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Perceptions of Medical Students Towards Artificial Intelligence

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ABSTRACT

The incorporation of technological advancements, particularly Artificial Intelligence has transformed healthcare systems globally, especially post-COVID-19. Medical education faces challenges in incorporating AI due to instructor shortages and high software costs. Understanding medical students' attitudes towards AI is crucial for its successful integration into medical practice and education. **Objective:** To evaluate the attitude of medical undergraduate students towards AI in medicine. **Methods:** A descriptive, online cross-sectional study was executed among undergraduate medical students utilizing a non-probability convenience sampling. The questionnaire, distributed to 340 participants, included demographic details, perceptions towards artificial intelligence, and its effect on medical education. A total of 252 responses were received, receiving a 74% response rate. Data analysis was executed through SPSS version 26.0. **Results:** Demographic characteristics of 252 subjects revealed a mean age of 23.5 years, with a majority being female (74.2%) and in their first to third year of study (58.3%). Participants generally had intermediate computer literacy (75.7%) and used technology consistently for learning (57.5%). Regarding perceptions of AI, most students strongly agreed that AI will significantly impact healthcare (48.8%) and that all medical students should be educated about it (31.3%). Additionally, a substantial majority believed that integrating AI into medical education would enhance its quality (66.6%) and facilitate the learning experience (57.9%). **Conclusions:** It was concluded that students have positive perceptions regarding AI systems, demonstrating enthusiasm for expanding their knowledge of AI within their medical education.

INTRODUCTION

The healthcare systems worldwide have experienced significant transformations with the integration of technological advancements, especially in the aftermath of COVID-19 [1]. In recent years, artificial intelligence has garnered the attention of medical experts and practitioners due to its extensive applications in healthcare [2]. AI holds the promise of being a valuable medical resource in diagnostics and scientific decision-making, thanks to its remarkable ability to synthesize large amounts of data [3]. The applications of AI in medicine can facilitate a range of functions, including clinical research, treatment, administrative tasks, and drug development, owing to its capacity to learn from wide-ranging datasets [4]. Across the globe, numerous nations have started to adopt AI to improve the efficiency of healthcare distribution systems. Numerous healthcare professionals are optimistic about the implementation of AI in diagnostics, prognostics as well as therapeutic interventions [5]. Nevertheless, as AI systems become more prevalent in the healthcare sector, concerns regarding the ethical implications of utilizing technology are becoming gradually significant [6]. The COVID-19

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pandemic has underscored AI's influence on medical education, providing medical students with interactive learning experiences and enabling virtual simulations and training, which allow them to practice complex procedures on simulated patients without risking harm to real patients. However, many educational institutions face challenges in effectively integrating AI into their curricula due to a shortage of qualified instructors, the high costs of AI software, and ethical considerations [7]. The advent of Chat GPT 4, which is a novel AI-powered language technology, has showcased the potential to assist a community of students in grasping challenging scientific concepts while also raising ethical concerns [8]. As AI applications are set to profoundly impact medical pieces of training, all the alertness is being directed towards preparing the health workforce for the transition by exploring the perspectives of healthcare professionals and medical students [9]. Numerous studies have examined knowledge, perceptions, as well as attitudes of medical and healthcare specialists or students regarding AI in various states, including the Republic of Korea, Germany, the United Kingdom, Canada, the United States, Pakistan, Australia, New Zealand, Malaysia, Turkey, Saudi Arabia, United Arab Emirates, and Kuwait [10]. A noticeable knowledge gap exists in the area of Pakistan, which needs to be addressed due to the anticipated rise in Artificial intelligence utilization within the medical field. Understanding the attitudes as well as behaviours of medical students to be future consumers of AI applications is crucial for the successful integration of AI in health-related and medical education. Furthermore, assessing students' perceptions of AI is vital to determine if further workshops will be necessary, as they will frequently engage with clients and utilize technologies. However, to our information, there has been insufficient current literature focusing on the perceptions of medical students regarding the addition of AI into medical education.

This study aims to recognize the attitudes of medical students towards AI, explore current AI training prospects, investigate the necessity for AI addition in medical courses, and ascertain favoured means for educating AI-related content. Outcomes will inform choices regarding the application of medical AI and the future growth of medical syllabi.

