

The Impact of Artificial Intelligence (AI) in Physiotherapy Practice: A Study of Physiotherapist Willingness and Readiness

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Abstract: Analyzing the current state of artificial intelligence (AI) is a critical first step toward its integration into physiotherapy practice. Therefore, this study aimed to assess physiotherapist (PT) perceptions, knowledge, and willingness to accept AI implementation. An exploratory cross-sectional online questionnaire was conducted for PT working in United Arab Emirates (UAE) from October to December 2021. A previously validated survey gathered the participant's demographic information, perceptions, knowledge, readiness, and challenges of integrating AI into practice. The results showed a considerable lack of knowledge among PT about AI. Most of the participants appreciated the role of AI applications and expected it would play a significant role in practice. Participants indicated the lack of educational resources and proper training as the main challenges for AI integration. Participants expressed a strong desire to incorporate AI into undergraduate and graduate programs. The excitement about integrating AI in physiotherapy practice requires an effort to provide education and training for students and professionals. Physiotherapists were worried that the job disturbance could be released with proper preparations to improve awareness about the AI role and challenges. Implementation of AI into PT practice will shape the future of healthcare delivery and education of physiotherapists. AI will make a faster diagnosis, better performance, and accurate results for patients and providers. Even at this early stage of AI implementation in physiotherapy, AI application raises questions and increase expectations.

Keywords: artificial intelligence, deep learning, physiotherapy, physiotherapist, knowledge, practice.

人工智能在物理治疗实践中的影响：物理治疗师意愿和准备情况的研究

摘要：分析人工智能的当前状态是其融入物理治疗实践的关键第一步。因此，本研究旨在评估物理治疗师的认知、知识和接受人工智能实施的意愿。2021年10月至2021年12月，我们为在阿拉伯联合酋长国工作的PT进行了探索性横断面在线问卷调查。先前经过验证的调查收集了参与者的人口统计信息、看法、知识、准备情况以及将人工智能融入实践的挑战。结果表明，物理治疗师在人工智能方面相当缺乏知识。大多数参与者都赞赏人工智能应用的作用，并期望它将在实践中发挥重要作用。参与者表示，缺乏教育资源和适当的培训是人工智能集成的主要挑战。参与者表达了将人工智能纳入本科和研究生课程的强烈愿望。将人工智能整合到物理治疗实践中的兴奋需要努力为学生和专业人士提供教育和培训。物理治疗师担心工作障碍可以通过适当的准备来释放，以提高对人工智能角色和挑战的认识。将人工智能应用于PT实践将塑造医疗保健服务和物理治疗师教育的未来。人工智能将为患者和提供者提供更快、更好的性能和准确的结果。即使在物理治疗中人工智能实施的早期

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阶段, 人工智能应用也会提出问题并增加期望。

关键词: 人工智能, 深度学习, 理疗, 理疗师, 知识, 实践。

1. Introduction

Artificial Intelligence is defined as the advancement of technology in tasks requiring human intelligence involvement [1]. Machine learning can provide humans with the capability of supervised and unsupervised learning and be used for better training and prediction of our system [2]. Furthermore, AI technology differs from the usual software and hardware interface by developing systems to learn from their datasets [3].

The physiotherapy profession is undergoing a fundamental change because of the integration of advanced technologies, specifically artificial intelligence (AI) applications [4–6]. Currently, AI is a significant opportunity to improve professional success and performance. Integration of AI in healthcare offers unique opportunities to improve patient care outcomes, decision making, professional performance, and reduce costs. There have been promising examples of AI applications vital to achieving physiotherapist (PT) tasks [7].

Implementing AI in physiotherapy has proven beneficial; it facilitates the PT job and tasks and improves performance. With the help of AI applications, PT is getting the tools and support to decrease the workload, treat more patients, and increase patient outcomes [2, 5].

On the other hand, many researchers believe that AI and deep learning applications will threaten the physiotherapy profession [8, 9]. This concern is because the advancement of technologies can shift the balance of power away from a human to machines.

