

# Investigating Students' Perceptions of Artificial Intelligence in Medical Education: A Cross-Sectional Study

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## ABSTRACT

**Background:** Artificial Intelligence (AI), recognized as the fourth industrial revolution, is revolutionizing medical practice through enhanced diagnostics, treatment planning, and healthcare delivery. Its expanded role post-COVID-19 underscores the urgency of AI literacy among future physicians. This study aimed to explore medical students' perceptions of AI in medical education.

**Methods:** A cross-sectional study was conducted from June to July 2024 at CMH and AIMC medical colleges in Pakistan. Using a non-probability convenience sampling technique, an online questionnaire was distributed among MBBS students from both public and private institutions. A minimum of 10% of students from each academic year were invited, yielding a final sample of 139 respondents (response rate: 92%). Associations between categorical variables were analyzed using the chi-square test.

**Results:** Among participants, 57.2% were female and 42.8% male. Most students (96.4%) agreed that computers aid learning, and 93.5% believed AI will be essential in future medical practice. Additionally, 77% felt AI would improve medical education, while 87.7% expressed willingness to receive AI-based instruction. A majority (89.1%) supported the inclusion of AI training in the curriculum, and 83.5% believed AI knowledge would benefit their careers. Female students were significantly more likely to support curriculum integration ( $p = 0.03$ ) and AI instruction ( $p = 0.04$ ), though no significant gender differences were observed in perceptions of AI's future role ( $p = 0.12$ ).

**Conclusion:** Medical students exhibited highly positive attitudes toward AI. While they do not view AI as replacing physicians, they recognize its transformative role. Integrating AI education into MBBS curricula is therefore essential.

**Keywords:** Medical Students; Perceptions; Artificial Intelligence, Pakistan.

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## INTRODUCTION

Recently, artificial intelligence (AI) has attracted a lot of interest; in fact, several experts have dubbed AI the fourth industrial revolution. Wealthy nations have made significant investments in artificial intelligence and its application to the medical field<sup>1</sup>. Artificial intelligence expertise and resources have been much more in demand in the healthcare industry since the COVID-19 pandemic, with the intention of decreasing diagnostic mistakes and effort<sup>2</sup>. AI-based computer systems that leverage knowledge and data improve medical decision-making. The ultimate objective is to increase career performance<sup>3</sup>. AI systems may help doctors with drug development, sickness diagnosis, health monitoring, medical data management, personalized medicine, health plan, surgical, and medicinal therapy analysis<sup>4</sup>.

In order to change medical practice, students must comprehend the importance of AI in contemporary medical knowledge. AI will undoubtedly play a big part in medicine in the future, and AI-based medicine is necessary. Everyone agreed that while AI won't replace doctors, it will drastically alter how healthcare is delivered<sup>5</sup>. AI in healthcare has gained much traction in recent years, attracting the curiosity of professionals and students<sup>6,7</sup>. The introduction of OpenAI's Chat Generative Pre-trained Transformer (ChatGPT) in November 2022 has accelerated the development of this advanced chatbot, which is based on a large language model (LLM) and has conversational skills that closely resemble those of a person<sup>8,9</sup>. ChatGPT-3.5 nearly passed the USMLE without medical data training. GPT-4, its successor, surpassed it with 84.3% accuracy on quick responses. Specialist medical LLMs like Google's MedPaLM-2 have improved the discipline by obtaining over 85% accuracy on the MedQA dataset of USMLE-type questions. MedPaLM-2 is also the first model to pass the MedMCQA dataset, which contains medical exam questions from top universities, including the All-India Institute for Medical Sciences and the National Eligibility cum Entrance Test<sup>5</sup>.

Furthermore, there is less information about the disposition of medical students towards the acquisition and use of artificial intelligence in clinical practice<sup>10</sup>. Therefore, it is essential to raise early

knowledge and avoid misunderstandings about the role of AI in medicine. Generally speaking, as AI becomes more and more integrated into healthcare, medical education should include not just the foundations of the biological and clinical sciences but also a wide range of skills required of future doctors in order to effectively use AI systems in clinical settings<sup>11</sup>. Diverse student perspectives exist on artificial intelligence in medical education. Some students could think of artificial intelligence (AI) as a useful tool that might improve clinical practice and their educational experience<sup>12</sup>. Some could be hesitant or worried about how AI might affect their jobs as medical practitioners. Thus, there is a need for empirical study on medical students' views and perceptions of artificial intelligence. This research set out to assess what the students thought about artificial intelligence (AI) in medical education. This research set out to find out how students at a medical school in Lahore, Pakistan, felt about artificial intelligence (AI) in medicine.

