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Knowledge, Attitude, and Practices of Artificial Intelligence in Undergraduate and Postgraduate Physical Therapy Students

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ABSTRACT

Background: Artificial intelligence has grown in prominence over the last few decades, and its use in medicine is spreading throughout the world. The adoption of AI-based healthcare solutions is lagging in Pakistan and other developing countries. **Objective:** To analyze the knowledge, attitudes, and practices of Pakistani undergraduate and graduate physiotherapy students about artificial intelligence. **Methodology:** This multicentre analytical cross-sectional study was conducted six months after ethical approval, including participants from CMH Lahore Medical College & Institute of Dentistry, Lahore, University of Lahore, University of South Asia, University of Management and Technology, Lahore, and Riphah International University, Lahore. Non-probability convenience sampling was used to include both male and female undergraduate, graduate, and postgraduate physiotherapy students aged 18 to 45 years, from 1st to 5th year undergraduate and 1st and 2nd year postgraduate physiotherapy students. While students enrolled in other medical and allied health sciences programs, MBBS and BDS students were excluded from this study. Data collection commenced after obtaining ethical approval, and informed consent was obtained from every participant. Data were collected by online survey and by distributing the questionnaires to physiotherapy students wherever possible. Frequencies and percentages are used to express descriptive statistics. Frequencies and percentages are used for categorical values. **Results:** Approximately 92% of physiotherapists were aware of artificial intelligence. Of these, 45.6% believed that it should be taught in medical schools, as it is essential to the medical field. Almost 31.4% of respondents think artificial intelligence can enhance the therapeutic relationship between patients and therapists. About 58.6% reported that using AI technologies in their employment had made their jobs easier. However, just 14.5% of students claimed that using AI was simple. **Conclusion:** Most students had some knowledge of artificial intelligence, and many respondents expressed interest in working on AI-related projects in the future. These findings demonstrate the high level of interest, optimistic outlook, and potential of integrating artificial intelligence in the physiotherapy sector.

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INTRODUCTION

The use of electronics and technology to mimic human-like cognitive capacities and decision-making is known as artificial intelligence (AI). In 1956, John McCarthy defined AI as the science and engineering of building intelligent machines. Through individualized learning technology, artificial intelligence (AI) is revolutionizing health profession education (HPE).¹ Artificial intelligence is an electronic tool that uses data sources to make decisions either alone or in combination with people in an effort to mimic human cognition. It has reduced a lot of medical diagnostic and follow-up errors and helped treat a wide range of ailments. The all-encompassing strategy incorporates machine learning, deep learning, representation learning, and natural language processing.² While “user interaction” refers to the specific engagement and interaction between the user and the AI system, which may include tasks like answering questions, providing assistance, or having a conversation, “communication” in this context refers to the more general exchange of information and ideas.

AI programs show off their inventive capabilities by using deep learning and natural language processing to generate responses to input text, among other functions.³ AI potential in healthcare resides in its ability to analyze unstructured data, spot irregularities, build relationships, and automate or assist with certain human tasks.⁴ In recent years, the healthcare industry has commonly faced high workloads, insufficient finances, a lack of qualified workers, employee burnout, the difficulties brought on by an ageing population, and unanticipated emergencies like the COVID-19 epidemic. However, integrating AI into healthcare presents the possibility of addressing these issues in a number of ways.⁵

AI, referred to as the fourth industrial revolution, has gained huge attention in recent decades. Many financial stakeholders have invested in AI research and medical applications. Government initiatives to promote AI haven't stopped developing nations like Pakistan from falling behind in AI education, research, and application, generally, and in the healthcare industry specifically. Reducing workload and diagnostic mistake rates in the healthcare sector requires an understanding of AI and its real-world applications. Because AI can diagnose patients remotely, medical services may now be provided outside of the world's largest

cities and in rural areas as well. AI in healthcare seems to have a bright future, even though much work remains. AI may be able to lessen some of the drawbacks of diagnosing and treating patients using conventional techniques. Among these drawbacks are the potential for mistakes brought on by psychological impacts and medical burnout, the necessity of rapidly examining a large number of patients, the potential for sporadic diagnosis errors, and patients' nervousness while visiting a clinical physician.⁶

