Artificial Intelligence in The Healthcare System; A Cross-Sectional Study Involving Medical Students

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ABSTRACT

Introduction: Artificial Intelligence has brought revolutionary changes in the medical field in terms of diagnosis, surgeries, and rehabilitation. This study aims to assess the knowledge and perceptions of medical students regarding Artificial Intelligence.

Methods: This is a cross-sectional study having a sample size of n= 210. The study was conducted in a medical university of Rawalpindi, among all the years of medicine. A pre-made questionnaire to assess the knowledge and perceptions of the students. The data was collected from September to December 2022. SPSS version 26 and Microsoft Excel were used for data analysis. The data were deposited in a repository of Zenodo with the persistent identifier.

Results: Only 13% of students understood what is meant by neural networks. With 65.4% believing that AI will be able to help to establish a prognosis, 60.1% expressed their confidence in AI to replace humans in performing surgery, and 40.3% found it a threat to physicians' jobs being replaced by AI. The majority (73.9%) of students thought that health equity will face quite a lot of new challenges if AI steps into medicine but they also agreed that AI skills should be ingrained in medical training.

Conclusion: Medical students lack an understanding of AI but are quite optimistic that it has the potential to transform existing healthcare practices. Students believe that training in AI competencies should be added to their curriculum so that they can be well equipped with upcoming challenges.

Keywords: Artificial Intelligence, Healthcare, Medical Students.

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INTRODUCTION

Artificial Intelligence (AI) is the process of helping humans in doing complex tasks with accuracy and perfection. If we consider AI in the medical field, it includes the use of machines and systems to have an insight into the medical data to improve the healthcare systems, so that patients can benefit from the best available healthcare. AI is being seriously used in the field of medicine almost since the 1950s when many doctors first tried to revamp their diagnoses using certain computer programs[1]. Interests of professionals and advancements in applications of AI in medicine have peaked in the past few years due to some extraordinarily efficient computers and the great amount of digital data available for analysis and utilization [2]. Like every other aspect in today's world that involves dealing directly or indirectly with humans.

Healthcare systems have fancied the use of technology to get improved results resulting in better patient satisfaction and experience. AI has brought revolutionary changes in the medical field. Its use in medical practice has improved diagnosis, surgeries, rehabilitation, etc. AI has also been found helpful in predicting the prognosis of the disease in individual patients. The AI algorithms have been most beneficial in the field of radiology, but some applications in other fields like medicine, pathology, psychiatry, cardiology, oncology, psychiatry, medicine, ophthalmology, dermatology, and oncology can also be seen[3]. Surgeries that were considered difficult to perform in the past are now being easily performed by the use of technology and AI. Much more AI applications are yet to come considering the ever-emerging needs of patients. The AI perspective and its application in healthcare settings is amazing but still, there is a huge need for new research and studies to fully establish the efficacy and applications of AI in the medical field especially when it comes to patient satisfaction and patient experience with the use of technology[4]. Some have argued that AI cannot replace the human doctor as the machines lack human qualities such as compassion, sympathy, etc. Furthermore, it is quite humane for patients to not immediately trust AI because it is certainly not the traditional way[5]. Studies have shown that Some healthcare professionals also consider AI as a risk to their livelihood, especially the radiologists. Talking specifically about radiology, certain multi-center surveys on medical students were already conducted in Canada and Germany, [6,7] to assess their opinions about the AI[8]. Results of these studies have shown that the students feel reluctant in selecting radiology as their future specialty due to some valid concerns, the major one being AI replacing radiologists in the future[9].

As the application of AI in health care is continually expanding day by day, it can be seen that proper AI curricula and courses are needed for medical students and clinicians[8]. To assess the knowledge and perceptions of medical students about Artificial Intelligence (AI), we aim to conduct this research and to gain more insight into the thoughts that the medical students have about AI and how this would affect the future of the healthcare system as a whole. As the applications of AI in the medical field are increasing day by day, we wish to know what are the opinions of medical students regarding AI itself. A question remains that whether medical schools should make AI education compulsory for their students or not. We also wish to asses through this study that while selecting the specialty for their future careers, are the medical students considering AI's scope or not. Therefore, the study aimed to assess the knowledge and perceptions of medical students regarding Artificial Intelligence.

METHODS

This study was conducted at a medical university in Rawalpindi, Pakistan. It is a Cross-sectional study. The sample size was calculated using the WHO sample size calculator which came out to be n=210 from a population of 460 medical students with a 95% confidence level and 5% margin of error. The survey was filled by 211 participants from different years of M.B.B.S after taking informed consent. The Institutional Review Board (IRB) of Rawalpindi Medical University approved the study (Reference number is PSY-69-46-22).

