an overall AI knowledge score of 58.9% and a positive perception score of 74.8% among health sciences faculty. Nevertheless, 72.4% of the participants had never received any formal training in AI, and only 33.7% believed that AI-generated outputs were reliable and accurate. Opinions on whether AI supported academic integrity varied. While 21.1% agreed, 35.8% were neutral, and 43.0% disagreed or strongly disagreed.

Overall, both studies showed positive attitudes towards AI use among educators, alongside concerns about academic integrity, information accuracy, and responsible use. Differences in participant groups and survey methods limited direct comparisons between the studies.

Table 2. Characteristics and main ethical findings of studies investigating medical educators' perspectives on AI in medical education.

Study / Country	Participants and background	AI experience / Assessment	Main ethical findings
Cervantes (25) USA	48 educators from allopathic and osteopathic medical schools	12-item survey; 85% aware of GenAI; 42% never used it	Cheating, misinformation, lack of context, reduced human interaction, insufficient guidelines
Al Zahrani (26) Saudi Arabia	293 faculty: medicine (44), nursing (58), applied health sciences (176), pharmacy (15)	Validated questionnaire; 72.4% had no formal AI training	Reliability, academic integrity, privacy, overreliance, bias, reduced human interaction

AI: artificial intelligence; GenAI: generative artificial intelligence. The studies involved different educator populations and assessment instruments; their findings should not be interpreted as directly comparable estimates.

Table 3 provides a comparison of the ethical issues addressed in student- and educator-focused studies. Both groups of studies examined academic integrity, the reliability of AI-generated content, and responsible AI use. Student-focused studies more often addressed AI-assisted learning, academic misconduct, and overreliance on AI. Educator-focused studies placed more emphasis on assessment integrity, institutional guidance, and human interaction in education. These differences reflect the topics examined in the studies rather than established differences between students and educators.

Table 3. Comparison of ethical perceptions and concerns reported in student- and educator-focused studies.

Ethical domain	Students (6 studies)	Educators (2 studies)
Educational benefits	Learning, information retrieval, academic writing, and research support (19–24)	Teaching, assessment, research, and productivity (25,26)
Academic integrity	Plagiarism, cheating, misconduct, and originality (19–24)	Cheating in assessments, plagiarism, and academic standards (25,26)
AI reliability	Misinformation, inaccurate outputs, and fabricated information (19–24)	Inaccurate outputs and lack of contextual understanding (25,26)
Privacy and bias	Privacy, confidentiality, and algorithmic bias (20,21,24)	Privacy, data security, and bias (25,26)
Educational development	Overreliance and concerns about critical thinking (19,23,24)	Reduced human interaction and dependence on AI (25,26)
Governance and AI literacy	Clear rules, ethical guidance, and AI literacy needs (21–24)	Institutional policies, faculty training, and oversight (25,26)

The table presents a thematic comparison of concerns reported across the included studies. Citations identify relevant supporting studies and do not imply that every participant or study reported the same concern. Differences in survey instruments, participant populations, and outcome measures preclude direct quantitative comparisons.

3.4 Methodological Quality Assessment.

The item-level methodological quality assessment of the eight included studies is summarized in Table 4. The AXIS appraisal identified methodological differences in sampling procedures, sample size justification, questionnaire development, and reporting of potential sources of bias.

Pallivathukal et al. (19) and Alfahl (22) reported sample size calculations. Several studies described questionnaire development, pilot testing, or validation, including Pallivathukal et al. (19), Ganjavi et al. (20), Hu et al. (21), Alfahl (22), Lymar et al. (23), Liu et al. (24), and Al Zahrani et al. (26). Hu et al. (21) reported sending reminders to non-respondents. In contrast, Lymar et al. (23) reported a response rate of only 4.9% (244 of 5,000 invited participants), raising concerns about non-response bias and the representativeness of the sample. Uncertainty remained for several items where the available publications did not provide sufficient information to support a definitive appraisal. The cross-sectional designs, convenience or incompletely documented sampling procedures, and variation in response-rate reporting and assessment methods should be considered when interpreting the generalizability and comparability of the findings.

Table 4. Item-level methodological appraisal of the included studies using the AXIS checklist.

