ARTIFICIAL INTELLIGENCE IN NIGERIAN PHYSIOTHERAPY: EXPLORING IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

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ABSTRACT

Background: Artificial intelligence (AI) has emerged as a transformative tool in healthcare, with growing relevance in physiotherapy for improving assessment, diagnosis, and treatment planning. However, the integration of AI into clinical practice, particularly in low-resource settings such as Anambra State, Nigeria, faces numerous challenges.

Aim: To identify the facilitators and barriers of AI applications in physiotherapy practices in Anambra state.

Materials and methods: This study was a cross-sectional which used a convenience sampling technique to recruit 60 physiotherapists residing and/or working in Anambra State's health facilities. Data were collected using a self-structured questionnaire and analysed using descriptive statistics.

Results: Most participants (53.3%) were female, within the age group of 30–39 years. Most participants (88.0%) indicated that

they had never used AI during treatment. Approximately 53.3% identified social media as the platform where they sourced information about the application of AI in physiotherapy, and 98.3% indicated that the application of AI cannot replace physiotherapists. Wearable devices were identified as the most impactful AI tool. The inability of AI to manage all patients' health conditions or impairments, cost of AI equipment and treatment, and acceptance and adoption of AI technologies were identified as the major barriers.

Conclusions: The findings indicated limited application of AI among physiotherapists, despite the potential for improvement through various supportive measures. Factors such as funding availability, training programs, and access to AI-powered platforms can significantly enhance the integration of AI in healthcare practices.

Keywords: Facilitators, Barriers, Artificial Intelligence, Physiotherapy, Healthcare Technology

INTRODUCTION

Recent advances in health technology have positively impacted various economic sectors, especially the healthcare industry. These advancements provide solutions that ensure the expansion and interchange of medical knowledge and information, and ensure long-term health results.^{1,2} Digital health technologies, such as wearable devices, computerized decision support systems, and telemedicine, improve the technical performance and satisfaction of healthcare employees, decrease direct and indirect costs of medical services, and enhance the quality of care.³

Artificial intelligence (AI), a major field in computer science, can enhance the healthcare system via novel delivery strategies, informed decision-making, and facilitation of patient engagement. AI can forecast outcomes and automate decisionmaking. The features of this technological breakthrough impact all facets of society,

potentially disrupting socioeconomic, health, legal, and moral institutions, ultimately contributing the advancement to of humanity.⁴ AI technologies, including machine learning, neural networks, and deep learning, are increasingly playing a role in health-related practices.⁵ many Many healthcare professionals these use technologies in clinical decision-making, diagnosis, and patient management.⁶⁻⁸

Restoring physical strength and function is the main goal of physical therapy; however, physiotherapy interventions can take many different forms, including multi- or singlecomponent programs, hospitalor community-based, clinician-led or self-Physical therapy is readily directed. available; however, its use is often underutilized, and compliance rates are low globally.9 One of the physical therapists' responsibilities is to conduct physical rehabilitation assessment and design appropriate clinical plans of care for patients with physical disorders.¹⁰ This initial process depends on the experience of the physiotherapists, and the time constraints or limited availability of the human workforce can make it challenging. Hence, there is a need for advanced technologies such as AIbased applications.

The primary applications of AI in physiotherapy and rehabilitation include risk analysis, virtual assistants, dexterous robotics, video analysis, and predictive algorithms.8 These approaches can improve implementation. analysis and data classification of functions, and disability predictions.

Furthermore, in physiotherapy practices, AI systems can be used to train patients and monitor their progress, using either virtual (informatics) or physical (robotics) AI concepts.¹⁰ Moreover, a study showed the effectiveness of a virtual physiotherapy system in improving the balance and mobility of patients with Parkinson's disease remotely.¹¹ AI technology has a high accuracy level in remote training and patient management processes. Moreover, AI can monitor and enhance patient adherence to therapeutic exercises for musculoskeletal issues, such as neck or back pain. Similarly, a study found that using AI-enabled mobile applications with patients who had neck and back pain was beneficial in increasing therapeutic exercise adherence.¹²

Additionally, research into supervised machine learning has also examined whether AI-enabled devices can monitor patients' compliance with home exercises. However, there are still challenges in using AI in medicine, including ethical considerations, issues with technology trust, a lack of knowledge and expertise among medical practitioners, and maintenance costs.13 Therefore, this study aimed to ascertain the facilitators and barriers of artificial intelligence applications in physiotherapy practices in Anambra State.