The sampling was done by using Convenient sampling and data collection was completed from September 2022 to December 2022. All the medical students of all the years were included in this study. Whereas, medical students who were foreigners (belonged to other nations than Pakistan) were excluded from this study. Informed consent was taken from all participants before participating in this study. A pre-made questionnaire was adapted through literature review 20 and after applying a few changes was used to assess the knowledge and perceptions of medical students regarding AI was employed. All responses were recorded on google forms. IBM SPSS version 26 and Microsoft Excel were used for data analysis for designing graphs and tables. The Name of the repository was Zenodo with a Persistent identifier / DOI: https://doi.org/10.5281/zenodo.7589254 under the Data license of Creative Commons Attribution 4.0 International.

RESULTS

A total of n=211 medical students filled out the Google form-generated questionnaires. The respondents were mostly 1st year and 2nd-year MBBS students of Rawalpindi Medical University (86.7%, n=183/211). Most of the participants were females (71.6%, n=151/211). Only one-fourth of the respondents had an academic background in Computer Science (26.5%, n=56/211) and a similar proportion

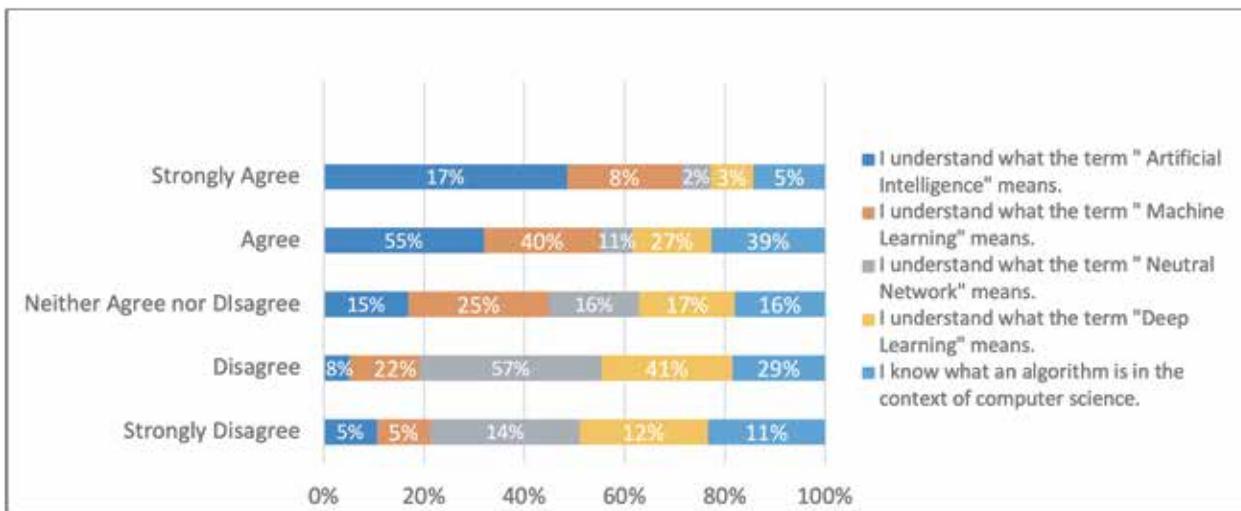of students had a basic knowledge of AI by listening to a talk or lecture (26.7%, n=56/211). Very few (8.1%, n=17/211) had taken a training course on AI, machine learning, or deep learning, and (8.6%, n=18/211) on coding or programming. This data is given in Table 1.

Table 1: Exposure to artificial intelligence.

Variables	No exposure to AI	Exposure to AI
Training in artificial intelligence	193(91.9%)	17(8.1%)
Attended lecture on Artificial Intelligence	154(73.3%)	56(26.7%)
Training in programming/coding	192(91.4%)	18(8.6%)