AXIS Items	Palliv.	Ganjavi	Hu	Alfahl	Lymar	Liu	Cervantes	Zahrani
Q1: Clear study aims	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q2: Appropriate study design	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q3: Sample size justified	Yes	No	No	Yes	No	No	No	No
Q4: Target population clearly defined	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q5: Appropriate sampling frame	Yes	DK	Yes	Yes	Yes	Yes	Yes	Yes

Q6: Representative participant selection	No	No	No	DK	No	No	DK	DK
Q7: Measures addressing non-responders	No	No	Yes	No	No	No	No	No
Q8: Appropriate variables measured	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q9: Appropriate and previously tested instruments	Yes	Yes	Yes	Yes	Yes	Yes	DK	Yes
Q10: Statistical significance or precision defined	Yes	Yes	Yes	Yes	DK	Yes	DK	Yes
Q11: Reproducible methods	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q12: Basic data adequately described	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q13: Response rate raises non-response bias concerns	DK	DK	DK	DK	Yes	DK	DK	DK
Q14: Information on non-responders	No	No	No	No	Yes	No	No	No
Q15: Internally consistent results	Yes	Yes	Yes	DK	Yes	Yes	Yes	DK
Q16: Analyses described in Methods presented	Yes	Yes	Yes	DK	Yes	Yes	Yes	Yes
Q17: Conclusions justified by results	Yes	Yes	Yes	DK	Yes	Yes	Yes	Yes
Q18: Study limitations discussed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q19: Potentially influential funding or conflicts of interest	No	No	No	No	No	No	No	No
Q20: Ethical approval or consent obtained	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Each finding is a separate appraisal judgment. DK is not evidence of misconduct or poor quality; it identifies limits of the published report or unresolved ambiguities.

4. Discussion

4.1 Key Findings and Overall Interpretation.

This systematic review highlights a discrepancy between the growing discussion of ethical issues surrounding artificial intelligence (AI) in medical education and the limited empirical evidence available from medical students and educators themselves. Only eight studies met the eligibility criteria, all employing cross-sectional designs. Across these studies, AI was generally perceived as useful for improving efficiency, productivity, and access to educational resources, while recurring concerns included plagiarism, academic dishonesty, misinformation, fabricated

references, bias, privacy, reduced originality, overreliance on AI, and the potential impairment of critical thinking.

Although students and educators shared many concerns, the included studies suggested differences in emphasis. Students more frequently highlighted the practical and educational utility of AI, whereas educator-focused studies placed greater emphasis on academic integrity, educational quality, and professional standards. These findings should be interpreted cautiously because student-based studies predominated and direct comparisons between stakeholder groups were limited. Nevertheless, the relative lack of educator-focused evidence represents an important gap, given the role of educators and institutions in defining acceptable AI use and establishing educational and professional standards.

Beyond academic misconduct, these findings raise broader questions about responsibility and professional formation in medical education. Medical training involves not only acquiring information but also developing critical judgment and the ability to appraise the reliability of evidence (27). Concerns regarding misinformation and fabricated references may therefore be understood not only as technical limitations of AI but also as challenges to learners' ability and responsibility to critically assess AI-generated information (28, 29). Similarly, overreliance on AI may become educationally problematic when it reduces engagement with reasoning processes that contribute to the development of clinical judgment (30).

These considerations suggest that AI literacy in medical education should extend beyond technical competence. Medical students should also understand the limitations, ethical implications, and appropriate uses of AI-supported technologies (31, 32). Accordingly, educational and institutional guidance should address not only how AI tools are used but also principles of verification, transparency, accountability, and human responsibility for AI-assisted outputs (29).

Overall, this review extends existing literature by showing that, despite extensive discussion of AI-related ethical concerns, the empirical evidence underlying these discussions remains limited, predominantly descriptive, and largely student-focused. Future research should move beyond identifying ethical concerns to examine actual AI-related practices, differences between stakeholder groups, and the influence of AI literacy, training, and institutional guidance on responsible use.

4.2 Academic Ethics, Integrity, and the Responsible Integration of AI in Medical Education.

The ethical challenges identified across the included studies suggest that AI integration in medical education should not be evaluated solely in terms of its educational benefits. While AI can support academic tasks, it also complicates the distinction between acceptable assistance and academic misconduct (19–26). This distinction is important because academic integrity concerns not only the originality of submitted work but also transparency regarding how it was produced and whether it reflects the student's own understanding. These findings suggest a need for clearer expectations regarding permissible AI assistance, attribution, and disclosure, rather than treating all AI use as inherently inappropriate (28, 33–36,39).