The study aimed to assess physiotherapists' readiness to accept AI in their work practice and the impact of AI on work performance.

2. Methods

An exploratory cross-sectional online questionnaire of PT working within the United Arab Emirates (UAE) was conducted [8–10]. The study instrument was previously validated and used by the research team. The questionnaire was reviewed and piloted to suit the physiotherapy profession. The questionnaire was composed of questions gathered demographic information from the participants, including gender, age, academic degree, and practice experience. In addition, the PT perceptions, knowledge, readiness, and challenges of incorporating AI in their practice were captured using multiple response and attitudinal scale questions.

The population size was unidentified as there were no similar previous studies in the country. The

participants' numbers calculated based on a cross-sectional studies formula for a sample size with a margin of error was set at 5% and 95% confidence levels. A total of 72 participants were accepted for this study. The online questionnaire used "Google Form" (Google, Mountain View, CA). The questionnaire link was shared via research assistant with regular reminders to maximize the responses. The data collection duration was three months (October to December 2021). Before starting the questionnaire, the invitation and introduction statements to explain the study's aim and consent to participate were placed. A clear statement to the participants explains their ability to withdraw at any time before submitting the questionnaire without consequences. The responses were checked for duplication and filtration to remove any missing information. Study approval was obtained from the University of Sharjah Research Ethics Committee (REC), "REC-20-05-06-01". The REC reviewed and approved the methods and protocol.

2.1. Statistical Analysis

Responses were collected, characterized, and analyzed using the Statistical Package for Social Sciences (SPSS), version 24®. The descriptive statistics were expressed as percentages, mean and standard deviations.

3. Results

3.1. Demographics and Participants' Background

A total of 72 responses were received from the physiotherapists, (n=30, 41.7%) were males and (n=42, 58.3%) were females. The majority of the respondents (n=43, 59.7%) had bachelor's degrees, while (n=16, 22.2%) of them were diploma holders and (n=13, 18.1%) had master's degrees. Most of the participants were between the ages of 21-30, accounting for (n=60, 83.3%) while (n=11, 15.3%) of them were between 31-40, and a were (n=1, 1.4%) was above 41.

They showed that (n=30, 41.7%) of the respondents graduated from the UAE, (n=12, 16.7%) from Egypt, (n=19, 26.4%) from India, and (n=11, 15.3%) of them from Philippine. Of the total respondents (n=54, 75%) have professional experience between 1-5 years, (n=11, 15.3%) have 6-10 years, and only (n=7, 9.7%) have over 10 years of experience.

A majority of the respondents were working at hospitals (44.4%, n=32), followed by participants from sports clubs (18.1%, n=13) and clinics (11.1%, n=8). An equal number of participants (9.7%, n=7) worked at private clinics and home care, and the least number of

respondents were from academic institutes (6.9%, n=5).

3.2. Perceptions Assessment

The respondents were assessed on their perceptions of the AI's importance in their practice through a 5

point Likert scale. Scores were assigned for responses, 1 = 'Strongly Agree', 2 = 'Agree', 3 = 'Neutral', 4 = 'Disagree', and 5 = 'Strongly Disagree', following which mean and SD of the responses were calculated.

The results are shown in Table 1.

Table 1 Perceptions of AI

	SA (%)	A (%)	N (%)	D (%)	SD (%)	Invalid
AI will play an essential role in the practice of PT professions.	21(29.2)	45(62.5)				6(8.3)
AI will take place in many applications	27(37.5)	27(37.5)	12(16.7)	6(8.3)		
AI will threaten/disrupt the PT professional practice.	6(8.3)	6(8.3)	12(16.7)	36(50)	9(12.5)	3(4.2)
AI will threaten/disrupt some PT professional careers.	6(8.3)	15(20.8)	15(20.8)	30(41.7)	6(8.3)	
AI has 3 limitations in my work	9(12.5)	18(25)	27(37.5)	15(20.8)		3(4.2)
I am ready to learn and apply AI in my practice	30(41.7)	30(41.7)	9(12.5)	3(4.2)		