To create professionals who are equipped to function in the healthcare system of the twenty-first century, physiotherapy education may adapt in response to the influence of AI-based technology in clinical practice. As physiotherapy educators, we have to confront some challenging problems regarding the function and significance of understanding the implications of AI in clinical practice for physiotherapy. Furthermore, we need to prepare the students to absorb and apply the technical and data literacy needed to understand and control smart equipment.⁷ Given the developing innovation of AI applications in rehabilitation, it is essential to carefully consider the attitudes and viewpoints of physical therapists to boost engagement and adoption of this technology. The practice of physical therapy necessitates problem-solving, diagnosis, and treatment planning skills. AI applications are being studied more and more in the field of rehabilitation.⁹

Given the speed at which technology and scientific knowledge are developing, it will be crucial to include AI-based content in medical education.⁸ Concerns about AI have been highlighted by the growing trend of adopting AI applications, the socio-technical ignorance of AI applications, and a lack of expertise.⁹ The necessity for a worldwide reassessment of physiotherapy education is reflected by the growth of the physiotherapy profession along with the evolution of healthcare.¹⁰ Physical therapy is prone to depend on digitalization, mobile applications that promote an active lifestyle, and different remote rehabilitation methods are fair examples. However, there is a lot of space for physical therapists (PTs) to advance in this area. PT needs to be active in the creation of AI systems to meet the growing demands of PT students in the future. Young people's lives, as well as those of potential patients and clients, are becoming more and more digitalized. Additionally, integration of AI with the existing curricula,

keeping a futuristic approach, is required to effectively educate students, including working in fully digitalized hospitals and other care facilities.¹¹

As the world becomes more digitally connected, integrating digital components into daily tasks might help physiotherapists in their work, but it can also present certain difficulties. The attitude of physiotherapists regarding digitization is not well understood.¹² Virtual or physical (robotics) AI concepts can be utilized in physical therapy practices to train patients and track their progress.^{13,14} There is a lack of literature, and students are less aware of the implications of artificial intelligence in the field of physiotherapy. This study aims to determine how much knowledge and understanding Pakistani undergraduate and graduate physiotherapy students have about AI and its effects, as well as how familiar they are with the nation's present AI practices. Determining the knowledge, attitudes, and practices of artificial intelligence among undergraduate and graduate physiotherapy students in Lahore, Pakistan, was the aim of the study.

METHODOLOGY

This multicentre analytical cross-sectional study was conducted six months after ethical approval (case no. 22/ERC/CMH/LMC dated 03-05-2024), including participants from CMH Lahore Medical College & Institute of Dentistry, Lahore, University of Lahore, University of South Asia, University of Management & Technology, Lahore, and Riphah International University, Lahore. The sample size was calculated by the WHO software using this formula.³

$$N = z^2 * p (1 - p) / d^2 = 330$$

Confidence level (%)=95%, P is the anticipated population proportion=0.68, d is the absolute precision required=0.05, and n is the sample size =330. Non-probability convenience sampling was used to include both male and female undergraduate, graduate, and postgraduate Physiotherapy students aged 18-45 years, from 1st to 5th year undergraduate and 1st and 2nd year postgraduate Physiotherapy students. While students enrolled in other medical and allied health sciences programs, MBBS and BDS students were excluded from this study.

Data collection commenced after obtaining ethical approval, and informed consent was obtained from

every participant. Data were collected by online survey and by distributing the questionnaires to undergraduate and postgraduate Physiotherapy students wherever possible. A questionnaire from previous literature by Swed S.et al (2022) was utilized in this study with the permission of the corresponding author.³ Cronbach's alpha scores for the sub-scales ranged from 0.7 to 0.8, indicating internal consistency (knowledge=0.79, practice=0.70, and attitude=0.66). SPSS version 25.0 was used to analyze the data. Frequencies and percentages are used to express descriptive statistics. Frequencies and percentages are used to convey categorical values.