These issues can be interpreted through the six fundamental values of academic integrity identified by the International Center for Academic Integrity (ICAI): honesty, trust, fairness, respect, responsibility, and courage (4). Plagiarism and undisclosed AI assistance relate to honesty and responsibility, while unequal access to AI tools and differences in institutional expectations raise questions about fairness. The reliability of AI-generated information and transparency regarding its use are also relevant to trust, whereas respect and courage emphasize acknowledging intellectual contributions and maintaining ethical standards. This framework provides a broader

perspective for interpreting the concerns reported in the included studies, although it was not used as a predefined criterion for study selection or data extraction.

Concerns about misinformation, fabricated references, and inaccurate outputs (19–21, 24, 25) extend beyond academic misconduct to the reliability of information used in medical education. Previous literature has also highlighted algorithmic bias, limited contextual understanding, privacy risks, and a lack of transparency in AI systems (33, 35–37). These concerns suggest that responsible AI use requires more than appropriate attribution, as even transparently disclosed AI assistance may introduce inaccurate or biased information. This is particularly relevant to medical education, where students must learn to critically evaluate information that may inform their future clinical decisions.

Similarly, concerns about overreliance on AI, reduced originality, and impaired critical thinking (19, 23, 24) suggest a possible tension between immediate academic efficiency and independent learning. However, the included cross-sectional studies examined perceptions rather than demonstrating that AI directly affects these abilities. Its educational implications may depend on how the technology is used. Using AI to compare explanations or critically evaluate alternative interpretations differs from accepting generated content without verification. Therefore, students' independent reasoning and engagement with AI-generated information may be more relevant than AI use alone when considering its educational implications (7, 8, 28, 35–39).

Taken together, these findings suggest that academic integrity in AI-supported medical education extends beyond preventing plagiarism and cheating to include transparency, critical evaluation, and responsibility for AI-assisted outputs. These considerations are particularly important in medical training, where independent judgment and professional accountability are essential.

4.3 Students' and Educators' Perspectives.

Across the included studies, both medical students and educators generally expressed favorable attitudes toward AI integration while also raising concerns about academic integrity, the reliability of AI-generated information, and its responsible use (19–26). However, differences in emphasis emerged between the two groups. Student-focused studies more frequently discussed AI in relation to its immediate educational benefits, including information retrieval, academic writing, and support for learning activities (19–24). In contrast, educator-focused studies placed greater emphasis on assessment integrity, educational quality, institutional guidance, and the preservation of human interaction in teaching (25, 26). These differences may reflect the distinct educational roles of students and educators rather than fundamentally different ethical positions.

Differences were also observed across educational levels. Liu et al. (24) reported higher ethical concern scores among students in more advanced academic years, suggesting that educational experience may be associated with greater awareness of AI-related ethical issues. However, this relationship cannot be interpreted as causal because of the cross-sectional design. Moreover, the studies differed in their assessment instruments and participant characteristics, making it difficult to determine whether similar patterns exist across different educational settings.

The geographical and institutional diversity of the included studies provides further context for interpreting the findings. Studies conducted in Malaysia, the United States, China, Saudi Arabia, and Ukraine identified overlapping ethical concerns, despite differences in their educational environments (19–26). Nevertheless, variation in AI awareness, previous use, and formal training across studies should not be interpreted as evidence of regional differences without accounting for

differences in sampling methods, participant populations, and survey instruments. These findings suggest that institutional context and access to AI education may be relevant factors, although their independent contributions cannot be established from the available evidence.

Importantly, these comparisons remain limited by the predominance of student-focused studies and the inclusion of only two educator-focused studies. The available evidence therefore identifies recurring themes and possible differences in emphasis rather than statistically established differences between stakeholder groups or geographical regions. Future studies using comparable instruments across educational levels, institutions, and stakeholder groups would help clarify how these factors relate to ethical perceptions and practices.