## METHODS

The present study was carried out following the Declaration of Helsinki for research with human participants, and ethical approval was taken from ERC (Case #901/ERC/CMH/LMC).

A cross-sectional survey was conducted using an online questionnaire to gather responses from students enrolled in public and private medical colleges. Participants were selected through a non-probability convenience sampling technique, primarily due to practical constraints such as limited access to centralized student databases and logistical challenges in reaching a randomized sample across multiple institutions. To enhance representativeness within this framework, at least 10% of students from each academic year were invited to participate. The data collection was carried out between June and July 2024. For the purpose of analysis, the undergraduate medical curriculum was categorized into two distinct phases: Phase I (pre-clinical years – 1st to 3rd year MBBS) and Phase II (clinical years – 4th and final year MBBS). The sample size was estimated using standard sample size calculation for cross-sectional studies, based on an expected prevalence of awareness of students from prior studies, with a 95% confidence level and a 5% margin of error. Accounting for potential non-response or incomplete data, a buffer of

10–15% was added to the estimated minimum. The final target sample included at least 10% of students from each academic year across selected public and private medical colleges.

The questionnaire items were adapted from two previously validated studies to ensure content validity. Internal consistency of the instrument was confirmed through a pilot study, yielding a high reliability score with a Cronbach's Alpha of 0.845, indicating strong internal consistency of the scale used<sup>13</sup>. The survey examined demographics, AI opinions, and medical training. It was created online using Google Forms. Sending the questionnaire link to phase I and II medical students via WhatsApp eased data collection.

Data organization, analysis, and display will be carried out utilizing version 26.0 of the Statistical Package for the Social Sciences software. Frequency and percentage analyses will be employed to generate descriptive statistics for all questionnaire items. Chi-square tests will be utilized to identify any associations or notable variances among the categorical variables, with the

significance level set at  $p < 0.05$ . The results of the survey will reveal interesting insights into students' perceptions of artificial intelligence in medical education. The results of the survey will show that the majority of students will have positive attitudes towards artificial intelligence in medical education.

## RESULTS

It is deduced from the data that the majority of the students are in their later years of their academic careers. a sample size of 150 students of each class is the minimum 10% (15 students from each class) needed for meaningful results. The response rate was 92% with 138 students. The majority of the students are either literate or adept at computers. The results show that although most students have some basic to moderate computer skills, only a few have attained a higher level of competency. Most of the students use computer technology for learning. This demonstrates the value of incorporating digital tools into the curriculum and points to the necessity of focused initiatives to raise computer literacy, especially to assist more students in becoming skilled.

**Table 1: Characteristics of the Study Population (138)**

Characteristics	N (%)
<b>AGE</b>	
Mean ± SD	22.4 ± 3.81
<b>Gender</b>	
Male	59 (42.8%)
Female	79 (57.2%)
<b>Institution</b>	
Public	74 (43.6%)
Private	64 (46.4%)
<b>Current Academic Study Year</b>	
First To Third-Year	58 (42.0%)
Fourth To Final Year	80 (58.0%)
<b>Computer Literacy Level</b>	
Literate	64 (46.4%)
Competent	58 (42%)
Proficient	16 (11.6%)
<b>Usage of Computer Technology for Learning</b>	
Always	49 (35.5%)
Sometimes	84 (60.9%)
Never	5 (3.6%)

**Table 2: Students' Perceptions Towards Artificial Intelligence (n=138)**

Factor	Reliability (α)	Mean	SD
Artificial intelligence (AI) will play an important role in health care	.863	1.83	0.528
AI will replace some specialties in healthcare during my lifetime	.843	2.16	0.692
I understand basic AI principles	.824	2.19	0.607
I am comfortable with AI terminologies	.830	2.17	0.595
I understand AI limitations	.832	2.05	0.566

**Table 2** shows students' perceptions and understanding of artificial intelligence (AI) in healthcare, with all items demonstrating good internal consistency (Cronbach's α ranging from 0.824 to 0.863). The statement "AI will play an important role in healthcare" had the lowest mean score ( $1.83 \pm 0.528$ ), indicating strong agreement among respondents. In contrast, higher mean scores for items such as "I understand basic AI principles" ( $2.19 \pm 0.607$ ), "I am comfortable with AI terminologies" ( $2.17 \pm 0.595$ ), and "I understand AI limitations" ( $2.05 \pm 0.566$ ) suggest limited familiarity and confidence in their knowledge of AI. Additionally, the perception that "AI will replace some specialties in healthcare during my lifetime" had a mean of  $2.16 \pm 0.692$ , reflecting moderate concern about AI's potential impact on future medical careers. Overall, the findings indicate a strong recognition of AI's importance but highlight gaps in understanding and preparedness among students.