METHODS

A descriptive, cross-sectional, online questionnaire-based study was conducted for a six months period in Lahore. The target population consisted of undergraduate medical students registered in the faculty of medicine at either private-sector or public-sector universities. Non-probability convenient sampling was utilized as the sampling technique. Informed consent was taken from each participant. Data were collected through a questionnaire. The questionnaire comprised three sections: (1) demographic baseline details, (2) perception of AI, and (3) effect of AI on medical education. These are measured through a point Likert scale. It was adapted from a previous literature [11]. The data collection questionnaire was designed in an electronic pattern using online Forms. Criteria for participant selection were: Students currently listed in the faculty of medicine at private sector or public sector university in Lahore, undergraduate students of any year, Undergraduate students who transferred from the faculty of medicine to other programs like Faculty of Science, Health sciences, D-Pharmacy, or Nursing) and have education experience for a minimum of a year in the faculty of medicine. Exclusion criteria were graduated medical students who completed their medical studies, and medical students who have withdrawn from their education. The sample size for our study was determined using the formula for cross-sectional studies: n=Z2·P (1–P) /E2. Where: n=Required sample size, Z=Z-score for a 95% confidence level (1.96), P=Assumed prevalence of awareness or positive perceptions of artificial intelligence (50% or 0.5, as no prior studies were available in this context) and E=Margin of error (5% or 0.05). Adjusting for a finite population of approximately 1,000 medical students at the institutions. n adjusted= n/1+n−1/N =278. To account for potential non-responses, the sample size was increased by 20%, resulting in a target of 334 participants. The questionnaire was distributed to 340 participants and received 252 complete responses, achieving a response rate of 74%. The questionnaire was distributed among 340 participants. 252 responses were received, depicting a response rate of 74%. To minimize bias and reduce the risk of students overstating their comfort and understanding of artificial intelligence, the questionnaire was administered anonymously to ensure that participants felt secure in providing honest responses without fear of judgment. Data analysis was executed via SPSS version 26.0. Descriptive statistics were utilized to formulate frequency and percentage tables. The chi-square test was applied to analyze the difference in perception of students with years of education.

RESULTS

The mean age of the respondents was 23.5 years (± 2.2 years). Among the participants, 25.7% were male (n=65), and 74.2% were female (n=187). The distribution of participants by their current year of study showed that 58.3% (n=147) were in their first to third year, while 41.6% (n=105) were in their fourth to final year. Regarding computer literacy, the majority (75.7%, n=191) had an intermediate level of proficiency, while 18.2% (n=46) reported basic literacy and 5.8% (n=15) advanced skills.

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Most participants (57.5%, n=145) consistently utilized technology for learning purposes, 39.2% (n=99) used it occasionally, and only 3.1% (n=8) reported rare usage. A summary of the demographic and technological characteristics of the study participants was provided in Table 1.

Table 1: Demographic Characteristics of Participants (n=252)

Characteristic	n (%)
Age (in years)	
Mean ± Standard Deviation	23.5 ± 2.2
Sex	
Male	65 (25.7%)
Female	187 (74.2%)
Current Year of Study	
First to Third-Year	147 (58.3%)
Fourth to Final Year	105(41.6%)
Level of Computer Literacy	
Basic	46 (18.2%)
Intermediate	191 (75.7%)
Advanced	15 (5.8)
Frequency of Technology Utilization for Learning	
Consistently	145 (57.5%)
Occasionally	99 (39.2%)
Rarely	8 (3.1%)

A significant majority (91.2%) agreed or strongly agreed that AI would have a profound impact on the future of healthcare, with 48.8% strongly agreeing. Half of the participants (50.7%) agreed that AI could replace certain medical specialities during their lifetime, while 27.7% disagreed. Regarding personal understanding, 53.9% agreed to have a basic grasp of AI concepts, although only 6.3% strongly agreed. Most participants (63.8%) felt comfortable with AI-related terminology, and 57.1% were aware of AI's limitations. AI was seen as beneficial for professional development by 93.1% of respondents, and 81.6% agreed or strongly agreed that all medical students should be educated about AI. Confidence in using AI applications and integrating AI into clinical practice by the end of training was less pronounced, with 44.8% and 46.8% agreeing, respectively. A smaller proportion (47.2%) believed they would gain a clear understanding of evaluating AI performance by the end of their medical education. Outlines of participants' perceptions of artificial intelligence (AI) in healthcare and medical education are given in Table 2.

