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Original Research Article

A cross-sectional study on attitude and understanding of artificial intelligence and its use in medical education among medical students in a tertiary care teaching hospital

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ABSTRACT

Background: Artificial intelligence (AI) has the potential to revolutionize medical education by enhancing diagnostic accuracy, improving decision-making and streamlining healthcare delivery. Aims and objectives of the study were to assess the attitude towards the use of AI in medical education and to evaluate the level of understanding of AI concepts among medical students along with identification of factors influencing their attitudes and understanding of AI.
Methods: A cross-sectional study was undertaken at a tertiary care teaching hospital after taking institutional ethics committee (IEC) approval. A total of 250 medical students from various academic years were included in the study. A self-made structured questionnaire was administered to collect data on student's demographic characteristics, attitudes towards AI, understanding of AI concepts and their readiness to integrate AI into their future practice. Data were later analyzed using appropriate statistical tests.
Results: Majority of students were aware of AI. Most students acknowledged AI's potential to enhance medical learning, particularly in diagnostics (76%) and nearly half (45%) of students expressed concerns about AI replacing human judgment in clinical decision-making. Moreover, the study found a significant gap in formal education on AI with majority of students stating that AI was not adequately addressed in their curriculum.
Conclusions: While medical students recognize the transformative potential of AI in healthcare, there is a clear need for enhanced AI education within medical curricula. So, this study highlights the importance of integrating AI-related content into medical education to prepare students for the evolving landscape of healthcare.

Keywords: Medical students, Artificial intelligence, Healthcare, Medical curriculum, AI ethics, Ethics

INTRODUCTION

Artificial intelligence (AI) may be defined as the ability of computers to perform tasks that normally require human intelligence. It also refers to the development and programming of devices having human-like characteristics which can perform various complex functions such as diagnosing a medical condition, discovering new drug, and proving mathematical theorems. It is currently being applied in our everyday activities, like from virtual assistants on our phones to self-driving cars and sophisticated robotics.[1] So currently, there have been extensive discussions regarding its rapid advancement and the revolutionary impact it can have on several fields.[2]

As the human society has entered the age of artificial intelligence; medical practice and medical education are undergoing profound changes. AI is rapidly transforming various sectors, including healthcare and medical education. AI applications, such as machine learning, natural language processing, and robotics, have been increasingly integrated into medical practice, enhancing diagnostic accuracy, personalizing patient care, and optimizing administrative functions.[3] AI is increasingly

transforming various fields, including healthcare, by providing new opportunities for patient care, diagnostics, and personalized medicine. In the realm of medical education, AI has the potential to revolutionize learning by providing personalized education, facilitating complex decision-making, and enhancing the training of future healthcare professionals.[4] The integration of AI tools, such as machine learning algorithms, natural language processing, and predictive analytics, can lead to more efficient and effective educational practices. AI is revolutionizing multiple sectors, including healthcare and medical education.[5]

The role of AI is constantly expanding in the field of medicine. It also promises to revolutionize patient care in the coming years with the aim of optimizing personalized medicine and tailoring it to the use of individual patients. As far as the acceptance of AI is concerned, some specialties such as radiology have quickly adopted to it, whereas others like pathology are only now beginning to utilize AI in clinical use.[6]

As AI continues to evolve, it is becoming crucial for medical professionals to be well-versed in its applications, potential, and limitations. Consequently, integrating AI into medical education is gaining momentum globally, aiming to prepare future healthcare providers to harness AI-driven innovations effectively. Its application in medicine can be beneficiary in several ways. It is believed to reduce the burden of physicians as they can focus on establishing diagnosis and updating their knowledge as opposed to recalling what they know or interpreting digital data. Therefore, in the long run, it can reduce medical cost and increase efficiency of hectic medical departments.[7] Conversely, there are numerous ethical concerns, including the threat to data security, the changing nature of the patient-physician relationship in health, the generation of potential social inequalities, and the development of AI robots that may eventually replace many professional tasks, which can result in increasing unemployment rates.[8]

Medical students, as future healthcare professionals, are key stakeholders in this transformation. Their understanding and attitude towards AI in medical education can significantly impact the adoption and application of AI technologies in clinical practice. Despite the growing emphasis on AI in healthcare, there is a limited understanding of how medical students perceive its use in their education. Thus, it is the need of hour to review the medical curricula and educational opportunities for patients, physicians, medical students, health administrators, and other healthcare professionals to foster a better understanding of the numerous aspects of health care AI, both positive and negative.[9] Understanding their attitudes, awareness, and preparedness to incorporate AI tools in their learning and future practice is essential for designing effective educational strategies that foster AI literacy.