The collective responsibility for the phrase "I understand what the term artificial intelligence means" from students who selected 'agreed' or 'strongly agreed' was 71.5% (151/211). Similarly, for 'machine learning' was 46.6% (98/211), 13.2% (28/211) for 'neural network', 29.8% (36/211) for 'deep learning', and for 'algorithms' was 44% (93/211). Complete data is given in Figure 1.
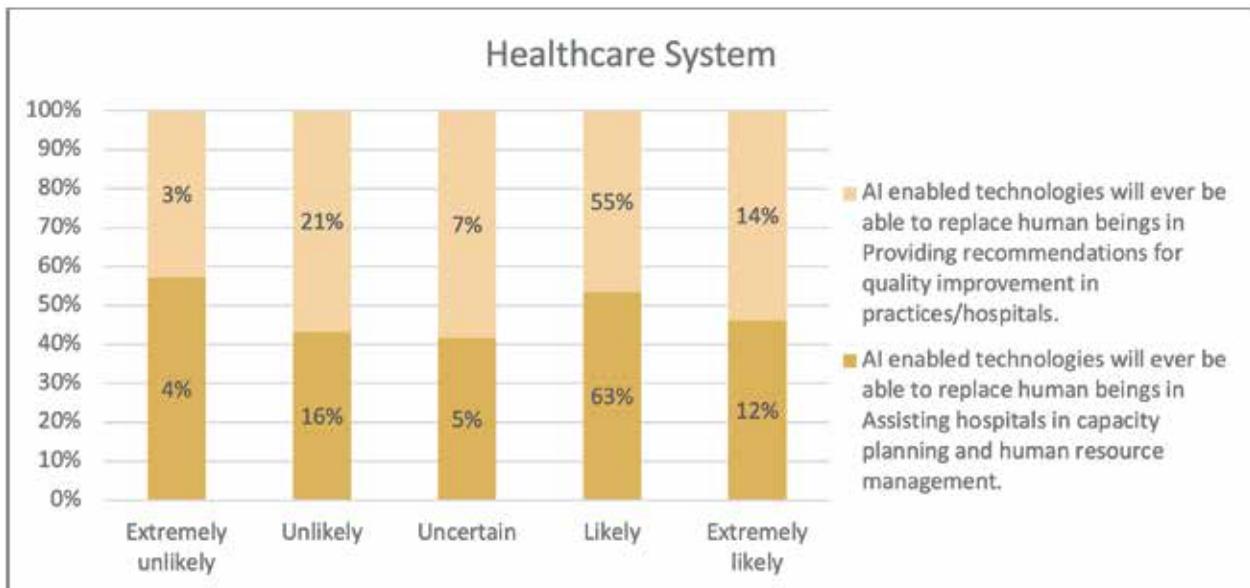

Figure 1. Knowledge of Artificial Intelligence among the medical students.

Knowledge of AI competence in the spheres of individual patient care and the healthcare system of medical students along with the expected timeline of their implementation are discussed in the upcoming paragraphs. Note that responses of 'extremely unlikely' and 'unlikely', and 'extremely likely' and 'likely' are collectively being referred to as 'unlikely' and 'likely' respectively. The opinion of medical students on AI's potential to use patient information to make diagnoses was 63.9% (135/211) with 27.1% believing that this would be a reality within 5-10 years, and 32.3% within 11-25 years. 65.4% of the students believed that AI would be able to help to establish a prognosis. 23.9% expect this to be a reality in the next 10 years and 37.4% in the next 25 years.

In response to the question of whether AI can read and comprehend diagnostic imaging, 81.9% (173/211) responded that it was possible, with 29.6% feeling it to be attained in 5-10 years and 34.9% in the coming 25 years. Students were optimistic about AI's ability to design personalized treatment plans for patients —54% (114/211) felt it was likely, 37.8% thought this was possible in 25 years, and 23% in 26-50 years from now. More than half of the students 60.1% (127/211) expressed their confidence in AI to replace human beings in performing surgery e.g., robotic surgery, and 30.5% responded that it was possible within 25 years.

Students believe that AI will have an essential role in future healthcare systems (Figure 2). 74.8% (58/211) replied that the likelihood of AI assisting in capacity planning of hospitals and human resource management, seemed to be a reality for 29.9% in the next 10 years and for 33.9% in only 25 years. Relevantly same answers were recorded on the statement that AI will "provide recommendations for quality improvement in practices/hospitals with", 69% (146/211) of the students finding it likely to happen. For 28.3% in 5 to 10 years and 32.1% in the next 25 years.

Figure 2. AI and the existing Healthcare Systems.

The presence of AI in healthcare will markedly change the job dynamics in medicine and students feel that this change might affect them at a professional level as well. When questioned whether "Artificial intelligence will reduce the number of jobs available to physicians", (40.3%, 85/211) of the students agreed to it, while a few expressed a stronger agreement (18%, 38/211), still fewer with a strongly disagreed to it (4.3%, 9/211) and 23.3% had a neutral response. Upon asking if "Artificial Intelligence will reduce the number of jobs in certain medical specialties more than others", the majority of medical students (67.2%, 142/211) agreed. Finally, there were mixed opinions on "Artificial Intelligence will/already did impact my choice of specialty selection": 45.4% (96/211) had a negative response, 27% (57/211) agreed and 27.5% (58/211) neither agreed nor disagreed.