A significant number of participants (n=45, 62.5%) agreed with the statement that AI will play an essential role in the practice of physiotherapy professionals ($\mu=1.54$, $SD=0.6$). There were (n=54, 75%) who agreed that AI would take place in many applications ($\mu=1.96$, $SD=0.9$). The participants (n=45, 62.5%) disagreed with the statement that AI will threaten/disrupt physiotherapy professional practice ($\mu=3.38$, $SD=1.2$). Further, (n=36, 50%) disagreed that AI will threaten/disrupt some professional physiotherapy careers ($\mu=2.58$, $SD=1.0$). There were (n=60, 83%) participants who affirmed that they are ready to learn and apply AI in their practice ($\mu=1.79$, $SD= 0.8$). The participants were asked about their feelings about the implementation of AI into the department, to which (n=27, 37.5%) stated they were excited, and an equal number of participants (37.5%, n=27) stated they were aware of the challenges. The other (n=18, 25%) stated they felt neutral, worried about the impact, or did not know enough information (Fig. 1).

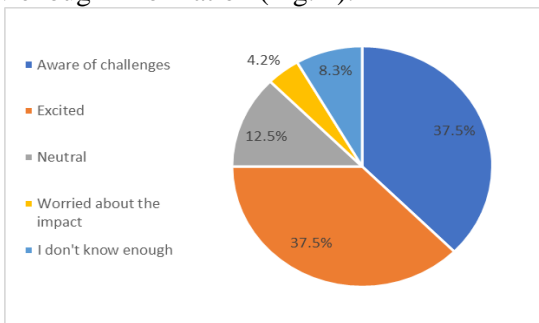


Fig. 1 Perceptions of AI

3.3. Knowledge Assessment

The respondents were asked how well they understand what is meant by AI, for which (n=24, 33.3%) stated they are comfortable with what it means but had no technical information, and (n=24, 33.3%) declared they are familiar with it but would not be confident to apply that knowledge at work. (n=18, 25%).

The respondents stated their knowledge of AI is limited to those they have read in news, posters, or media, and (n=6, 8.3%) stated they have no idea (**Ошибка! Источник ссылки не найден.**).

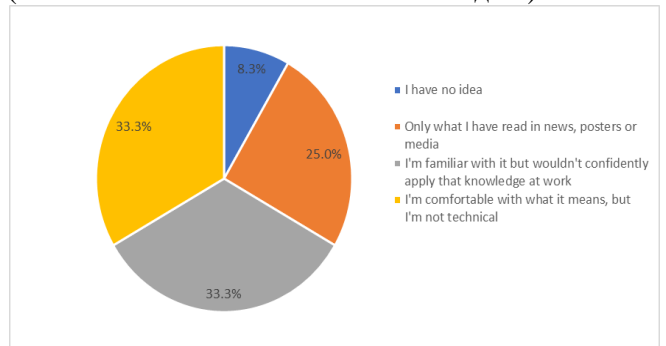


Fig. 2 Knowledge of AI

Table 2 shows the responses of the physiotherapists regarding their knowledge and perceptions of learning about AI.

Table 2 Knowledge of AI

	SA (%)	A (%)	N (%)	D (%)	SD (%)
The curriculum should include at least some basic knowledge of AI	21(29.2)	33(45.8)	18(25)		
AI should be taught in the undergraduate program	18(25)	30(41.7)	21(29.2)	3(4.2)	
AI should be taught in the postgraduate program	30(41.7)	30(41.7)	12(16.7)		
I have a basic understanding of AI	3(4.2)	18(25)	24(33.3)	15(20.8)	12(16.7)
I have a working knowledge of AI	12(16.7)	6(8.3)	27(37.5)	21(29.2)	18(25)
I have been trained and educated about the AI	18(25)	9(12.5)	9(12.5)	33(45.8)	21(29.2)

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Ошибка! Источник ссылки не найден. shows the responses of the physiotherapists regarding their knowledge and perceptions of learning about AI.

