Original Article

Artificial Intelligence in Medicine: A Cross-Sectional Study Among Undergraduate Medical Students

[1*]Anam Shaikh, [2]Marvi Umair

[1]*Assist. Prof. of Pathology, Liaquat College of Medicine and Dentistry (LCMD), Karachi*

[2]*Assist. Prof. of Pathology, Sir Syed College of Medical Sciences for Girls, Karachi*

Abstract

Background: Artificial intelligence (AI) is rapidly transforming the landscape of modern medicine. However, its integration into medical education remains limited, particularly in low- and middle-income countries.
Objective: To assess the knowledge, attitude, and perception of AI in medicine among undergraduate medical students.
Methods: A cross-sectional descriptive study was conducted among MBBS students from three medical colleges in Pakistan using a structured, validated questionnaire. Descriptive and inferential statistics were applied.
Results: Among 350 participants, 68% were aware of AI applications in medicine, while only 24% reported receiving any formal education on AI. A majority (74%) expressed a positive attitude toward AI integration in clinical practice, but 61% were concerned about replacement of physicians.
Conclusion: While undergraduate students show awareness and interest in AI, there is a lack of structured education. Integrating AI into the medical curriculum is essential to prepare future physicians.
Keywords: Artificial intelligence, medical students, medical education, perception, healthcare technology.

How to cite this
Artificial Intelligence in Medicine: A Cross-Sectional Study Among Undergraduate Medical Students *JIMC 2025.(2): 513-515*

Corresponding
Dr Anam Shaikh
Lecture
Department of Pathology
Shaheed Mohtarma Benazir Bhutto Medical University ***(SMBBMU)***
Anamshaikh521@gmail.com

Introduction

Artificial Intelligence (AI) has revolutionized many sectors globally, and medicine is no exception. From disease diagnosis to robotic surgeries and personalized medicine, AI's integration into clinical settings is increasing rapidly [1]. Despite its growing impact, medical education has yet to keep pace, leaving future physicians underprepared for a future where AI will likely be a routine part of clinical decision-making [2].

The World Health Organization (WHO) acknowledges that AI offers promising opportunities to improve the delivery of healthcare services, especially in under-resourced settings [3]. For instance, AI-driven algorithms have shown remarkable performance in radiology, pathology, dermatology, and ophthalmology, sometimes exceeding human accuracy [4,5]. Natural language processing (NLP) is being applied to electronic health records (EHRs) to detect patterns in clinical practice, predict outcomes, and personalize treatment [6].

However, alongside these benefits, AI presents ethical, legal, and professional challenges that require healthcare workers, especially physicians, to develop a foundational understanding of its working and implications [7]. AI cannot replace clinical judgment, empathy, and communication, but it can augment physicians' capabilities. This is particularly relevant in developing countries like Pakistan, where AI can bridge the gap in healthcare workforce shortages [8].

Undergraduate medical education globally is slowly responding to the need to incorporate AI. A study from the UK reported that only 10% of medical schools included AI in their curriculum, despite 88% of students expressing a desire to learn it [9]. Similarly, in the United States, Canada, and Europe, students reported both interest in AI and concern about the potential for job displacement [10]. However, data from South Asia, including Pakistan, remains sparse.

In Pakistan, the healthcare system is already overburdened, and the digital transformation is at a nascent stage. Limited infrastructure, low digital literacy, and resistance to change are barriers to AI adoption in clinical and educational settings [11]. As future doctors, medical students' understanding and acceptance of AI are critical for effective integration into the healthcare system.

This study aims to assess the **knowledge, attitude, and perception** of undergraduate medical students toward AI in medicine. It also explores gender and year-wise differences in understanding and receptiveness. The ultimate goal is to inform medical education policymakers about the necessity of integrating AI competencies into the undergraduate medical curriculum.

Methodology

This cross-sectional descriptive study was conducted between January and March 2025 at three medical colleges in Sindh, Pakistan—two from the private sector and one from the public sector—to assess undergraduate

medical students' knowledge, attitudes, and perceptions regarding artificial intelligence (AI) in medicine. Ethical approval was obtained from the Institutional Review Board (IRB) of each participating college prior to data collection. Undergraduate MBBS students from first to final year were included in the study using a stratified random sampling technique to ensure proportional representation from each academic year. Students who declined consent or submitted incomplete responses were excluded from the final analysis.