4.4 Regulation, AI Literacy, and Curriculum Integration.

Across the included studies, medical students and educators identified the need for clearer institutional policies, AI literacy education, ethical guidance, and curriculum integration to support the responsible use of AI in medical education (19, 20, 23–26). Some studies highlighted uncertainty regarding acceptable AI use, while educator-focused studies also reported limited AI training despite generally favorable attitudes toward AI integration (25, 26). These findings suggest that positive attitudes toward AI do not necessarily indicate sufficient preparation for its responsible educational use.

The broader literature also emphasizes the importance of ethical reasoning, transparency, data governance, AI literacy, curriculum development, and faculty training in AI integration strategies (15, 17, 29, 35, 40-42). In this context, medical education should address not only the technical use of AI tools but also the verification of AI-generated information, recognition of fabricated references and algorithmic bias, protection of confidential data, and appropriate disclosure of AI assistance. Faculty development is equally important for establishing clear expectations and designing assessments that preserve students' independent reasoning and professional responsibility.

However, the included studies primarily examined participants' perceptions, concerns, and recommendations. They did not directly evaluate the effectiveness of institutional policies, AI literacy programmes, or curriculum interventions. Therefore, the educational and institutional measures discussed here should be interpreted as implications of the available evidence rather than interventions whose effectiveness has been established by this review.

4.5 Contribution to Existing Literature and Research Priorities.

Previous reviews have discussed ethical challenges associated with AI in medical education, including academic integrity, governance, and curricular integration (14, 17, 28). The present systematic review addresses a narrower but complementary question by synthesizing original empirical studies that used structured, closed-ended assessments to investigate ethical perceptions and practices among medical students and educators. By focusing on these studies, the review distinguishes stakeholder-reported concerns from the broader conceptual and theoretical discussions presented in the existing literature.

The contribution of this review lies primarily in organizing findings from eight eligible cross-sectional studies, identifying recurring ethical concerns across stakeholder groups, and examining the methodological and contextual limitations of the available empirical evidence. In particular, the synthesis highlights the predominance of student-focused research, the limited evidence concerning educators' perspectives, and the heterogeneity in participant characteristics, educational settings, and assessment instruments. These findings provide a clearer understanding of both the ethical issues currently addressed in empirical research and the gaps that remain in the evidence base.

Several priorities for future research emerge from these findings. First, studies should include more diverse educational and institutional settings and investigate students' and educators' perspectives using comparable assessment instruments. Second, future research should provide more detailed reporting of sampling procedures, sample size justification, instrument validity and reliability, and potential non-response bias. Third, longitudinal and intervention-based studies are needed to examine whether AI literacy education and institutional policies influence actual AI-related practices, academic integrity, and educational outcomes. Finally, qualitative research could complement structured surveys by providing a deeper understanding of how students and educators interpret acceptable AI use across different educational contexts.

4.6 Limitations.

This systematic review has several limitations that should be considered when interpreting its findings. First, only eight studies met the eligibility criteria, and all employed cross-sectional designs based primarily on self-reported data. Therefore, the findings largely reflect participants' perceptions and reported practices rather than objectively measured ethical behavior or educational outcomes. The predominance of student-focused studies also limits the available evidence regarding educators' perspectives.

Second, the included studies were conducted in different geographical, institutional, and educational settings. Differences in educational systems, institutional policies, previous AI experience, and cultural perceptions of academic integrity may have influenced the reported findings. In addition, the studies used different questionnaires, outcome measures, and definitions of ethical AI use. This heterogeneity limited direct comparisons between studies and made quantitative synthesis inappropriate. Methodological limitations identified through the AXIS assessment, particularly those related to sampling procedures and potential non-response bias, should also be considered when interpreting the generalizability of the findings.

Third, the literature search was limited to PubMed and Scopus, English-language publications, and studies published between January 2020 and March 2026. The search strategy also focused primarily on academic integrity-related terminology, such as plagiarism, cheating, and academic misconduct. As a result, relevant studies addressing broader ethical issues, including privacy, algorithmic bias, transparency, or data governance, may not have been identified.

Finally, this review included only original studies using structured, closed-ended assessment instruments. Although this approach allowed a focused synthesis of survey-based evidence, studies relying exclusively on qualitative methods were excluded. Such studies may provide additional insights into how educational, institutional, and cultural contexts shape ethical perceptions and practices related to AI use.

