ORIGINAL RESEARCH PAPER

Medical Science

KNOWLEDGE, ATTITUDE, AND PRACTICES REGARDING ARTIFICIAL INTELLIGENCE AMONG THE STUDENTS OF A MEDICAL COLLEGE IN NORTH INDIA

KEY WORDS: Artificial Intelligence; Medical Students; Knowledge; Attitude

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ABSTRACT

Background: Artificial Intelligence (AI) is increasingly influencing healthcare and medical education, yet formal AI training remains limited. **Objective:** To assess knowledge, attitudes, perceptions, and practices regarding AI among medical students in Chandigarh. **Methods:** A cross-sectional study was conducted in 2023-24 among 400 MBBS students at Government Medical College and Hospital, Chandigarh, using simple random sampling and a self- administered, semi-structured, validated questionnaire. Data were analyzed in SPSS version 29 using descriptive statistics and the Chi-square test. **Results:** Of 400 respondents, 90.25% knew the term AI, 59.75% knew machine learning, and 32.5% knew deep learning. Only 43.25% knew an AI application in medicine, and 5.25% had received formal AI teaching. **Conclusion:** Awareness of AI was high, but applied knowledge and formal training were limited. Most respondents supported early AI education, indicating a need to integrate structured AI literacy into undergraduate medical education.

INTRODUCTION

Artificial intelligence (AI) has emerged as a transformative force in healthcare, influencing diagnostic accuracy, treatment planning, and patient care. AI encompasses technologies such as machine learning, deep learning, and natural language processing. Despite rapid advances, formal AI education remains underrepresented in undergraduate medical curricula. Studies have reported high awareness of AI alongside gaps in understanding clinical applications, ethics, limitations, and practical use. Medical students generally support AI integration but also express concerns regarding professional displacement. Evidence suggests that effective AI education should address AI fundamentals and limitations, critical interpretation of AI outputs, ethics, data protection, and practical clinical application rather than advanced programming. Structured training has been associated with improved knowledge, confidence, and attitudes, although faculty expertise, infrastructure, and curriculum constraints remain barriers. Against this background, the present study assessed knowledge, attitudes, perceptions, and practices regarding AI among medical students in Chandigarh, India, to identify educational needs relevant to future AI-enabled healthcare.

MATERIAL AND METHODS

A cross-sectional study was conducted among MBBS students from first year to final year at Government Medical College and Hospital (GMCH), Chandigarh. The sample size was calculated using $N=4Pq/d^2$, assuming 50% knowledge of AI and 5% relative precision, giving an ideal sample of 400. Respondents who did not consent or returned incomplete questionnaires were excluded. A self-administered, semi-structured, validated questionnaire was used and the Statistical Package for Social Sciences (SPSS) version 29 software was used for data entry and coding to analyze the data. The data was checked for its distribution (normal or skewed). The univariate data was presented as frequencies, percentages, mean (standard deviations), median (interquartile range).

RESULTS

A total of 400 respondents participated. There were 173 males (43.25%), 225 females (56.25%), and 2 participants identifying as Others (0.5%). Most participants were aged 18–21 years (291; 72.75%), followed by 21–25 years (107; 26.75%) and ≥25 years (2; 0.5%).

Respondents were distributed across Year 1 (104; 26%), Year 2 (121; 30.25%), Year 3 (125; 31.25%), and Year 4 (50; 12.5%).

Knowledge: 361 (90.25%) knew the term AI, 239 (59.75%) knew machine learning, and 130 (32.5%) knew deep learning. Only 173 (43.25%) knew an application of AI in medicine. Among those aware of applications, 37% identified 3D anatomy/robotic surgery, whereas 4.62% identified prognosis/prescription-related applications. Only 5.25% reported having been taught about AI in medical school.

Attitude: 182 (45.3%) agreed that AI would reduce job opportunities, while 107 (26.6%) strongly agreed. Overall, 132 (32.8%) agreed/strongly agreed that AI would replace physicians in the future, while 169 (42%) agreed that AI is essential in medicine. A total of 172 (42.8%) agreed/strongly agreed that AI could influence specialty choice.

Perception: 227 (56.5%) considered AI likely to provide preventive health recommendations; 199 (49.5%) considered it likely to analyze patient information for diagnosis; 203 (50.5%) for prognosis; 197 (49%) to interpret diagnostic imaging; 173 (43%) to perform surgery; and 153 (38.1%) to formulate personalized treatment plans. Only 71 (17.7%) considered empathetic care likely, while 184 (45.8%) considered it extremely unlikely. AI-based monitoring of adherence was considered likely by 151 (37.6%).