Table 2: Perceptions of Participants Regarding Artificial Intelligence

Characteristics	Strongly -agree n (%)	Agree n (%)	Disagree n (%)	Strongly-Disagree n (%)
AI significantly impact the future of healthcare	123 (48.8%)	107 (42.4%)	17 (6.7%)	5 (1.9%)
AI could potentially replace certain medical specialties in my lifetime	44 (17.4%)	128 (50.7%)	70 (27.7%)	10 (3.9%)
I have a basic understanding of AI concepts	16 (6.3%)	136 (53.9%)	88 (34.9%)	12 (4.7%)
I feel at ease with AI-related terminology	74 (29.3%)	161 (63.8%)	16 (6.3%)	1 (0.3%)
I am aware of the limitations of AI technology	26 (10.3%)	144 (57.1%)	74 (29.3%)	8 (3.1%)
Learning about AI will enhance my professional development	73 (28.9%)	162 (64.2%)	17 (6.7%)	0 (0.0%)
All medical students should be educated about AI	79 (31.3%)	127 (50.3%)	46 (18.2%)	0 (0.0%)
I will be confident consuming AI applications after medical training	36 (14.2%)	113 (44.8%)	90 (35.7%)	13 (5.1%)
I will gain a clearer understanding of how to evaluate healthcare AI performance by the end of my medical training	20 (7.9%)	119 (47.2%)	95 (37.6%)	18 (7.1%)
I will acquire the skills necessary to integrate AI into clinical practice by the end of my medical education	30 (11.9%)	118 (46.8%)	90 (35.7%)	14 (5.5%)

A significant majority of respondents (96.7%) agreed or strongly agreed that AI technologies enhance the quality of medical education, with 66.6% agreeing and 30.1% strongly agreeing. Similarly, integrating AI into medical training was viewed positively by 91.9% of participants, with 34.1% strongly agreeing and 57.9% agreeing that AI would facilitate the learning experience. Regarding AI's potential to prepare students for practical clinical scenarios, 87.2% agreed or strongly agreed, while 25.7% strongly agreed and 61.5% agreed. On the other hand, the statement that AI may take over some responsibilities of future physicians received mixed reactions, with 78.5% disagreeing (49.6% disagreed and 28.9% strongly disagreed), and only 21.3% agreeing (3.9% strongly agreed and 17.4% agreed). Participants' perceptions regarding the influence of artificial intelligence (AI) on medical education are presented in Table 3.

Table 3: Influence of AI upon Medical Education

Characteristics	Strongly -agree n (%)	Agree n (%)	Disagree n (%)	Strongly-Disagree n (%)
AI technologies enhance the quality of medical education	76 (30.1%)	168 (66.6%)	7 (2.7%)	1 (0.3%)
Integrating AI into medical training would facilitate the learning experience	86 (34.1%)	146 (57.9%)	14 (5.5%)	6 (2.3%)
Utilizing AI in medical education will equip me for practical clinical scenarios	65 (25.7%)	155 (61.5%)	52 (20.6%)	10 (3.9%)
AI may take over some responsibilities of future physicians	10 (3.9)	44 (17.4)	125 (49.6)	73 (28.9)

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The p-values indicate significant differences in some of the responses between the two groups. For the statement "AI technologies enhance the quality of medical education," a higher percentage of students in the Fourth to Final Year (73.3%) agreed compared to those in the First to Third Year (61.9%), with a p-value of <0.05, suggesting a statistically significant difference. Similarly, in the statement "Integrating AI into medical training would facilitate learning," a higher percentage of Fourth to Final Year students (62.8%) agreed compared to First to Third Year students (54.4%), with a p-value of <0.05, also indicating statistical significance. Regarding the statement "Utilizing AI in medical education will equip me for clinical work," 69.5% of Fourth to Final Year students agreed, while 55.7% of First to Third Year students agreed, with a p-value of 0.04, again showing a significant difference between the groups. In contrast, for the statement "AI may take over some responsibilities of future physicians," a higher percentage of students in the First to Third Year (55.7%) disagreed, compared to 40.9% in the Fourth to Final Year group. The p-value of 0.02 highlights a statistically significant difference between the two groups. The results of a Chi-square test comparing the year of study (First to Third Year vs. Fourth to Final Year) with participants' views on the influence of AI on medical education are displayed in Table 4.

Table 4: Chi-Square Test Comparing the Year of Study with Influence of AI On Medical Education

Characteristics	Response	First to Third-Year	Fourth to Final Year	p-value
AI technologies enhance the quality of medical education	Strongly Agree	46 (31.2%)	30 (28.5%)	<0.05
	Agree	91 (61.9%)	77 (73.3%)	
	Disagree	8 (5.4%)	2 (1.9%)	
	Strongly Disagree	2 (1.4%)	0 (0%)	
Integrating AI into medical training would facilitate learning	Strongly Agree	57 (38.7%)	29 (27.6%)	<0.05
	Agree	80 (54.4%)	66 (62.8%)	
	Disagree	8 (5.4%)	6 (5.7%)	
	Strongly Disagree	2 (1.4%)	4 (3.8%)	
Utilizing AI in medical education will equip me for clinical work	Strongly Agree	40 (27.2%)	25 (23.8%)	0.04
	Agree	82 (55.7%)	73 (69.5%)	
	Disagree	20 (13.6%)	32 (30.4%)	
	Strongly Disagree	5 (3.4%)	3 (2.8%)	
AI may take over some responsibilities of future physicians	Strongly Agree	8 (5.4%)	2 (1.9%)	0.02
	Agree	22 (15.0%)	22 (20.9%)	
	Disagree	82 (55.7%)	43 (40.9%)	
	Strongly Disagree	35 (23.8%)	38 (36.1%)	