This cross-sectional study aims to evaluate the attitude and understanding of AI use in medical education among medical students at a tertiary care teaching hospital. By assessing their current knowledge, perceptions, and perceived barriers or facilitators, this study will provide valuable insights into how medical curricula can be adapted to integrate AI concepts effectively and prepare students for the future of medicine in an AI-driven era.

Rationale

Despite the rapid growth of AI in healthcare, there is limited understanding of how medical students perceive its integration into their education. Students' attitudes and understanding towards AI can significantly impact its adoption and effective utilization. Therefore, this study aims to assess the attitudes and understanding of medical students in a tertiary care teaching hospital towards the use of AI in medical education, identify factors influencing these attitudes, and provide insights for curriculum development.

Aims and objectives

Aims and objectives of the study were to assess the attitude of medical students towards AI in medical education, to evaluate the level of understanding and perception towards AI among medical students, and to identify factors influencing student's attitudes and understanding of AI.

METHODS

A cross-sectional, observational study was conducted at Government Medical College Jammu, after taking IEC approval. The purpose of the study was explained and informed consent was obtained from all participants before they filled out the questionnaire. Confidentiality of all participants was maintained. Data was collected for a period of four weeks; from 24 November 2024 to 24 December 2024. The study population comprised 250 medical students enrolled in different academic years (1st to 5th year) of MBBS program at a tertiary care teaching hospital. Data were collected using a structured questionnaire developed specifically for this study. The questionnaire was pre-tested among 20 students to ensure clarity and reliability. The questionnaire consisted of four sections: demographics - age, gender, year of study, and prior exposure to AI or computer science, attitude towards the use and teaching of AI of medical students in medical education - questions assessing students' perceptions of AI's role in medical education, its benefits, challenges, and potential impact on future careers, understanding of AI concepts and perception towards teaching of AI among medical students - multiple-choice and true/false questions assessing knowledge of AI, machine learning, deep learning, natural language processing, and predictive analytics, and factors influencing student's attitudes and understanding of AI.

Inclusion criteria

Medical students currently enrolled in undergraduate programs (MBBS), students who provide informed consent to participate in the study, and students from all academic years were included.

Exclusion criteria

Students who do not consent to participate in the study were excluded.

Sampling method

For this study convenience sampling method was used. Data were analyzed using statistical package for social sciences (SPSS) version 26.0. Data was later tabulated, analyzed and expressed in as mean±standard deviation (SD) and n (percentage).

RESULTS

Demographics

A total of 250 students participated in the study. The mean age of the participants was 21.6 years (SD=2.1), with 58% being female and 42% male. The distribution of participants across different years of study was as follows: 1st year (20%), 2nd year (22%), 3rd year (20%), 4th year (18%), and 5th year (20%), as shown in Figure 1.

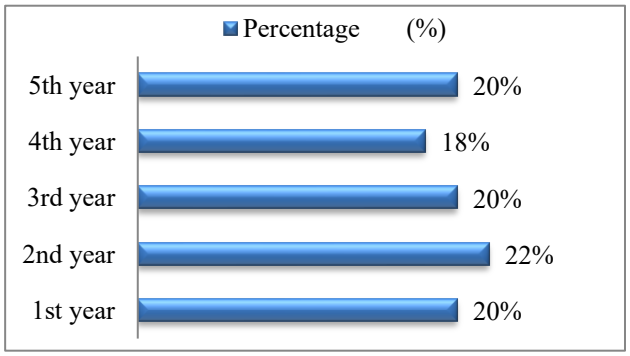

Figure 1: Year wise distribution of the study population.

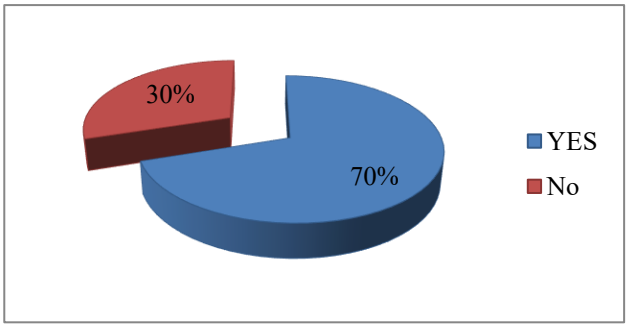

Figure 2: Concerns about the ethical implications of AI.