**Table 3: Impact of Artificial Intelligence on Medical Education**

Factor	Reliability (α)	Mean	SD
AI teaching will benefit my career	.828	1.93	0.565
All medical students should receive AI teaching	.843	1.87	0.646
I will be confident using AI tools at the end of my medical degree	.819	2.12	0.614
I will have a better understanding of the methods used to assess healthcare AI performance at the end of my medical degree	.827	2.1	0.64
I will possess the knowledge needed to work with AI in routine clinical practice at the end of my medical degree	.825	2.1	0.579
AI systems would have a positive impact on medical education	.819	1.95	0.629
Incorporating AI systems in medical education would ease your learning process	.823	1.87	0.559
Using AI systems in medical education would prepare you for real clinical practice	.821	2.13	0.669

**Table 3** reflects students' perceptions of the role of AI in medical education and their preparedness to use AI in clinical practice, with all items showing good internal consistency (Cronbach's α between 0.819 and 0.843). Students strongly agreed that AI teaching would benefit their careers (mean =  $1.93 \pm 0.565$ ) and that all medical students should receive AI instruction (mean =  $1.87 \pm 0.646$ ). They also believed AI would positively impact medical education and ease their learning process. However, higher mean scores for statements about confidence in using AI tools and understanding AI performance assessment methods (means around 2.1–2.13) suggest that while students recognize the value of AI integration, they feel only moderately prepared to apply AI in real clinical settings by the end of their degree.

**Table 4: Influence of Students' Interest on Computer Literacy Level**

Variable	Current Academic Study Year	Computer Literacy Level
Current Academic Study Year	1	0.105
Sig. (2-tailed)	-	0.222
Computer Literacy Level	0.105	1
Sig. (2-tailed)	0.222	-

**Table 4** shows, A very minor positive correlation (Pearson Correlation of 0.105) has been found between "Current Academic Study Year" and "Computer Literacy Level," indicating that students' computer literacy increases slightly as they go through their academic years. The correlation is not statistically significant, as indicated by the p-value of 0.222. This suggests that the observed link may result from chance rather than a genuine relationship. Furthermore, supporting the conclusion that there is no significant or obvious association between the academic year and computer literacy level are the computed covariance and the weak correlation.

## DISCUSSION

The study's findings show that medical students strongly support the use of artificial intelligence (AI) in healthcare, with the majority agreeing that AI will play an important role in future medical practice. To properly use digital healthcare systems, all stakeholders must acquire the requisite skills and understand the implications for general and case-by-case patient management<sup>14</sup>. Physicians must stay current on medical knowledge, which is growing exponentially. They also need to be able to convey, analyze, and remember medical information quickly from various sources<sup>15</sup>.

In addition to changing how doctors practice medicine, digitization, including artificial intelligence, requires that medical education adapts to these quite diverse healthcare settings from those of conventional teaching models. Furthermore, digital technologies compete with and raise questions about medicine's non-analytical, humanistic parts. After modern technologies are incorporated into mainstream healthcare, students and healthcare professionals must embrace these technologies and evaluate their use<sup>16</sup>. Acceptance, a desire to use the knowledge and abilities of digital tools, and a joy to use digital tools as a natural means of providing services by healthcare professionals, especially physicians, all contribute to the integration of eHealth and, therefore, improve the standard of treatment<sup>17</sup>.

According to a survey in one study, the majority of students, 61.7%, had no prior experience with artificial intelligence. For AI's perceived usefulness in radiology, replacement with human radiologists, expected dominance in clinical practice, willingness to introduce in medical education, excitement to adopt, perceived as a burden, and practicability, the mean scores were 1.89, 2.83, 2.76, 2.35, 2.13, 3.18, and 2.39, in that order. They concluded that medical students had a good view of artificial intelligence being used in undergraduate medical education<sup>7</sup>.