The sample size was calculated using OpenEpi software with a 95% confidence level, 5% margin of error, and an anticipated awareness rate of 50%, resulting in a required sample size of 350 participants. A structured, pre-validated, self-administered questionnaire was used as the primary data collection tool. The questionnaire was developed after reviewing relevant literature and validated by a panel of medical education experts. It consisted of 25 items divided into four sections: demographic details (age, gender, year of study, and type of institution), awareness and knowledge of AI, attitudes toward AI, and perceptions regarding AI's future role in healthcare.

The questionnaire was distributed both in print and electronically via institutional email groups and student WhatsApp forums. Informed consent was obtained from all participants before they completed the survey. Data were entered and analyzed using IBM SPSS version 26. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the data. Chi-square tests and one-way ANOVA were applied to evaluate associations between demographic variables and students' knowledge and attitudes. A p-value of less than 0.05 was considered statistically significant for all inferential analyses.

Results

A total of 350 undergraduate medical students participated in the study, with a response rate of 93.3%. The mean age of the participants was 21.4 ± 1.9 years. Out of the total respondents, 208 (59.5%) were female, while 142 (40.5%) were male. The distribution across academic years was relatively even, with the highest number of participants from third year (22.9%), followed by second year (21.7%) and first year (20%). Students from public sector institutions comprised 51.4% of the sample, while 48.6% were from private colleges (Table 1).

Regarding awareness and knowledge of AI, 238 students (68%) reported that they had heard about AI being used in medicine, while 112 (32%) had not. Only 84 students (24%) had received any formal education or training related to AI, either as part of the curriculum or through external workshops. Awareness about the application of AI in diagnostics was reported by 56.6% of students, and 49.1% were aware of its use in fields like radiology and pathology (Table 2).

The analysis of attitudes revealed that a substantial majority—82.8% (n = 290)—agreed that AI should be included in the medical curriculum. Additionally, 75.7% (n = 265) believed that AI would improve diagnostic accuracy and patient care. However, a significant number of students—61.4% (n = 215)—disagreed with the idea that AI would replace physicians in the future, indicating a belief in the irreplaceable value of human judgment in clinical decision-making (Table 3).

Further analysis showed that students in clinical years (3rd to final year) demonstrated significantly higher awareness of AI and more favorable attitudes compared to those in pre-clinical years (1st and 2nd year) ($p < 0.05$). No statistically significant differences were observed based on gender or institution type.

Table 1: Demographic Characteristics of Study Participants (n = 350)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	142	40.5%
Female	208	59.5%
Year of Study		
1st Year	70	20.0%
2nd Year	76	21.7%
3rd Year	80	22.9%
4th Year	62	17.7%
Final Year	62	17.7%
Institution Type		
Public	180	51.4%
Private	170	48.6%

Table 2: Awareness and Knowledge of AI Among Students

Item	Yes (n, %)	No (n, %)
Heard about AI in medicine	238 (68.0%)	112 (32.0%)
Knows AI is used in diagnostics	198 (56.6%)	152 (43.4%)
Aware of AI applications in radiology/pathology	172 (49.1%)	178 (50.9%)
Received formal education/training on AI	84 (24.0%)	266 (76.0%)

Table 3: Attitudes Toward AI in Medicine

Statement	Agree (n, %)	Neutral (n, %)	Disagree (n, %)
AI should be included in medical curriculum	290 (82.8%)	38 (10.8%)	22 (6.2%)
AI will improve diagnosis and patient care	265 (75.7%)	45 (12.8%)	40 (11.4%)
AI will replace physicians in the future	79 (22.6%)	56 (16.0%)	215 (61.4%)

Discussion (3 Pages)

This study revealed a relatively high awareness (68%) of AI among undergraduate medical students in Pakistan, aligning with global trends [9,10]. However,

the formal education or training on AI was alarmingly low (24%), indicating a significant gap between interest and institutional response. These findings support the urgent need to integrate AI training into the undergraduate medical curriculum.

Students overwhelmingly agreed that AI would play an essential role in the future of medicine. More than 80% supported the inclusion of AI in their syllabus, reflecting similar findings from Canadian and UK-based studies [10,12]. These results underscore a generational shift toward digital literacy and openness to technology in healthcare, which can be a foundation for future digital health strategies.