The application of AI to healthcare can raise some issues of ethical and social nature. Keeping in view the current Pakistani healthcare system, 66.8% (141/211) of students disagreed that we are well equipped to deal with AI challenges, and 14.7% neither agreed nor disagreed. Three-fourths of the students agreed (75.3%, 159/211) that "AI in medicine will raise new ethical challenges". Only 7.7% disagreed with this statement, and 17% had a neutral stance. Similarly, 75.8% (160/211) agreed that "AI in medicine will raise new social challenges". When inquired about whether "AI in medicine will raise new challenges around health equity", the majority (73.9%, 156/211) agreed.

Only 18.9% of students agreed that their medical curriculum is sufficiently educating them to use AI tools. With 77.7% of students agreeing that AI skills should be ingrained in medical training and 76.7% (162/211) wanting it to be mandatory. Upon asking when the training for healthcare professionals to use AI tools should begin, the majority of 68.2% (144/211) selected that training regarding AI tools should be started as early as a medical student, 19% (40/211) opted for residency, and 7.1% (15/211) selected as practicing physician. 5.7% (12/286) of the medical students felt that there was no need for AI skills to be taught. It is depicted in Figure 3.
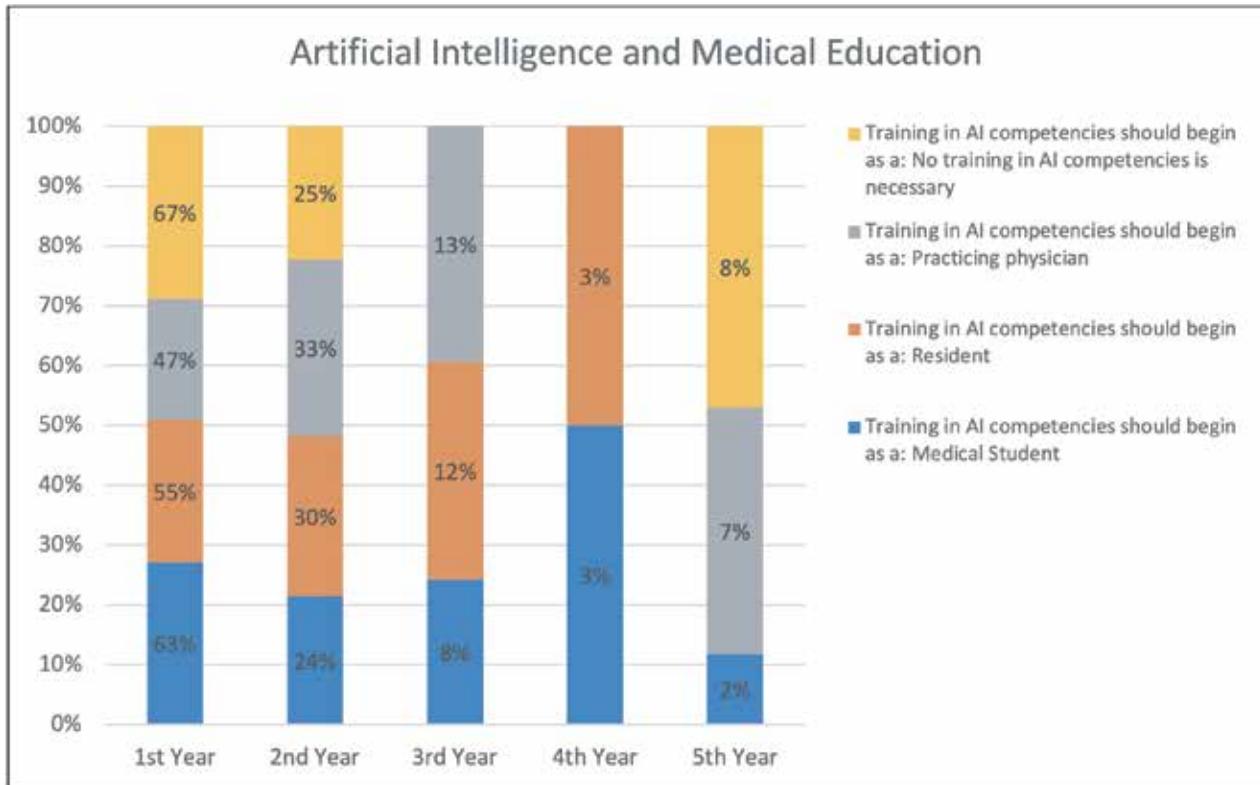
Figure 3. Opinion of medical students on Training in AI competencies.