RESULTS

Between the ages of 18 and 45, the subjects' mean age was 28.03±3.31. There were 257 participants, and the majority of them were female. Of those who were employed, the majority (68) were lecturers, while a startling 150 were unemployed. Table 1 provides sociodemographic and professional data. Approximately 76.6% of the participants in this study were female. Of those enrolled, 45.3% were undergraduates, 29% had graduated, and 22.05% were postgraduates. About half (24.16%) of undergraduate students were in their fourth professional year. An alarming ratio (45.3%) of graduates were unemployed. According to the figure, 58.9% of students concurred that medical pictures, including MRIs and X-rays, may be analyzed by AI to provide a diagnosis. The majority of students (58.9%) knew of the use of AI in the medical field (Figure 1).

According to the above table, 283 students, or 85.5%, thought AI was crucial to the medical industry. The majority of students, 306 (92.4%), think AI should be taught in medical school and in specialized training, and the majority of students, 303 (91.5%), think AI helps doctors diagnose patients early and gauge the severity of their conditions. However, 145 students (43.8%) stayed neutral and thought AI would increase the percentage of diagnosis errors, while 154 students (46.5%) remained neutral and thought AI would be a burden for practitioners.

The majority of students, 307 (92.74%), think that artificial intelligence will increase the effectiveness of physiotherapy services in terms of patient outcomes, and the majority, 283 (85.5%), were enthusiastic about the possible advantages of AI in physiotherapy practice. Over half of the 188

Table 1: Socio-demographic and academic status of the participants (n=331)

Variables		Frequency	Percentage
Age (years)	Mean	28.03±3.31	
	18-23	52	15.7
	24-29	271	81.9
	30-35	2	0.6
	36-40	2	0.6
	41-45	4	1.2
Gender	Male	74	22.4
	Females	257	77.6
Study level	Undergraduate	150	45.3
	PG scholars	96	29
	Postgraduate	73	22.05
	PhD scholars	9	2.4
	PhD	2	0.6
DPT year of study	1st year	0	0
	2nd year	20	6.0
	3rd year	30	9.0
	4th year	80	24.16
	5th year	20	6.0
Designation	House officer	103	31.1
	Practitioner	78	23.6
	Unemployed	150	45.3
	Demonstrator	21	6.34
	Lecturer	63	19.1
	Assistant	16	4.83
	Professor	4	1.20
	Associate	2	0.60
	Professor	228	68.88
	Professor	0	0

students, or 56.8%, said that they are willing to put in the time and effort to learn about AI and its uses in physiotherapy, and that it will improve the therapeutic interaction between the patient and the physiotherapist. Over half of the students (58.6%) have used AI technology in some capacity, and the majority of students (75.5%) find it neither simple nor challenging to use. As for the students, more than half (58.6%) said AI made their work easier, and 66.5% said they would prefer to work on AI in the future. About 41.4% of students have not used AI technology in any field, whereas 58.6% of students have used it in some capacity.