A majority of the respondents (n=54, 75%) agree that physiotherapy curriculums should include at least some basics of AI ($\mu=1.9$, $SD=0.7$). Furthermore, there is (n=48, 66.7%) of participants think AI should be taught in the undergraduate program ($\mu=2.13$, $SD=0.8$), while (n=60, 83.4%) of them agree that AI should be taught in the postgraduate program ($\mu=1.75$, $SD=0.7$).

The study gathered data on how the participants developed their skills and knowledge of AI, and the results are depicted in

Fig. 3. A majority of the participants (50%, n=36) were self-taught, and (n=18, 25%) mentioned they did not have AI knowledge. Considering the skills developed, (n=21, 9%) were self-taught, (n=12, 17%) attended courses, and 13% (n=9) benefitted through work-related activities.

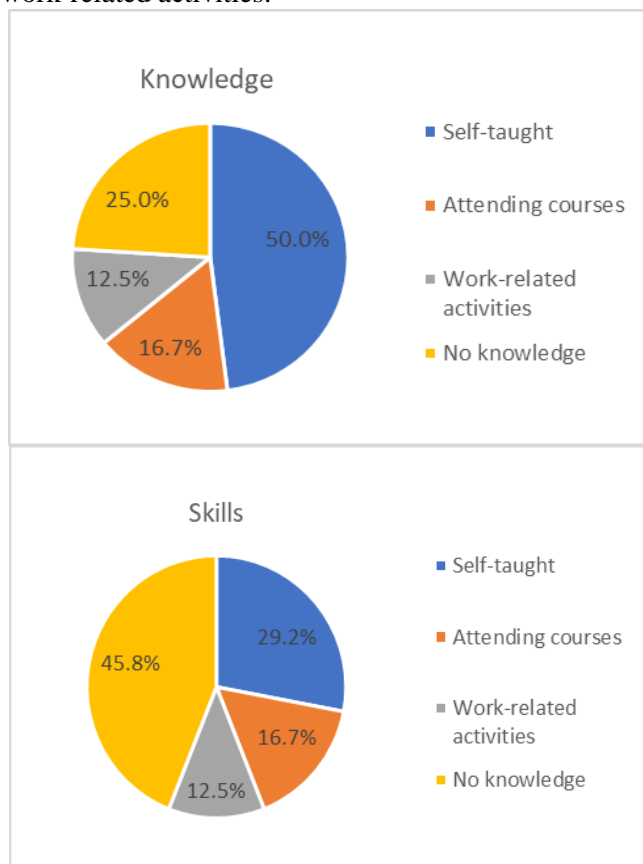


Fig. 3 Knowledge and Skills Gain

3.4. Organizational Readiness

The respondents were asked about their institute's readiness to integrate AI into work practice. The majority of the participants stated that there is no

personnel or unit specialized in AI preparation and integration in practice (n=54, 75%), while (n=33, 45.8%) of the respondents stated that they were expecting that their organization will have a strategy for AI in future. Meanwhile, (n=12, 16.7%) responded that they are looking forward to incorporating AI at work.

3.5. Challenged for AI Implementation

The study revealed that (n=36, 50%) of the respondents had faced drawbacks in finding good education and training courses in AI and the relevant skills development. Further, (n=12, 16.7%) of the respondents thought the biggest challenge was the lack of AI integration in the undergraduate/postgraduate courses. An equal number of participants thought the overall lack of knowledge contributed to the same.

3.6. AI Area of Interest

The popular areas of interest in implementing AI were in providing assistance to physiotherapists (as Physiotherapy assistants) (58.3%, n=42), performing treatment (54.2%, n=39), and making a diagnosis (41.7%, n=30). Relatively low interest was shown in making treatment decisions (25%, n=18) and developing home programs (20.8%, n=15).

3.7. Comparison of Demographics and Responses

Chi-Square analysis was conducted to study the association between participant demographics and their responses. First, to summarize the data, 'neutral' responses were excluded. Then, two new data groups were formed, each adding the two 'extreme' columns of data on either side of the 'neutral' data column. Thereby, new data sets were 'Agreement' and 'Disagreement'.