DISCUSSION

Even today, very few research articles have touched on this important topic of applications of Artificial Intelligence in the field of medical education and clinical expertise[10]. This study is a one-step forward approach that tries to analyze the perception of AI in medical students. It clearly shows the lack of attention paid to this such an advantageous and revolutionary field[11]. Undoubtedly the new generation is well aware of the ever-increasing demands of machine learning but is not ready to take an extra step out of their comfort zones and invest time and energy in it. So, it will be really good to see the authorities taking the necessary incentives to make it easily accessible. It will be really helpful to design an inclusive.

By adding refined concepts to the previously existing base of curriculum, and by ensuring better planning and strategies; we can surely hold a better position in AI and hence secure a better future as well[12,13]. The majority of the study population believed AI can contribute a lot to providing individualized patient care in healthcare settings. Around 3/4th of the participants believed AI will be able to help patients with preventive health measures (e.g., exercise, diet, wellness) and that AI will help in designing automatic machines, software, robots, and apps that will be capable enough to analyze the condition of patient by his vitals and other signs and symptoms to suggest treatment plans and surgeries accordingly. This shows that medical students are quite optimistic about AI. This study also shows the level of misconceptions that medical students might be having regarding the application of AI in healthcare settings. 61% of our study participants found it unlikely to happen that AI will be providing psychiatric/ personal counseling. A scoping review on the role of chatbots in treating mental disorders concluded that there are different chatbots, which are currently being used to treat mental disorders and they proved to be effective[14].

Concerns regarding the ethical issues that might arise with the expanding use of AI in healthcare have already been present. In this study, three-fourths of the students agreed that the use of AI in the field of medicine is going to raise new ethical and social challenges. The majority of the study participants also believed it to raise new challenges in the equity of health distribution. To build the necessary trust regarding AI in people, it is mandatory to create an ethical global governance framework and special guidelines for the application of AI in healthcare settings[15]. No doubt that AI can be of great help in Individual Patient Care, but due to a lack of emotions, accountability, and a sense of responsibility, it has always been controversial in the patient and doctors' circles[16]. This study added value to it by pinpointing different ethical

and social challenges like health inequity to be responsible for this lack of trust indicated in a similar study conducted in the UK[17].

This study further has found that Medical Students believe that AI will play an essential role in healthcare systems soon. 74.8% of study participants believed it is likely that AI will assist hospitals in capacity planning and human resource management[18]. Correlating all the patient's history and recent diagnosis with current medication and future strategies will help improve all the fields but especially, it will help to tackle medical emergencies more strategically and easily[19,20]. This study has further observed that 40% of the medical students believed that the advent of AI will reduce the number of available job opportunities to physicians. This is such an alarming percentage to deal with compared to Europe where the undergraduates are not much insecure about their jobs when it comes to the application of AI in their healthcare systems. Lack of proper job opportunities and unemployment in developing countries like Pakistan is a major reason for this insecurity which is hindering the road to the AI revolution[7].

For medical students, appropriate and relevant subjects and courses must be included in their curriculum[12]. In this study only 19% of study participants believed that medical education given to them is aptly preparing them to work alongside AI tools, clearly indicating the loopholes in our medical education system. All of this points to the fact attention must be paid to giving AI exposure, education, and training to medical students in medical schools. Healthcare systems around the globe should equip themselves with AI technologies. And this can only be possible if healthcare professionals are provided with courses, education, and training in AI competencies.

CONCLUSION
Medical students lack an understanding of AI but are quite optimistic that AI has the potential to transform existing healthcare practices. Students believed that training in AI competencies should be added to their curriculum so that they can be well equipped with upcoming challenges that can arise with the use of AI technologies in healthcare systems.

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CONFLICT OF INTEREST
There was no conflict of interest.

ETHICS APPROVAL
The study was ethically approved from the institu-tional review board of Rawalpindi medical university (Reference number: PSY-69-46-22).

PATIENT CONSENT
Informed consent was taken from all participants.

AUTHORS' CONTRIBUTIONS
FF did the Study conception, data analysis, and write-up; AK did the Study conception, final revision, and write-up of the manuscript; HJ did the study conception and final revision; IR performed data collection, manuscript writing, and planning; MD did data collection, manuscript writing, and planning; MA performed data collection and manuscript writing.

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