Recommendations to support the responsible integration of AI into medical education

- Develop clear institutional policies defining acceptable AI use, including expectations for transparency, attribution, and accountability.
- Integrate AI literacy and ethical considerations into medical curricula, emphasizing critical evaluation of AI-generated information and responsible use.
- Provide faculty development programmes addressing AI literacy, academic integrity, and appropriate assessment practices.
- Maintain human oversight in AI-assisted teaching, assessment, and research activities.
- Promote equitable access to AI-related educational resources.

- Conduct longitudinal and intervention-based studies to evaluate the educational and ethical implications of AI use.

5. Conclusions

- This systematic review synthesized findings from eight cross-sectional studies examining medical students' and educators' ethical perceptions and practices related to artificial intelligence (AI) in medical education. Although AI was generally viewed as a useful tool for learning, teaching, and research, recurring concerns included academic misconduct, misinformation, algorithmic bias, data privacy, and overreliance on AI-generated content.

- The findings suggest that responsible AI use involves more than preventing plagiarism and cheating. It also requires transparency, accountability, appropriate disclosure of AI assistance, and critical evaluation of AI-generated information. Student-focused studies more frequently emphasized the practical benefits of AI, while educator-focused studies placed greater emphasis on assessment integrity, educational quality, and institutional responsibilities. However, these differences should be interpreted cautiously given the limited number of educator-focused studies and the variation in assessment methods.

- Overall, this review highlights the importance of clear institutional guidance, AI literacy education, faculty development, and responsible curriculum integration. As the available evidence is largely based on self-reported perceptions, further longitudinal and intervention-based research is needed to examine actual AI-related practices and evaluate the effectiveness of educational and institutional measures.

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6. References

1. Hou Y. What do we mean by "AI integration"? Toward a typology of integrating artificial intelligence in higher education. *High Educ.* **2025**. https://doi.org/10.1007/s10734-025-01603-z
2. Zhai X, Chu X, Chai CS, Jong MSY, Istenic A, Spector M, et al. A review of artificial intelligence (AI) in education from 2010 to 2020. *Complexity.* **2021,** 2021(1), 8812542. https://doi.org/10.1155/2021/8812542
3. Chan KS, Zary N. Applications and challenges of implementing artificial intelligence in medical education: integrative review. *JMIR Medical Education.* **2019**, 5(1), e13930. https://doi.org/10.2196/13930
4. International Center for Academic Integrity. *The fundamental values of academic integrity.* 3rd ed. International Center for Academic Integrity (ICAI). **2021.** https://academicintegrity.org/aws/ICAI/asset_manager/get_file/911282?ver=1
5. Explanatory memorandum on the updated OECD definition of an AI system. **2024.** Report No.: 8. https://doi.org/10.1787/623da898-en
6. The European code of conduct for research integrity - ALLEA. **2023.** https://allea.org/code-of-conduct/.