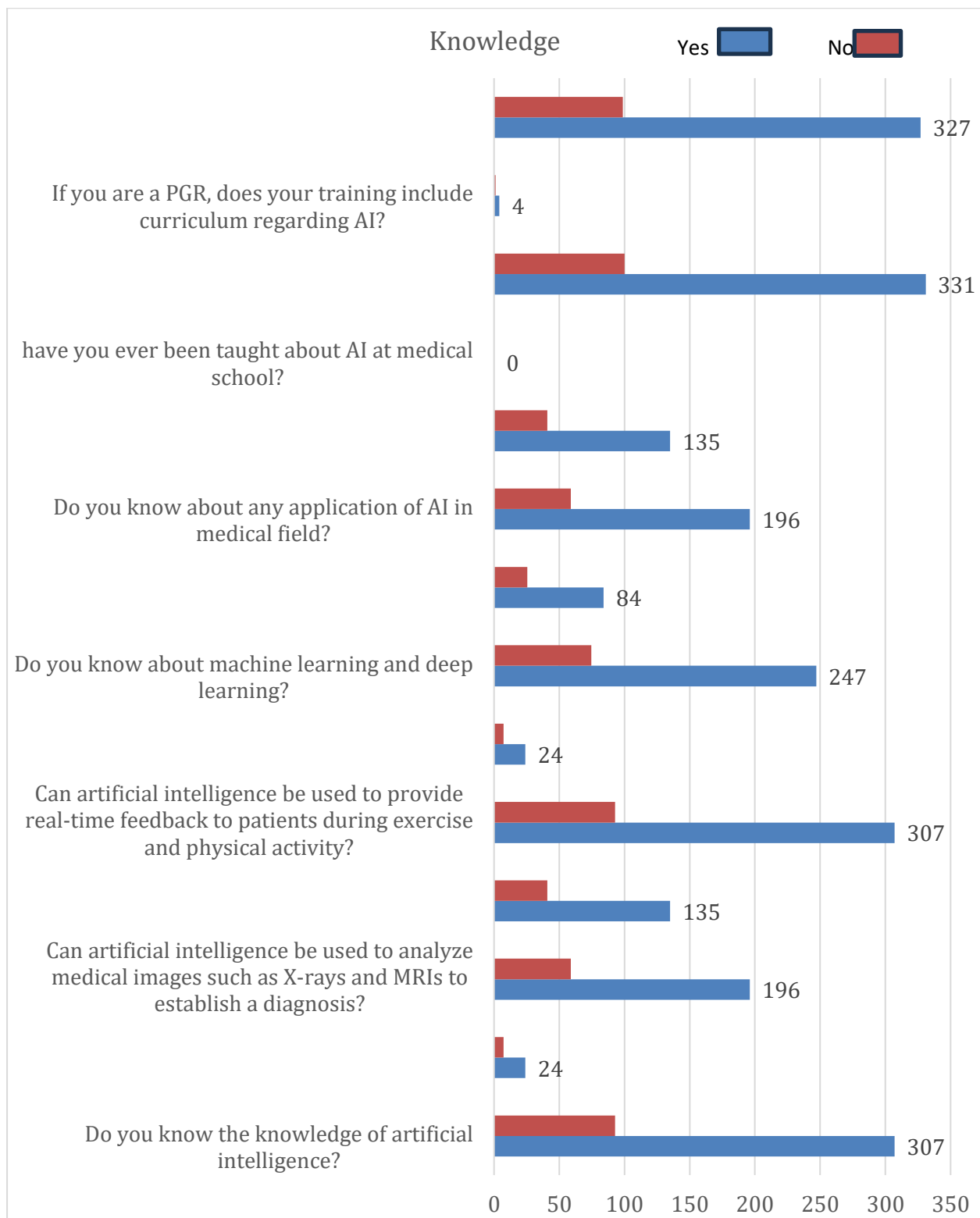
Mostly students (75.5%) neither find it easy nor difficult to apply AI, while 14.5% students easily applied AI. The majority of students (53.2%) disagreed and believed that the function of physiotherapists in the application and assessment of AI in the medical profession was not significant. However, only 2% of students believe that the function of physiotherapists is crucial to the use and assessment of AI in the medical profession. In the opinion of 58.6% of the participants, AI made

their work easier. In the future, over half of the students (66.5%) want to work in artificial intelligence. About 15.4% of students, however, were unsure.