MATERIAL AND METHODS Research design and Population

This was a cross-sectional study, involving a population of 90 physiotherapists residing and/or working in selected healthcare facilities in Anambra State who have at least one year of experience. A consecutive sampling technique was used to recruit

participants. The physiotherapists were recruited from the following health facilities: Azikiwe University Teaching Nnamdi Hospital; Landmark Physiotherapy Services, Nnewi: General Hospital Ekwulobia; Chukwuemeka Odumegwu University General Teaching Hospital, Amaku: Enugwu-Ukwu; Federal Hospital and Medical Centre, Onitsha.

Inclusion criteria

- 1. Licensed physiotherapists with at least one year of experience.
- 2. Physiotherapists who reside and/or work in Anambra state.
- 3. Physiotherapists who were willing to participate in the study.
- 4. Physiotherapists with slight knowledge of artificial intelligence applications in physiotherapy practices.

Research instrument

A structured self-administered questionnaire was designed to assess the facilitators of and barriers to AI applications in physiotherapy practices. It was a 21-item questionnaire categorized into four sections. Section A assessed the socio-demographic profile of the participants. Section B determined the application of AI in physiotherapy practice. Section C assessed the facilitators of AI in physiotherapy practice. Section D ascertained AI in physiotherapy practice.

Data collection

Ethical approval was sought and obtained from the Ethical Review Committee of the Nnamdi Azikiwe University Teaching Hospital, Nnewi, before the commencement of the study (Ethical approval number: FHST/REC/024/890). Six research assistants were recruited and trained to administer the questionnaire, and the completed questionnaires were collected afterward.

Data analysis

statistics Descriptive were used to summarize participants' demographic characteristics and responses. Frequencies and percentages were computed for categorical variables such as gender, work setting, awareness and use of AI, and perceptions of facilitators and barriers to AI adoption in physiotherapy. Cross-tabulations were performed to observe trends and potential associations between demographic characteristics (years of experience and gender) and AI usage or perceptions. Statistical significance was set at p < 0.05.

RESULTS

Socio-demographic characteristics of the participants

Sixty physiotherapists participated in this study. Approximately 53.3% were female. Most participants were within the age group of 30–39 years, accounting for 46.7%. Additionally, 35% had less than 3 years of experience. Most participants (80.0%) held a bachelor's degree as their highest educational qualification, and 55% were classified as junior physiotherapists (Table 1).

Application of AI in Physiotherapy

This study revealed that most participants (88.0%) had never used AI during treatment (Fig. 1). Approximately 53.3% identified social media as the platform where they sourced information about the application of AI in physiotherapy (Fig. 2). More than half of the participants (58.3%) indicated that the important essence ΑI most of in physiotherapy practice was providing a thorough assessment (Fig. 3). Most participants (65.0%) revealed that the area of physiotherapy that AI would be more useful was neurology (Fig. 4). Furthermore, 98.3% of the participants indicated that AI cannot replace physiotherapists (Fig. 5). Additionally, most participants (63.3%) indicated that wearable devices, an artificial intelligence tool, would have the best impact on patients (Fig. 6).

Facilitators of AI applications in physiotherapy practices

This study revealed that approximately 83.3% of the participants affirmed that workshops, seminars, and training programs are needed to educate physiotherapists on AI technologies to enhance their integration. Additionally, 76.7% affirmed that reliable internet access and an AI-powered software platform are essential for AI-based physiotherapy. Similarly, most participants (68.3%) concurred that AI-based tools that

provide treatment plans and patient would monitoring encourage physiotherapists to adopt them. Additionally, most participants (70.0%) concurred that creating awareness about the benefits of AI for improving patient outcomes can facilitate broader acceptance practitioners among and patients. Additionally, the study showed that most participants (86.6%) stated that the availability of funding from private and public sources could enhance the use of AI in physiotherapy practice (Table 2).