The study concluded that there is an association between the number of years of experience of physiotherapists and their opinion that AI will threaten/disrupt the physiotherapists' professional practice ($p = 0.011$), where 100% of the physiotherapists with experience of 5-10 years and more than 10 years disagreed and 70.7% of those with experience less than 5 years disagreed.

The study further revealed the association between the physiotherapists' workplace and the inclination to disagree that AI will threaten/disrupt some PT professional careers ($p = 0.033$). Of the physiotherapists from healthcare sectors (hospital, Clinical, Private center), 52.8% stated they disagree, while 81% of physiotherapists from other sectors (Sports club, academic institution, home care) disagree.

A strong association was found between the time of experience working as a physiotherapist and the training and education received about AI ($p=0.034$). Of the physiotherapists who had more than 10 years of experience, 42.9% of them agreed that they had been

trained or educated on AI, while 100% of physiotherapists who have been working for 5-10 years stated they did not receive training or education on AI.

4. Discussion

The challenges facing AI's integration in physiotherapy practice have to be addressed. This study reports the end users' challenges in understanding the current situation and suggesting future solutions. Nevertheless, physiotherapists are excited about advancing the technology, aware of the practice changes, and agree it requires proper preparation [11].

Although some of the respondents are worried about the threat and disturbance of the current practice, most participants understand the considerable benefit AI will bring to the patients. This concern could be explained by the lack of knowledge, skills, and understanding of the AI role in practice. The study results may support this concern as only 33.3% of the participants understand what AI means, and the rest have limited knowledge about AI [2, 5].

Indeed, the results showed that only 16.7% of the participants had a systemic AI study or training compared to 25% who had no previous education, and 50% had their knowledge from self-taught. These results raised concerns about the lack of AI physiotherapy training or courses. Academic institutes and professional organizational bodies should be aware of this deficiency and develop proper educational routes. Furthermore, understanding the end user's needs regarding the advancement of the technology will improve the adaptation to the new products [12]. The interest of the end-users will be improved when there can accomplish specific tasks and improve their performance and patient care delivery service.

Various studies reviewed the physiotherapy education strategies to develop students' professional knowledge and skills about AI and DL [2, 5, 12]. While AI and DL may eventually take over the tiresome tasks of the learning process, educators should still identify the education objectives and develop continuing education programs for professionals. In addition, technological advancement requires concentration on changing physiotherapy education to suit future practice. Physiotherapists should excel in the intelligence era and face the challenges of using AI to improve patient care delivery.

5. Conclusion

In conclusion, the integration of AI into physiotherapy practice will continue to pique interest. The authors suggest preparing educational materials, instructional training, and workshops from verified sources rather than medical companies and vendors.

Knowledge gained from this study will alarm the UAE educational institutions and professional bodies to plan strategies to support AI integration. Universities

and continuous education centers can cover the current lack of knowledge, skills, and local learning resources by designing education courses for students and professionals [10, 13].

UAE government recognizes the positive impact of deploying AI in service delivery. Therefore, the government is encouraging the acceleration of AI adoption through strategic partnerships with local and international organizations. In addition, the government supports the healthcare sector to prepare improvement plans and educational programs to incorporate AI into practice.

AI integrated into the healthcare delivery system, confirmed as cleverer than human beings, and will gradually take over some health professional tasks. Integrating AI in physiotherapy in clinical practice will improve PT performance and provide better diagnostic abilities. Therefore, it is vital that physiotherapists actively engage in AI education and training and determine the needs for future implementations [14]. The challenge for AI interaction in PT practice will improve the interaction between humans and machines and increase human capacity [4, 11].

5.1. Limitation

The main limitation of this study was the sample size of the studied population. The author tried to increase the response rate, but due to COVID-19 Pandemic, it was challenging to reach different areas in the country. Therefore, a future conclusive study will increase the sample size and find out the current and future AI applications in physiotherapy practice.

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