A comparable study revealed 223 (47.45%) doctors and 247 (52.55%) medical students among 470 participants; 170 (68.8%) medical students and 165 (74%) physicians understood AI, while only 61 (27.3%) doctors and 48 (19.4%) students knew its medicinal uses<sup>18</sup>. In terms of mentality, 237 (76.7%) respondents supported teaching AI in the classroom, 368 (78.3%), 305 (64.9%), 281 (59.8%), and 269 (57.2%) found AI vital for radiology, pathology, and the COVID-19 epidemic. The majority of physicians and medical students, the researchers discovered, were not aware of artificial intelligence (AI) or its advantages, but they nevertheless loved the idea and wanted to use it<sup>19</sup>.

Pakistan's AI adoption is early, and local data is scarce. One of the studies mentions Pakistani medical students and professionals' AI knowledge, attitudes, and usage. There were 470 doctors and medical students in the study, 50.9% male and 49.1% female, a ratio of 1.03. Of the 470 participants, 35.3% knew about AI's ML and DL subtypes, whereas 71.3% knew nothing about it. Men dominated AI expertise, and over two-thirds of study participants were ignorant of medical AI usage. Despite a basic grasp of AI, Pakistani doctors and medical students are ignorant of its use<sup>20</sup>.

According to the authors, the quantitative study section revealed for the first time that students' perspectives should be analyzed using varied stances rather than structural unity. More problem-based curriculum (PBC) students than science-based curriculum (SBC) students, and more graduate than undergraduate students think AI will hinder physicians' medical skills. More PBC, male, and graduate students believe AI can detect rare diseases. The quantitative survey's AI questions, first raised in the qualitative study section's interviews, were difficult for 38% of our students to answer. However, this is encouraging compared to a previous survey that found 70% of respondents were unaware of AI in medicine<sup>19</sup>. According to previous reports, students in this survey showed a strong

desire to include digitization, artificial intelligence, and machine learning into the medical curriculum. Since both research sections emphasize the need for increased AI proficiency in medical education, the qualitative portion of the study, at least, aligns well with the views of German medical faculty members from the students' standpoint<sup>15,21</sup>.

Students must actively adjust as AI changes medical education using AI-enhanced technologies supporting inquiry-based learning and critical thinking. We must critically assess AI-generated content to ensure it satisfies our academic standards and educational goals. Working with peers, educators, and outside experts will help us stay up to date on the most recent developments in artificial intelligence<sup>22</sup>. We will also be able to sustain vital relationships if we cultivate learning communities that strike a balance between AI-driven customization and human engagement. We can take charge of our education and make it more individualized, efficient, and interesting while gaining the skills necessary to meet the opportunities and difficulties of an AI-driven future by emphasizing the development of critical thinking, problem-solving, and ethical decision-making abilities<sup>3,23,24,25,26</sup>.

Given these results, it is not only necessary but also essential that artificial intelligence be incorporated into medical education. Curriculum reform that incorporates AI competencies from the undergraduate level is urgently needed, especially considering Pakistan's early embrace of AI and the obvious knowledge gaps among students and doctors. Despite their short exposure, students' positive attitudes regarding AI demonstrate their great local receptivity and capacity for quick adaptability. In order to give aspiring healthcare professionals the critical, analytical, and moral abilities they need to successfully negotiate the quickly changing digital healthcare world, educational institutions must move quickly to create organized, contextually appropriate AI curricula. Ignoring this change could leave graduates unprepared for the rigors of contemporary medicine.

## CONCLUSION

This study demonstrates how medical students are becoming more conscious of and have favorable opinions about the use of AI in healthcare and medical education. Students understand AI's transformative potential in healthcare decision-making, diagnosis, and learning, even though they also agree that it will not replace doctors. These results highlight how vital it is to include structured AI instruction in Pakistan's MBBS program so that aspiring physicians are prepared to succeed in the country's increasingly digital

healthcare landscape.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, and the work was not supported or funded by any company.

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## ETHICAL APPROVAL

Ethical Approval was sought from the CMH Lahore Medical College & IoD (Case #901/ERC/CMH/LMC).

## AUTHORS' CONTRIBUTIONS

**SI** conceived the research study and design and helped in data collection. **HS** helps in data acquisition. **MM** contributes to data acquisition and analysis. **FHK** Designed and did the interpretation of data and overall supervised the work of other authors. **SF** did the statistical analysis. **SI and AZ** did data collection and manuscript writing.

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