Attitude towards AI in medical education

Overall, 72% of students expressed a positive attitude towards the integration of AI in medical education, believing that AI could enhance learning and provide personalized education. Most students perceive AI as having a positive or very positive role in the future of medicine (80%), suggesting a high level of optimism about its potential to advance healthcare; however, 18% were neutral. The majority of students (82%), agreed that AI can significantly improve patient outcomes, demonstrating confidence in the potential benefits of AI for clinical care and patient management. This is further reflected in their excitement about the integration of AI into their medical practice, where 82% responded positively. However, a considerable proportion of students (70%) expressed concerns about the ethical implications of AI, highlighting apprehensions regarding data privacy, decision-making transparency, and patient autonomy (Figure 2). These findings emphasize the need for comprehensive education on the ethical and regulatory aspects of AI in medicine.

Interestingly, only a small fraction of students expressed negative or very negative views on the role of AI (5%) or disagreed with its potential to improve outcomes (6%), indicating minimal resistance to AI adoption among the cohort. Notably, attitudes varied significantly by the year of study, with senior students (4th and 5th year) showing more skepticism compared to juniors (1st and 2nd year). In conclusion, while medical students are largely optimistic about AI in medicine and its integration into their future practices, concerns regarding ethical implications suggest that addressing these issues through targeted training and discussion will be essential for smooth implementation.

Attitude towards teaching in AI

An overwhelming 85% of students rated the inclusion of AI in medical education as either "extremely important" or "very important". Thus these findings underscore the increasing recognition among medical students of the importance of incorporating AI into the medical curriculum. Approximately 65% of students expressed interest in additional courses or workshops on AI, indicating enthusiasm for further learning. However, 25% were uncertain, reflecting a potential gap in understanding AI's relevance or a lack of resources. The current medical curriculum was deemed insufficient in covering AI, with 67% of students disagreeing or strongly disagreeing that it adequately addresses AI applications.

The preferred teaching methods included hands-on workshops (75%), guest lectures by AI experts (70%), and online courses (60%), suggesting a preference for interactive and practical approaches. The popularity of "all of the above" (65%) indicates that students value a blended teaching methodology that combines theory, practice, and expert insights. Key barriers to learning AI included a lack of time (50%) and insufficient faculty expertise (45%),

emphasizing the need for dedicated AI courses and faculty training programs. The complexity of the subject (30%) and lack of resources (40%) were also notable barriers (Figure 3).

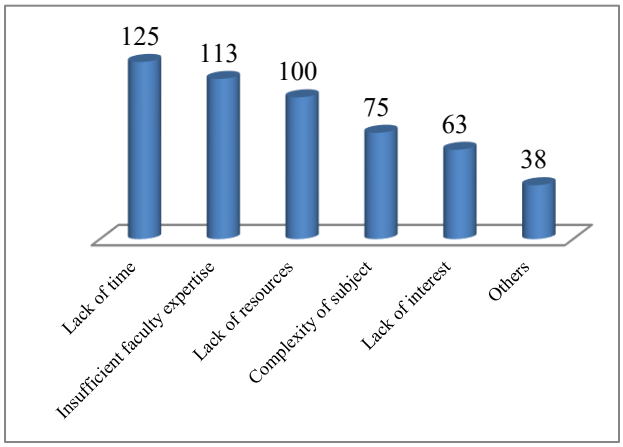

Figure 3: Main barriers to learning AI in medical education

Understanding of AI concepts

Only 40% of students demonstrated a good understanding of basic AI concepts such as machine learning, natural language processing, and deep learning. The remaining 60% had limited or no understanding. The findings also revealed a moderate level of understanding of AI in healthcare among medical students, with only 5% rating their knowledge as "excellent" and the majority (45%) describes it as "average", as shown in Table 1.

Table 1: Current understanding of AI in healthcare.