Practice/training preference: 243 (60.75%) preferred AI competency training to begin during medical school, 65 (16.25%) during postgraduate training, 37 (9.25%) during practice, and 55 (13.75%) felt no AI training was necessary.

Table 1. Demographic Distribution of Participants (N=400).

Characteristics	n	%
Male	173	43.25
Female	225	56.25
Others	2	0.50
Age 18–21	291	72.75
Age 21–25	107	26.75
Age ≥25	2	0.50
Year 1	104	26.00
Year 2	121	30.25

Year 3	125	31.25
Year 4	50	12.50

Table 2. Knowledge Regarding Artificial Intelligence (N=400).

Statements	Yes n (%)	No n (%)
Knows term AI	361 (90.25)	39 (9.75)
Knows machine learning	239 (59.75)	161 (40.25)
Knows deep learning	130 (32.50)	270 (67.50)
Knows an AI application in medicine	173 (43.25)	227 (56.75)

Table 3. Attitude Toward AI and the Medical Profession (N=400).

Statements	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
AI will reduce jobs	107 (26.6%)	182 (45.3%)	75 (18.7%)	27 (6.7%)	9 (2.2%)
AI will replace physicians	37 (9.2%)	95 (23.6%)	109 (27.1%)	106 (26.4%)	53 (13.2%)
AI is essential in medicine	51 (12.7%)	169 (42.0%)	126 (31.3%)	35 (8.7%)	19 (4.7%)
AI will impact specialty choice	29 (7.2%)	143 (35.6%)	121 (30.1%)	69 (17.2%)	38 (9.5%)

Table 4. Selected Perceptions of AI in Individual Patient Care (N=400).

Statements	Extremely unlikely	Unlikely	Uncertain	Likely	Extremely likely
Preventive recommendations	24 (6.0%)	58 (14.4%)	26 (6.5%)	227 (56.5%)	65 (16.2%)
Diagnosis	33 (8.2%)	82 (20.4%)	14 (3.5%)	199 (49.5%)	72 (17.9%)
Prognosis	33 (8.2%)	80 (19.9%)	20 (5.0%)	203 (50.5%)	64 (15.9%)
Diagnostic imaging	35 (8.7%)	79 (19.7%)	13 (3.2%)	197 (49.0%)	76 (18.9%)
Personalized treatment	57 (14.2%)	113 (28.1%)	26 (6.5%)	153 (38.1%)	51 (12.7%)
Empathetic care	184 (45.8%)	110 (27.4%)	17 (4.2%)	71 (17.7%)	18 (14.5%)
Medication/ exercise/diet adherence	57 (14.2%)	111 (27.6%)	30 (7.5%)	151 (37.6%)	51 (12.7%)
Psychiatric/ personal counseling	145 (36.1%)	123 (30.6%)	21 (5.2%)	92 (22.9%)	19 (4.7%)
Surgery/robotic surgery	58 (14.4%)	85 (21.1%)	19 (4.7%)	173 (43.0%)	65 (16.2%)

Table 5. Distribution of Study Participants from When Their Training in AI Competencies Should Begin (N=400).

Training stage	n	%
Medical student	243	60.75
Postgraduate	65	16.25
Practicing physician	37	9.25
No training necessary	55	13.75

DISCUSSION

The study demonstrates high conceptual awareness of AI but limited applied knowledge and formal exposure. The proportion knowing the term AI (90.25%) was higher than that reported in a Syrian study (70%), while knowledge of machine and deep learning remained substantially lower. Only 43.25% knew an AI application in medicine and 5.25% had received formal teaching, highlighting a gap between general awareness and curriculum- based competence. Concerns about professional displacement were evident: 45.3% believed AI would reduce job opportunities. Nevertheless, 42% considered AI essential in medicine and 60.75% supported introducing AI competency training during medical school.

Respondents expressed relatively positive views of AI for preventive recommendations, diagnosis, prognosis, imaging, surgery, and personalized treatment, but showed greater reservations regarding empathetic care. The findings support integration of structured AI literacy into undergraduate medical education, with emphasis on applications, limitations, ethics, critical evaluation, and responsible use. Strengths include the relatively large sample and representation of multiple academic years. Limitations include self-reported responses and limited generalizability beyond Chandigarh.

CONCLUSION

The study found high awareness of AI among medical students in Chandigarh but important gaps in applied knowledge and formal training. Most participants supported introducing AI competency training during undergraduate medical education. Structured AI education should therefore be considered within medical curricula, supported by faculty development and collaboration with relevant institutions, to prepare future physicians for responsible use of AI in healthcare.