7. Boscardin CK, Abdulnour R-EE, Gin BC. Macy foundation innovation report part I: current landscape of artificial intelligence in medical education. *Acad Med*, **2025**, 100(Supplement_1), S15–S21. https://doi.org/10.1097/ACM.0000000000006107
8. Gin BC, LaForge K, Burk-Rafel J, Boscardin CK. Macy foundation innovation report part II: From hype to reality: innovators' visions for navigating AI integration challenges in medical education. *Acad Med*, **2025,** 100(Supplement_1), S22–S29. https://doi.org/10.1097/ACM.0000000000006117
9. Boscardin CK, Gin B, Golde PB, Hauer KE. ChatGPT and generative artificial intelligence for medical education: potential impact and opportunity. *Acad Med.* **2024**, 99(1), 22–7. https://doi.org/10.1097/ACM.0000000000005439
10. Jalali A, Houssein KH, Fotsing S. Twelve practical tips for integrating AI into medical education: Tutorial to support educators across teaching, research, administration, and ethical domains. *JMIR Medical Education*. **2025,** 11, e81297. https://doi.org/10.2196/81297
11. Sriram A, Ramachandran K, Krishnamoorthy S. Artificial intelligence in medical education: Transforming learning and practice. *Cureus.* **2025**, 17(3), e80852. https://doi.org/10.7759/cureus.80852
12. Farhud DD, Zokaei S. Ethical issues of artificial intelligence in medicine and healthcare. *Iran J Public Health.* **2021**, 50(11), i–v. https://doi.org/10.18502/ijph.v50i11.7600
13. Elendu C, Amaechi DC, Elendu TC, Jingwa KA, Okoye OK, John Okah M, et al. Ethical implications of AI and robotics in healthcare: A review. *Medicine (Baltimore).* **2023**, 102(50), e36671. https://doi.org/10.1097/MD.0000000000036671
14. Itani A, Gronseth SL, Musaad S, Nguyen T, Mirabile Y, Beech BM. Ethical considerations for teaching with artificial intelligence: a scoping review in medical education settings. *International Journal of Educational Technology in Higher Education.* **2025**, 22(1), 68. https://doi.org/10.1186/s41239-025-00563-9
15. Triola MM, Rodman A. Integrating generative artificial intelligence into medical education: Curriculum, policy, and governance strategies. *Acad Med.* **2025,** 100(4), 413–418. https://doi.org/10.1097/ACM.0000000000005963
16. Bardakçı T, Barış M, Dabbagh H, Savulescu J, Saraçoğlu M, Razai MS. Teaching AI ethics in medical schools: a scoping review protocol on the ethical-technical balance in curricular frameworks. *BMJ Open.* **2026**, 16(6), e111721. https://doi.org/10.1136/bmjopen-2025-111721
17. Weidener L, Fischer M. Teaching AI ethics in medical education: A scoping review of current literature and practices. *Perspect Med Educ.* **2023**, 12(1), 399–410. https://doi.org/10.5334/pme.954
18. Downes MJ, Brennan ML, Williams HC, Dean RS. Development of a critical appraisal tool to assess the quality of cross-sectional studies (AXIS). *BMJ Open.* **2016**, 6(12), e011458. https://doi.org/10.1136/bmjopen-2016-011458
19. Pallivathukal RG, Soe HHK, Donald PM, Samson RS, Ismail ARH. ChatGPT for academic purposes: Survey among undergraduate healthcare students in Malaysia. *Cureus.* **2024**, 16(1), e53032. https://doi.org/10.7759/cureus.53032
20. Ganjavi C, Eppler M, O'Brien D, Ramacciotti LS, Ghauri MS, Anderson I, et al. ChatGPT and large language models (LLMs) awareness and use. A prospective cross-sectional survey of U.S. medical students. *PLOS Digit Health*. **2024**, 3(9), e0000596. https://doi.org/10.1371/journal.pdig.0000596
21. Hu N, Jiang XQ, Wang YD, Kang YM, Xia Z, Chen HH, et al. Status and perceptions of ChatGPT utilization among medical students: a survey-based study. *BMC Med Educ.* **2025**, 25, 831. https://doi.org/10.1186/s12909-025-07438-7
22. Alfahl S. Knowledge attitudes and ethical concerns about artificial intelligence among medical students at Taibah University: A cross-sectional study. *Adv Med Educ Pract.* **2025**, 16, 1609–1620. https://doi.org/10.2147/AMEP.S528281