S. no.	Current understanding of AI in healthcare		
	Response	**Number (n)**	**Percentage (%)**
1	Average	113	45
2	Good	63	25
3	Excellent	13	5
4	Poor	61	25

In terms of technologies associated with AI, machine learning was the most recognized (80%), followed by robotics (65%) and natural language processing (55%). This aligns with the current emphasis on machine learning in AI-driven healthcare innovation. Understanding varied significantly by year of study and previous exposure to AI-related content. Out of them only 25% of 1st year students demonstrated good understanding where as 55% of 5th year students showed a good grasp of AI concepts. Regarding applications, diagnostic imaging (90%) and predictive analytics (85%) were the most identified areas, reflecting widespread awareness of AI's utility in these domains. However, fewer students (65%) identified surgical assistance, despite its growing use in robotic surgeries. These results underscore the need for a broader curriculum that highlights diverse applications of AI. The understanding of how AI algorithms are trained was limited, with only 40% of students agreeing or strongly agreeing that they grasp the basic principles, and 25% disagreeing, highlighting a significant knowledge gap in foundational AI concepts.

Perception towards AI in medical education

Perceived benefits

It included enhanced learning: 65% of students agreed that AI could provide more personalized and efficient learning experiences, decision-making - 60% believed AI could aid in clinical decision-making and problem-solving, and skill development - 55% felt that AI could help develop critical skills needed for modern healthcare (Figure 4).

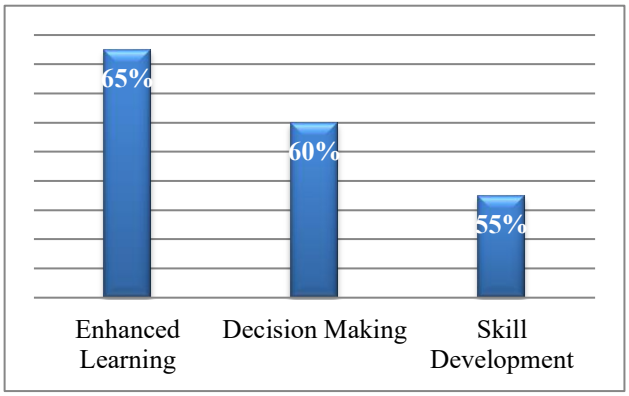

Figure 4: Perceived benefits in the study population.

Perceived challenges

It included ethical concerns - 40% expressed concerns about data privacy, AI-driven biases, and ethical implications, and job security - 30% were worried about potential job displacement due to AI advancements (Figure 5).

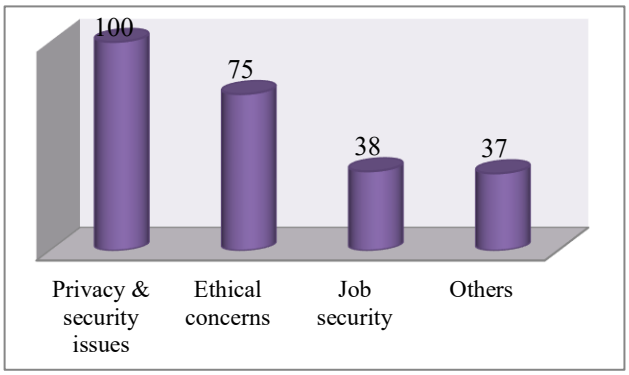

Figure 5: Main concerns about use of AI in medicine.

Factors influencing attitudes and understanding

Several factors were found to influence students' attitudes and understanding of AI. Senior students showed more

enhanced understanding and skepticism compared to juniors. Males demonstrated slightly better understanding but no significant difference in attitude compared to females. Students with prior exposure to AI or related courses showed significantly higher understanding and a more positive attitude towards AI.

DISCUSSION

During the past several years, AI has had an increasing influence in medicine, especially radiology, pathology, pharmacology, ophthalmology, and dermatology. Therefore, this study was conducted to better understand medical student's knowledge and attitude toward medical AI and to identify few barriers influencing their understanding of AI, so as to give few recommendations in revising the current medical curriculum to be AI inclusive.