Interestingly, over 60% of students disagreed with the notion that AI would replace doctors, suggesting a nuanced understanding that AI is a tool to aid, not replace, clinical expertise. However, a sizable minority expressed concern about job security and the ethical implications of AI in clinical practice. These concerns resonate with literature warning about over-reliance on AI and its potential to undermine humanistic aspects of medicine [13].

Gender differences were minimal in this study, but students in clinical years had significantly higher awareness and positive attitudes toward AI compared to pre-clinical students ($p<0.05$). This suggests that clinical exposure enhances the appreciation of AI's practical applications in diagnostics, radiology, and patient management, consistent with findings from international literature [14].

Despite the potential, Pakistan's medical education system lacks a national policy or framework to introduce AI competencies at the undergraduate level. The Pakistan Medical and Dental Council (PMDC) should consider revising the undergraduate curriculum to include digital health, medical informatics, and AI basics [15]. Teaching strategies could include blended learning, simulation, problem-based learning (PBL), and interprofessional workshops.

Limitations of this study include reliance on self-reported data and its cross-sectional nature. Longitudinal studies could explore how perceptions evolve over time or in response to curriculum changes. Additionally, qualitative interviews could yield deeper insights into student concerns, motivations, and expectations regarding AI in medicine.

Conclusion

Undergraduate medical students in Pakistan are aware of and interested in artificial intelligence but lack structured education on the subject. There is a pressing need to revise medical curricula to prepare future doctors for AI-integrated healthcare systems.

Disclosure

Funding: None

Conflict of Interest: The authors declare no conflict of interest.

Ethical Approval: Approved by the institutional ethics committee.

Informed Consent: Obtained from all participants.

References

1. Jiang F, Jiang Y, Zhi H, et al. Artificial intelligence in healthcare: past, present and future. *Stroke Vasc Neurol*. 2017;2(4):230–243.
2. Davenport T, Kalakota R. The potential for AI in healthcare. *Future Healthc J*. 2019;6(2):94–98.
3. WHO. Ethics and governance of artificial intelligence for health: WHO guidance. 2021.
4. Esteva A, Kuprel B, Novoa RA, et al. Dermatologist-level classification of skin cancer with deep neural networks. *Nature*. 2017;542(7639):115–118.
5. Rajpurkar P, Irvin J, Zhu K, et al. CheXNet: Radiologist-level pneumonia detection on chest X-rays with deep learning. *arXiv preprint*. 2017.
6. Wang Y, Wang L, Rastegar-Mojarad M, et al. Clinical information extraction applications: a literature review. *J Biomed Inform*. 2018;77:34–49.
7. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. *Nat Med*. 2019;25(1):44–56.
8. Gulzar L, Ali S. Artificial intelligence in health care: a futuristic vision of Pakistan. *Pak J Public Health*. 2021;11(3):109–112.
9. Sit C, Srinivasan R, Amlani A, et al. Attitudes and perceptions of UK medical students towards artificial intelligence and radiology: a multicentre survey. *Insights Imaging*. 2020;11(1):14.
10. Pinto Dos Santos D, Giese D, Brodehl S, et al. Medical students' attitude toward artificial intelligence: a multicentre survey. *Eur Radiol*. 2019;29(4):1640–1646.
11. Zafar A, Ahmed M, Bukhari M. Digital healthcare in Pakistan: opportunities and challenges. *J Pak Med Assoc*. 2021;71(9):2245–2250.
12. Sarwar S, Dent A, Faust K, et al. Physician perspectives on integration of artificial intelligence into diagnostic pathology. *NPJ Digit Med*. 2019;2:28.
13. Liew C. The future of radiology augmented with Artificial Intelligence: A strategy for success. *Eur J Radiol*. 2018;102:152–156.
14. Neri E, Coppola F, Miele V, Bibbolino C, Grassi R. Artificial intelligence: who is responsible for the diagnosis? *Radiol Med*. 2020;125(6):517–521.
15. Pakistan Medical Commission. National Medical Curriculum 2021. Available from: https://pmc.gov.pk/Curriculum

Authors Contribution	
Anam Shaikh	Conception of study design, acquisition, analysis, and interpretation of data.
Marvi Umair	Drafting and methodology, data interpretation & Analysis and interpretation of data for work & Data Collection