23. Lymar L, Kuchyn I, Bielka K, Puljak L. Academic misconduct and artificial intelligence use by medical students, interns and PhD students in Ukraine: a cross-sectional study. *BMC Med Educ.* **2025**, 25, 1496. https://doi.org/10.1186/s12909-025-08100-y
24. Liu M, Cheng Y, Li S, Wang S, Du F, Wei X, et al. Exploring medical students' attitudes and perceptions toward artificial intelligence in medicine in Shandong Province, China. *BMC Med Educ.* **2025**, 26(1), 106. https://doi.org/10.1186/s12909-025-08465-0
25. Cervantes J, Smith B, Ramadoss T, D'Amario V, Shoja MM, Rajput V. Decoding medical educators' perceptions on generative artificial intelligence in medical education. *J Investig Med.* **2024**, 72(7), 633–639. https://doi.org/10.1177/10815589241257215
26. Zahrani EMA, Elsafi SH, Al Musallam LD, Alharbi AH, Aldossari HM, Alomar AM, et al. Faculty perspectives on artificial intelligence's adoption in the health sciences education: a multicentre survey. *Front Med.* **2025**, 12, 1663741. https://doi.org/10.3389/fmed.2025.1663741
27. Cruess RL, Cruess SR, Boudreau JD, Snell L, Steinert Y. A Schematic Representation of the Professional Identity Formation and Socialization of Medical Students and Residents: A Guide for Medical Educators. Acad Med. **2015**, 90(6), 718–725. https://doi.org/10.1097/ACM.0000000000000700
28. Sallam M, Sallam M. Ethical aspects of implementing generative artificial intelligence in medical education: a narrative review. *History and Philosophy of Medicine*. **2025,** 7(4), 20. https://doi.org/10.53388/HPM2025020
29. Guidance for generative AI in education and research. *UNESCO*, **2023**. https://doi.org/10.54675/EWZM9535
30. Kasneci E, Sessler K, Küchemann S, Bannert M, Dementieva D, Fischer F, et al. ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences.* **2023**, 103, 102274. https://doi.org/10.1016/j.lindif.2023.102274
31. Paranjape K, Schinkel M, Nannan Panday R, Car J, Nanayakkara P. Introducing Artificial Intelligence Training in Medical Education. *JMIR Med Educ*. **2019**, 5(2), e16048. https://doi.org/10.2196/16048
32. McCoy LG, Nagaraj S, Morgado F, Harish V, Das S, Celi LA. What do medical students actually need to know about artificial intelligence? *npj Digit Med*. **2020**, 3, 86. https://doi.org/10.1038/s41746-020-0294-7
33. Ning Y, Ong JCL, Cheng H, Wang H, Ting DSW, Tham YC, et al. How can artificial intelligence transform the training of medical students and physicians? *Lancet Digit Health*. **2025,** 7(10) ,100900. https://doi.org/10.1016/j.landig.2025.100900
34. Ugwu CU. Impact of generative artificial intelligence on healthcare education: A systematic review of learning outcomes and academic integrity. *ijars*. **2026**, 2(2), 1322–1355. https://doi.org/10.70593/deepsci.0202053
35. Izquierdo-Condoy JS, Arias-Intriago M, Montero Corrales L, Ortiz-Prado E. Artificial intelligence in medical education: transformative potential, current applications, and future implications. *JMIR Med Educ.* **2026**, 12, e77127. https://doi.org/10.2196/77127
36. Le S, Kim Bao G. Artificial intelligence integration in medical education: A landscape with hot dimensions in Viet Nam. *World Bank Group.* **2026**. https://doi.org/10.1596/45024
37. Saroha S. Artificial intelligence in medical education: promise, pitfalls, and practical pathways. *Adv Med Educ Pract*. **2025**, 16, 1039–1046. https://doi.org/10.2147/AMEP.S523255
38. Jaleel A, Aziz R, Farid G, Bashir MZ. The impact of ChatGPT on academic integrity in medical education: a developing nation perspective. Front Educ. 2025, 10, 1554444. https://doi.org/10.3389/feduc.2025.1554444
39. Lund B, Mannuru NR, Teel ZA, Lee TH, Ortega NJ, Simmons S, et al. Student perceptions of AI-assisted writing and academic integrity: Ethical concerns, academic misconduct, and use of generative AI in higher education. *AI in Education.* **2025**, 1(1), 2. https://doi.org/10.3390/aieduc1010002

40. Civaner MM, Uncu Y, Bulut F, Chalil EG, Tatli A. Artificial intelligence in medical education: a cross-sectional needs assessment. BMC Med Educ. 2022, 22, 772. https://doi.org/10.1186/s12909-022-03852-3
41. Gaur A, Kirani Tan J, Sridhar Rao M, Fuad M, Bhatti T, Rishab Bharadwaj H, et al. Artificial intelligence in UK medical education: a framework for curriculum reform. JMIR Med Educ. 2026, 12, e81953. https://doi.org/10.2196/81953
42. Blanco MA, Nelson SW, Ramesh S, Callahan CE, Josephs KA, Jacque B, et al. Integrating artificial intelligence into medical education: a roadmap informed by a survey of faculty and students. Med Educ Online. 2025, 30(1), 2531177. https://doi.org/10.1080/10872981.2025.2531177


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