DISCUSSION

The purpose of this study is to determine the knowledge, attitudes, and behaviours of undergraduate and graduate physiotherapy students in Lahore, Pakistan, about artificial intelligence. Women made up the majority of study participants (76.6%). Of the students, 29% had graduated, 22.05% were postgraduates, and 45.3% were undergraduates. About 24.16% of undergraduate students were in their fourth year of employment. Of the graduates, 31.1% worked from home and 45.3% were unemployed. The majority of postgraduates (68.8%) were unemployed. Our study's participants were between the ages of 18 and 45, with an average age of 28.03±3.31. Among the 257 participants, women made up the majority, 92.7% of survey respondents demonstrated a solid grasp of AI in

Figure 1: Knowledge of AI



field, 58.9% were aware of AI's use in healthcare, and 25.4% knew about machine learning and deep learning. Walid et al.'s study in Jordan included 483 students, of whom 63.8% were female and 36.2% were male. The median age of the participants was 21, with a range of 21 to 22. Nearly half (47.6%) of the participants were studying medicine or dentistry, 10.8% were enrolled in other medical professions, and 41.6% were pursuing a Bachelor of Pharmacy (Pharm B) or Doctor of Pharmacy

(PharmD). More than two-thirds of the participants (67.9%) attended public universities. Based on the participants' expertise, 49.5% claimed to have a solid understanding of the principles of artificial intelligence, 58.9% were familiar with AI applications in their field of interest, and 37.4% were aware of deep learning (DL) and machine learning (ML).¹⁴ Artificial Intelligence will someday become the norm for healthcare services, and comes in many forms,

Table 2: Attitude about using AI

Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Do you believe AI is essential in the medical field?	132 (39.9)	151 (45.)	42 (12.6)	2 (0.6)	4(1.2)
Do you think AI should be included in the curriculum in medical school as well as specialist training?	152 (45.9)	154 (46.5)	20 (6)	2 (0.6)	3 (0.9)
Do you think that AI aids practitioners in early diagnosis and assessment of the severity of disease?	190 (57.4)	113 (34.1)	8 (2.4)	10 (3)	10 (3)
Do you believe that AI will replace physiotherapists in the future?	154 (46.5)	145 (43.8)	8 (2.4)	14 (4.2)	10 (3)
Do you believe AI would be a burden for practitioners?	27 (8.1)	38 (11.48)	154 (46.5)	68 (20.54)	44 (13.29)
Do you believe AI would increase the percentage of errors in diagnosis?	74 (22.4)	42 (12.7)	145 (43.8)	33 (9.96)	37 (11.17)
I am excited about the potential benefits of artificial intelligence in physiotherapy practice.	150 (45.3)	133 (40.2)	38 (11.48)	8(2.4)	2 (0.6)
Artificial intelligence will improve the efficiency of physiotherapy services in terms of patient outcomes.	122 (36.85)	185 (55.89)	8(2.4)	13 (3.92)	4 (1.2)
Artificial intelligence will enhance the patient-physiotherapist therapeutic relationship.	104 (31.4)	84 (25.4)	42 (12.7)	74 (22.4)	27 (8.2)
I am willing to invest time and effort to learn about artificial intelligence and its applications in physiotherapy.	104 (31.4)	84(25.4)	42(12.7)	74(22.4)	27(8.2)

including DL¹⁵, ML, artificial neural networks, and expert systems. By assisting with certain tasks, lowering workloads, substituting humans for particular tasks, and improving productivity and production quality, AI integration in healthcare can address these issues. There have been several studies on how students view AI's role in science, technology, and the creative arts. Furthermore, several studies have assessed medical students' perceptions of healthcare infused with AI.¹⁶ One popular application of AI in physical therapy evaluations is gait analysis. Computers can now automatically detect underlying pathology and abnormalities in gait, such as in people with osteoarthritis and Parkinson's disease, thanks to recent advancements in machine learning-based video analysis. Ongoing gait analysis and changes

in gait patterns, which are indicators of changes in pathology, can help identify and alert the appropriate staff to patients who are more likely to fall early.