REFERENCES

1. Ahmad, M. N., Abdallah, S. A., Abbasi, S. A., & Abdallah, A. M. (n.d.). Student perspectives on the integration of artificial intelligence into healthcare services. *Digital Health*.
2. Ahmed, Z., Bhinder, K. K., Tariq, A., Tahir, M. J., Mehmood, Q., Tabassum, M. S., Malik, M., Aslam, S., Asghar, M. S., & Yousaf, Z. (n.d.). Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Pakistan: A cross-sectional online survey. *Annals of Medicine and Surgery*.
3. Allam, A. H., Eltewacy, N. K., Alabdallat, Y. J., et al. (2024). Knowledge, attitude, and perception of Arab medical students towards artificial intelligence in medicine and radiology: A multinational cross-sectional study. *European Radiology, 34*(7), 4636–4649. https://doi.org/10.1007/s00330-023-10509-2
4. Barreiro-Ares, A., Morales-Santiago, A., Sendra-Portero, F., & Souto-Bayarri, M. (n.d.). Impact of the rise of artificial intelligence in radiology: What do students think? *International Journal of Environmental Research and Public Health*.
5. Bin Dahmash, A., Alabdulkareem, M., Alfutais, A., Kamel, A. M., Alkholaiwi, F., Alshehri, S., Al Zahrani, Y., & Almoaiqel, M. (2020). Artificial intelligence in radiology: Does it impact medical students preference for radiology as their future career? *BJR|Open, 2*(1), 20200037. https://doi.org/10.1259/bjro.20200037
6. Castagno, S., & Khalifa, M. (2020). Perceptions of artificial intelligence among healthcare staff: A qualitative survey study. *Frontiers in Artificial Intelligence, 3*, 578983. https://doi.org/10.3389/frai.2020.578983
7. Civaner, M. M., Uncu, Y., Bulut, F., Chalil, E. G., & Tatli, A. (n.d.). Artificial intelligence in medical education: A cross-sectional needs assessment. *BMC Medical Education*.
8. Demner-Fushman, D., Few, B., Hauser, S. E., & Thoma, G. (2006). Automatically identifying health outcome information in MEDLINE records. *Journal of the American Medical Informatics Association, 13*(1), 52–60. https://doi.org/10.1197/jamia.M1911
9. Doumat, G., Daher, D., Ghanem, N. N., & Khater-Menassa, B. (2022). Knowledge and attitudes of medical students in Lebanon toward artificial intelligence: A national survey study. *Frontiers in Artificial Intelligence, 5*. https://doi.org/10.3389/frai.2022.1015418
10. Ejaz, H., McGrath, H., Wong, B. L., Guise, A., Vercauteren, T., & Shapey, J. (n.d.). Artificial intelligence and medical education: A global mixed-methods study of medical students' perspectives. *Digital Health*.
11. Goldberg, J. E., & Rosenkrantz, A. B. (n.d.). Artificial intelligence and radiology: A social media perspective. *Current Problems in Diagnostic Radiology*.
12. Jafar, A., Saleem, H. G. M., Akram, A., et al. (2025). Medical students' attitudes toward AI in education: A cross-sectional study from Pakistan. *BMC Medical Education, 25*, 40. https://doi.org/10.1186/s12909-025-07058-1
13. Jackson, P., Sukumaran, G. P., Babu, C., et al. (2024). Artificial intelligence in medical education—Perception among medical students. *BMC Medical Education, 24*, 804. https://doi.org/10.1186/s12909-024-05760-0
14. Jebreen, K., Radwan, E., Kammoun-Rebai, W., et al. (2024). Perceptions of undergraduate medical students on artificial intelligence in medicine: Mixed-methods survey study from Palestine. *BMC Medical Education, 24*, 507. https://doi.org/10.1186/s12909-024-05465-4
15. Jha, N., Shankar, P. R., Al-Betar, M. A., Mukhia, R., Hada, K., & Palaian, S. (2022). Undergraduate medical students' and interns' knowledge and perception of artificial intelligence in medicine. *Advances in Medical Education and Practice, 13*, 927–937. https://doi.org/10.2147/AMEP.S368519
16. Kansal, R., Bawa, A., Bansal, A., Trehan, S., Goyal, K., Goyal, N., & Malhotra, K. (n.d.). Differences in knowledge and perspectives on the usage of artificial intelligence among doctors and medical students of a developing country: A cross-sectional study. *Cureus*.
17. Kolachalama, V. B., & Garg, P. S. (2018). Machine learning and medical education. *npj Digital Medicine, 1*, 54. https://doi.org/10.1038/s41746-018-0061-1
18. Lee, J., Wu, A. S., Li, D., & Kulasegaram, K. M. (n.d.). Artificial intelligence in undergraduate medical education: A scoping review. *Academic Medicine*.