The results of the current study indicate that while medical students have a generally positive attitude towards the use of AI in medical education, a significant gap in understanding persists across all academic years. This finding is critical as it highlights the disparity between the perceived potential benefits of AI and the actual knowledge base of medical students.[10] A positive attitude towards AI was observed in 72% of students, which aligns with previous studies that found a strong interest and optimism among medical students regarding AI's potential to enhance learning and clinical decision-making.[11]

However, only 40% of the students demonstrated a good understanding of basic AI concepts, such as machine learning, deep learning, and natural language processing. This gap in understanding could stem from the lack of formal education on AI in medical curricula. Current medical education is primarily focused on traditional teaching methods and does not include comprehensive AI training or exposure, which may explain the limited grasp of AI among students.[12]

The findings further indicate that student's attitudes and understanding of AI are influenced by factors such as year of study, gender, and prior exposure to AI. Senior students (4th and 5th years) showed more nuanced and cautious attitudes compared to their junior counterparts, which could be attributed to their greater clinical experience and awareness of the practical challenges associated with AI integration in healthcare settings.[13] Additionally, students who had previous exposure to AI or computer science courses demonstrated a significantly better understanding of AI concepts, suggesting that prior education and experience are key factors in shaping students' knowledge and perceptions.[14,15]

The results of this study are consistent with those of earlier research conducted in different regions. For example, a study by Santos et al in Germany also reported a positive attitude among medical students towards AI, with concerns centered on ethical implications and potential job displacement.[16] Similarly, in a survey on medical students, Sit et al found that while students recognized AI's potential benefits, there was a noticeable lack of understanding of its practical applications in clinical practice.[17]

Moreover, a scoping review by Gandomkar et al revealed that the lack of structured AI education within medical curricula across various countries contributes significantly to the gap in knowledge and understanding. This highlights a global trend where the enthusiasm for AI does not necessarily translate into knowledge competency, a gap that needs to be addressed through educational reforms.[18,19]

Additionally, a study by Sit et al emphasized that senior students and those with more clinical experience tend to be more skeptical about AI's capabilities, mainly due to concerns over its reliability and ethical implications in complex clinical settings.[15] This finding is mirrored in our study, where senior students exhibited more caution and skepticism, potentially due to their increased exposure to the intricacies and ethical dimensions of patient care.[20-26]

Limitations

While this study provides valuable insights into medical students' attitudes and understanding of AI in medical education, it is not without limitations. The use of convenience sampling may limit the generalizability of the findings to all medical students. Additionally, self-reported data through questionnaires could introduce response bias. Future studies should consider longitudinal designs to assess changes in attitudes and understanding over time and include a more diverse sample of students from multiple institutions to enhance generalizability.

CONCLUSION

The results of this study underline the urgent need for integrating AI-related content into the medical education curriculum. The positive attitude among students provides a conductive environment for educational institutions to introduce AI as a core component of medical training. Given the significant gap in understanding, it is essential to design educational programs that cover both the theoretical and practical aspects of AI in medicine. This includes the incorporation of foundational courses on AI, machine learning, and data science, as well as workshops and practical sessions that provide hands-on experience with AI tools and technologies used in clinical decision-making and personalized medicine. Medical educators should also focus on interdisciplinary learning, where collaboration between computer science and medical faculties can lead to the development of tailored AI courses that cater to the specific needs of medical students. Encouraging critical thinking about AI's ethical, legal, and social implications is equally important to ensure that future healthcare professionals are not only competent in using AI technologies but are also equipped to address the ethical challenges that may arise.

Furthermore, continuous professional development programs on AI should be made available to practicing physicians to keep them abreast of advancements in AI and its application in healthcare. This approach will ensure a seamless transition of AI knowledge from medical school to clinical practice, enhancing the overall preparedness of healthcare professionals for an AI-driven healthcare environment.

Recommendations

Future research should explore the effectiveness of different educational interventions, such as AI-based modules or simulation-based learning, in enhancing medical students' understanding of AI. Longitudinal studies could also investigate how exposure to AI during medical education impacts clinical practice and decision-making in the long term. Furthermore, studies focusing on the ethical implications and addressing the concerns raised by students, such as job security and data privacy, could help shape more comprehensive and balanced AI curricula for medical education.