When physiotherapists use technology to learn about anatomy, physiology, clinical symptoms, tests, investigations, therapeutic interventions, and electrical modalities, their knowledge will increase dramatically. Robots and automated mannequins will reduce the likelihood that students studying physical therapy will make mistakes and abuse patients. Robotics with AI capabilities that can help and guide patients in appropriate mobility will soon be extensively accessible.¹⁷ One speciality in the treatment of pain and traumatic bone injuries is physiotherapy. By

Table 3: Practices of artificial intelligence

		Frequency	Percentage
Have you ever applied technology in any field?	Yes	194	58.6
	No	107	41.4
Was it easy for you to apply AI?	Yes	48	14.5
	No	33	10.0
	Neither easy nor difficult	250	75.5
Did AI make your task easy?	Yes	194	58.6
	No	32	9.7
	Partially	105	31.7
Do you think the physiotherapist's role is important in application and evaluation of AI in medical field?	Strongly agree	7	2.1
	Agree	12	3.6
	Neutral	17	5.1
	Disagree	176	53.2
	Strongly disagree	117	35.3
Would you like to work on AI in future?	Yes	220	66.5
	No	58	17.5
	Not sure	51	15.4

giving consumers access to a digitalized physiotherapy system, artificial intelligence holds the potential to be one of the most significant tools in the area of physical therapy for raising the standard of care provided to those in need. In order to treat patients more effectively and lessen their workload, physiotherapists will be equipped with the latest equipment. Learning about these contemporary technologies can enable them to assist their students in the same manner.¹⁸

The majority of pupils (92.7%) have some knowledge of AI, and the findings were comparable to those of research conducted in Pakistan in 2022 by Zaboora Ahmed et al. The easy sampling strategy was used to select 470 participants for the study, including physicians and medical students. The majority of students (71.3%) knew the basics of AI, but our study reveals that only 166 (35.3%) are aware of its types, machine learning, and deep learning, and 76.8% were not aware of any applications of AI in the medical field. In contrast, 74.6% of students are aware of its subtypes, machine learning and deep learning, and 40.8% were not aware of this.¹⁹

Our study found that while most students (92.7%) were aware of AI, 40.8% were unaware of its applications in the medical profession, and 45.6% were adamant that AI was essential in the medical industry. These findings were partly consistent with a study conducted in Syria in 2022 by Sarya Swed et al., which found that 70% of students had a basic comprehension of AI, 23.7% of students were aware of its potential in medicine, and 45.6% of students concurred that the medical sector depends heavily on AI. When compared to this study, 34.7% of students have adequate knowledge of machine learning and deep learning, despite 74.6% of students knowing about these subtypes. This clearly demonstrates that Syrian participants lack appropriate knowledge of the medical integration of AI. When compared to this study, which indicates that 78.6% of students are also interested in working on AI in the future, about two-thirds of the students, 66.6% would like to do so in the future.²

The results of our study are similar to those of a 2024 study by Mohammed Hammad Jaber Amin et al., which discovered that medical schools had not

taught artificial intelligence and that the majority of students were aware of it. Even fewer students believe AI should be taught in medical school and in specialized training programs, with less than half of them believing it is essential in the medical field. In both studies, most students said they wanted to work with AI in the future.

Eight percent of the undergraduate and graduate physiotherapy students who participated in our study believe that AI would be a burden for practitioners, whereas 74.6% of them are aware of the two types of AI. Of the students who responded 58.6%, stated they had utilized AI in some way and that it had made their job easier. These findings, however, differed from the 2024 study by Hammad Jaber Amin et colleagues. Only 32.7% of medical students in that research were aware of the different types of AI (ML and DL), 53.2% had never used AI technology in any sector, and 42% said that AI had made their tasks more difficult.¹⁵ Most of the students in our study are aware of artificial intelligence and its subtypes, and a comparison of our findings with a 2024 study conducted in Lebanon by Samer A. Kharroubi revealed similar outcomes. More than half of the students (58.6%) in our study agreed that AI made their tasks easier, compared to the majority of students (89.5%) in that study.²⁰

CONCLUSION

Most students had some knowledge of artificial intelligence, and many respondents expressed interest in working on AI-related projects in the future. These findings demonstrate the high level of interest, optimistic outlook, and potential of integrating AI in the physiotherapy sector.

DECLARATIONS

Consent to participate: Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

Availability of Data and Materials: Data will be made available upon request. The corresponding author will submit all dataset files.

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