19. McLennan, S., Meyer, A., Schreyer, K., & Buyx, A. (2022). German medical students' views regarding artificial intelligence in medicine: A cross-sectional survey. *PLOS Digital Health, 1*(10), e0000114. https://doi.org/10.1371/journal.pdig.0000114
20. Mehta, N., Harish, V., Bilimoria, K., Morgado, F., Ginsburg, S., Law, M., & Das, S. (n.d.). Knowledge of and attitudes on artificial intelligence in healthcare: A provincial survey study of medical students.
21. Mousavi Baigi, S. F., Sarbaz, M., Ghaddaripouri, K., Ghaddaripouri, M., Mousavi, A. S., & Kimiafar, K. (n.d.). Attitudes, knowledge, and skills towards artificial intelligence among healthcare students: A systematic review. *Health Science Reports*.22Oh, S., Kim, J. H., Choi, S.-W., Lee, H. J., Hong, J., & Kwon, S. H. (2019). Physician confidence in artificial intelligence: An online mobile survey. *Journal of Medical Internet Research, 21*(3), e12422. https://doi.org/10.2196/12422
23. Park, C. J., Paul, H. Y., & Siegel, E. L. (n.d.). Medical student perspectives on the impact of artificial intelligence on the practice of medicine. *Current Problems in Diagnostic Radiology*.
24. Pinto-Coelho, L. (2023). How artificial intelligence is shaping medical imaging technology: A survey of innovations and applications. *Bioengineering, 10*(12), 1435. https://doi.org/10.3390/bioengineering10121435
25. Pinto dos Santos, D., Giese, D., Brodehl, S., Chon, S. H., Staab, W., Kleinert, R., Maintz, D., & Baeßler, B. (n.d.). Medical students' attitude towards artificial intelligence: A multicentre survey. *European Radiology*.
26. Pupic, N., Ghaffari-zadeh, A., Hu, R., et al. (2023). An evidence-based approach to artificial intelligence education for medical students: A systematic review. *PLOS Digital Health, 2*(11), e0000255. https://doi.org/10.1371/journal.pdig.0000255
27. Rodriguez-Ruiz, A., Lång, K., Gubern-Merida, A., Broeders, M., Gennaro, G., Clauser, P., et al. (n.d.). Stand- alone artificial intelligence for breast cancer detection in mammography: Comparison with 101 radiologists. *JNCI: Journal of the National Cancer Institute*.
28. Salama, M., Othman, M. S., Ramadan, R. A., et al. (2025). Medical students' knowledge, attitudes, and practices toward generative artificial intelligence in Egypt. *BMC Medical Education, 25*, 8. https://doi.org/10.1186/s12909-025-07329-x
29. Singh, R. P., Hom, G. L., Abramoff, M. D., Campbell, J. P., & Chiang, M. F. (n.d.). Current challenges and barriers to real-world artificial intelligence adoption for the healthcare system, provider, and the patient. *Translational Vision Science & Technology*.
30. Singla, R., Car, J., Meinert, E., et al. (2025). Differences in expert perspectives on AI training in medical education: Secondary analysis of a multinational Delphi study. *Journal of Medical Internet Research, 27*, e72186. https://doi.org/10.2196/72186
31. Stryker, C., & Kavlakoglu, E. (2025). What is artificial intelligence (AI)? *I B M* . https://www.ibm.com/think/topics/artificial-intelligence
32. Swed, S., Alibrahim, H., Elkalagi, N. K., Nasif, M. N., Rais, M. A., Nashwan, A. J., et al. (n.d.). Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Syria: A cross-sectional online survey. *Frontiers in Artificial Intelligence*.
33. Teng, M., Singla, R., Yau, O., et al. (2022). Health care students' perspectives on artificial intelligence: Countrywide survey in Canada. *JMIR Medical Education, 8*(2), e33390. https://doi.org/10.2196/33390
34. Weidener, L., & Fischer, M. (2023). Artificial intelligence teaching as part of medical education: Qualitative analysis of expert interviews. *JMIR Medical Education, 9*, e46428. https://doi.org/10.2196/46428
35. Wood, E. A., Ange, B. L., & Miller, D. D. (2021). Are we ready to integrate artificial intelligence literacy into medical school curriculum: Students and faculty survey. *Journal of Medical Education and Curricular Development, 8*, 23821205211024078. https://doi.org/10.1177/23821205211024078