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REFERENCES

1. Ahmad Z, Rahim S, Zubair M, Abdul-Ghafar J. Artificial intelligence (AI) in medicine, current applications and future role with special emphasis on its potential and promise in pathology: present and future impact, obstacles including costs and acceptance among pathologists, practical and philosophical considerations. A comprehensive review. Diagn Pathol. 2021;16:1-16.
2. Jindal A, Bansal M. Knowledge and education about artificial intelligence among medical students fr teaching institutions of India: a brief survey. Med Ed Publish. 2020;9:200.
3. Komasawa N, Nakano T, Terasaki F, Kawata R. Attitude Survey toward Artificial Intelligence in Medicine among Japanese Medical Students. Bull Osaka Med Pharm Univ. 2021;67(1):9-16.
4. Pinto Dos Santos D, Giese D, Brodehl S, Chon SH, Staab W, Kleinert R, et al. Medical students' attitude towards artificial intelligence: a multicentre survey. Eur Radiol. 2019;29(4):1640-6.
5. Gong B, Nugent JP, Guest W, Parker W, Chang PJ, Khosa F, et al. Influence of Artificial Intelligence on Canadian Medical Students' Preference for Radiology Specialty: ANational Survey Study. Acad Radiol. 2019;26(4):566-77.
6. Pauwels R, Del Rey YC. Attitude of Brazilian dentists and dental students regarding the future role of artifici intelligence in oral radiology: a multicenter survey. Dentomaxillofac Radiol. 2021;50(5):20200461.
7. Goldenberg SL, Nir G, Salcudean SE. A new era: artificial intelligence and machine learning in prostate cancer. Nat Rev Urol. 2019;16(7):391-403.
8. Association TWM. Statement on augmented intelligence in medical care. Geneva: Association TWM. 2019.
9. Katznelson G, Gerke S. The need for health AI ethics in medical school education. Adv Health Sci Educ Theory Pract. 2021;26(4):1447-58.
10. Lee SH, Park JY. Medical Students' Attitudes Towards Artificial Intelligence in Medicine: A Cross-Sectional Survey Study. Med Educ Online. 2021;26(1):101-9.
11. Masters K, Oh S. Artificial Intelligence in Medical Education: The Challenges and Opportunities. Med Teacher. 2021;43(3):242-6.
12. Gandomkar R, Mirmoghtadaie Z. Artificial Intelligence in Medical Education: A Scoping Review. Adv Med Educ Pract. 2020;11:345-54.
13. Sit C, Chen J, Chan M. Attitudes and Perceptions of Medical Students Towards Artificial Intelligence. BMC Med Educ. 2020;20(1):299.
14. Lau J, Makam AN, Chai S. Artificial Intelligence in Medicine: Implications for Medical Education. BMC Med Educ. 2021;21:1-11.
15. Mehta N, Harish V, Bilimoria K, Morgado F, Gingsburg S, Law M, et al. Knowledge and attitudes on artificial intelligence in healthcare: a provincial survey study of medical students. Med Ed Publish. 2021;10(75):1-8.
16. Sit C, Srinivasan R, Amlani A, Muthuswamy K, Azam A, Monzon L, et al. Attitudes and perceptions of UK medical students towards artificial intelligence and radiology: a multicentre survey. Insights Imaging. 2020;11(1):14.
17. Pinto Dos Santos D, Giese D, Brodehl S, Chon SH, Staab W, et al. Medical students' attitude towards artificial intelligence: a multicentre survey. Eur Radiol. 2019;29(4):1640-6.
18. Lee J, Wu AS, Li D, Kulasegaram KM. Artificial intelligence in undergraduate medical education: a scoping review. Acad Med. 2021;96(11S):62-70.
19. Topol EJ. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again. Basic Books. 2019.
20. Rigby MJ. Ethical dimensions of using artificial intelligence in health care. AMA J Ethics. 2019;21:121-4.
21. Briganti G, Le Moine O. Artificial intelligence in medicine: today and tomorrow. Front Med. 2020;7:27.
22. Malik P, Pathania M, Rathaur VK. Overview of artificial intelligence in medicine. J Family Med Prim Care. 2019;8(7):2328-31.

23. Mintz Y, Brodie R. Introduction to artificial intelligence in medicine. Minim Invasive Ther. 2019;28(2):73-81.
24. Grunhut J, Wyatt AT, Marques O. Educating future physicians in artificial intelligence (AI): an integrative review and proposed changes. J Med Educ Curric Dev. 2021;8:23821205211036836.
25. Bisdas S, Topriceanu CC, Zakrzewska Z, Irimia AV, Shakallis L, Subhash J, et al. Artificial intelligence in medicine: a multinational multi-center survey on the medical and dental Students' perception. Front Public Health. 2021;9:795284.
26. Blease C, Kharko A, Bernstein M, Bradley C, Houston M, Walsh I, et al. Machine learning in medical education: a survey of the experiences and opinions of medical students in Ireland. BMJ Health Care Inform. 2022;29(1):e100480.

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