DISCUSSION

Artificial Intelligence (AI) has recently garnered considerable attention in the healthcare sector and is emerging as a crucial element in the coming era of medicine, with implementations spanning several domains like pharmaceutics, informatics, imaging analysis, and medical aids [12]. A large majority of students believe that AI would play a vital part in health sciences. Comparable results were observed in studies conducted in the United Kingdom (UK) and the United States (USA), where over seventy-five per cent of medical students felt that AI would have a moderate to significant impact on the field of medicine throughout their professions [13]. Current study results were not astonishing in that a substantial number of pupils believed that AI education would enhance career prospects. It aligns with prior research [14]. However, the literature also documents instances of AI failures, for instance, IBM's Watson for Oncology which is an AI-driven decision support gadget that was initially implemented by several hospitals but ultimately withdrawn due to its subpar performance after substantial financial investments [15]. Furthermore, experts have indicated that AI and healthcare professionals can work synergistically; while AI is poised to transform medical practice, it is improbable that it will fully replace human practitioners shortly if ever [16]. In our study, approximately 2/3rd of participants thought that AI might supplant certain domains within health care during the lifespan, echoing comparable sentiments found among nearly half of UK students in another study [17]. Conversely, a significant majority (96.6%) of students in a German study did not agree with the concept that AI could substitute practitioners in foreseeable times [18]. It is essential to recognize that while AI may serve as an alternative for certain tasks performed by human physicians, such replacements are unlikely to be total. Rather, AI abilities might likely enhance the care provided to physicians in patient treatment and management [19]. Additionally, as AI continues to evolve, clearer guidelines for its integration into medical practices and patient pathways will likely emerge [9]. In our research, students generally reported a comprehension of AI language, restrictions, and values. Parallel results were reported in a UK study where students indicated a basic understanding of the computational principles related to AI and its limitations, although they expressed discomfort with AI vocabulary [20]. In another study, a majority of medical students (78.9%) claimed to have a solid grasp of AI; however, this study utilized correct/incorrect assessments that comprised both truths and misconceptions regarding AI, ultimately revealing that a significantly lower percentage truly understood the subject [21]. The majority of participants in the current study highlighted that by the conclusion of medical education, the capability to use AI tools will be, applied in everyday medical practices along with evaluating performances of health AI. One possible description for perceptions is that medical students at the University in Kuwait may have an overly simplified view of AI, although

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the robustness of this consideration was not quantitatively evaluated in this study, representing a limitation [13]. This is further supported by the observation that only a small fraction of the sample had gained AI information through formal training ways. In the unit of UK medical students, answers differed significantly and many expressing doubts about their readiness to engage with AI or confidence in utilizing AI tools when needed. Undoubtedly, technology can change individual's lives, and participate in technology within specific contexts. Strong belief in the prospective of AI apps to revolutionize medical curricula was evident among students. Numerous means via AI could improve education settings comprise intellectual coaching systems that identify knowledge limitation areas and provide solutions for them, computer-generated enablers, statistics mining and smart feedback mechanisms [22]. Current study, a significant bulk of students conveyed optimistic attitudes regarding the influence of AI on medical education and assumed that it would facilitate the education process. A study conducted in Pakistan highlighted several challenges that may need to be addressed when integrating AI into Pakistan's healthcare system. These challenges span various areas, including government-related issues, healthcare provider concerns, and technical difficulties. Given the scarcity of AI research in the country, healthcare providers may also lack trust in its accuracy and reliability [23]. However, the current study suggests that students recognized the value and influence of AI organizations as helpful tools in their educational journey. Their optimistic outlook was underscored by the fact that a large majority expressed a willingness to engage with AI in medical studies.

CONCLUSIONS

It was concluded that students have positive perceptions regarding AI systems, demonstrating enthusiasm for expanding their knowledge of AI within their medical education.

Authors Contribution

Conceptualization: SR1,
Methodology: SR1, SR2, MR, AH
Formal analysis: SR2
Writing review and editing: N, SB

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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