Barriers of AI applications in physiotherapy practices

Most participants indicated that the inability of AI to manage all patients' health conditions or impairments (93.3%) and the cost of AI equipment and treatment (86.7%) were barriers to AI applications in physiotherapy practice. Also, the acceptance and adoption of AI technologies by patients physiotherapists (83.3%) and and insufficient knowledge and skills (98.4%) were identified as barriers to AI applications physiotherapy practice. in Also. approximately 51.7% of the participants neither agreed nor disagreed that limited therapist-patient interaction was a barrier to AI applications in physiotherapy practice (Table 3).

| Variable | Class | Frequency | Percentage |
|------------------------|---------------------------|-----------|------------|
| Gender | Male | 28 | 46.7 |
| | Female | 32 | 53.3 |
| Age group | <29 years | 19 | 31.7 |
| | 30–39 years | 28 | 46.7 |
| | 40–49 years | 11 | 18.3 |
| | >50 years | 2 | 3.3 |
| Years of experience | < 3 years | 21 | 35.0 |
| | 3–6 years | 20 | 33.3 |
| | 7–10 years | 8 | 13.3 |
| | >10 years | 11 | 18.3 |
| Highest level in | Junior physiotherapist | 33 | 55.0 |
| physiotherapy practice | Senior physiotherapist | 11 | 18.3 |
| | Principal physiotherapist | 7 | 11.7 |
| | Chief physiotherapist | 8 | 13.3 |
| | Physiotherapists | 1 | 1.7 |
| Highest level of | B.Sc | 48 | 80.0 |
| education | M.Sc | 10 | 16.7 |
| | PhD | 2 | 3.3 |

Table 1. Socio-demographics characteristics of the participants

| | ····· | | I J | | | | | | | |
|---------------------------------|--------------|-------|-------|-------|------------|------|------------|------|----------|----------|
| Items | Strong | gly % | Disag | ree % | Neutra | al % | Agree | % | Strongly | % |
| | Disagr | ee | (n) | | (n) | | (n) | | Agree | |
| | (n) – | | | | | | | | (n) | |
| Workshop, seminars and | 1 | 1.7 | 1 | 1.7 | 8 | 13.3 | 23 | 38.3 | 27 | 45.0 |
| training programs to educate | | | | | | | | | | |
| physiotherapists on AI | | | | | | | | | | |
| technologies to enhance its | | | | | | | | | | |
| integration. | | | | | | | | | | |
| Reliable internet access and AI | 1 | 1.7 | 1 | 1.7 | 12 | 20.0 | 27 | 45.0 | 19 | 31.7 |
| powered software platforms | | | | | | | | | | |
| are essential for AI based | | | | | | | | | | |
| physiotherapy. | | | | | | | | | | |
| AI based tools that provide | 1 | 1.7 | 18 | 30.0 | 0 | 0 | 26 | 43.3 | 15 | 25.0 |
| treatment plans and patient | | | | | | | | | | |
| monitoring will encourage | | | | | | | | | | |
| physiotherapists to adopt | | | | | | | | | | |
| them. | | | | | | | | | | |
| Creating awareness about the | 1 | 1.7 | 0 | 0 | 17 | 28.3 | 27 | 45.0 | 15 | 25.0 |
| benefits of AI for improving | | | | | | | | | | |
| patient outcomes can facilitate | | | | | | | | | | |
| broader acceptance among | | | | | | | | | | |
| practitioners and patients | | | | | | | | | | |
| alike. | | | | | | | | | | |
| Availability of funding from | 1 | 1.7 | 0 | 0 | 7 | 11.7 | 26 | 43.3 | 26 | 43.3 |
| private and public sources can | | | | | | | | | | |
| enhance the use of AI in | | | | | | | | | | |
| physiotherapy practice | | | | | | | | | | |
| AI, Artificial Intelligence | | | | | | | | | | |

Table 2. Facilitators of AI applications in physiotherapy practices

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| Items | Strong Disagr (n) | gly % 'ee | Disag (n) | ree % | 6 Neutra (n) | al % | Agree (n) | % | Strongl Agree (n) | y % |
|---|-------------------------|--------------|--------------|-------|-----------------|------|--------------|------|-------------------------|------|
| Inability of AI to manage all patients' health conditions or impairments. | 1 | 1.7 | 0 | 0 | 3 | 5.0 | 21 | 35.0 | 35 | 58.3 |
| Cost of the AI equipment and treatment | 1 | 1.7 | 2 | 3.3 | 5 | 8.3 | 28 | 46.7 | 24 | 40.0 |
| Acceptance and adoption of AI technologies by both patients and physiotherapist | 0 | 0 | 0 | 0 | 10 | 16.7 | 33 | 55.0 | 17 | 28.3 |
| Insufficient knowledge and skills | 0 | 0 | 0 | 0 | 1 | 1.7 | 19 | 31.7 | 40 | 66.7 |
| Limited therapist-patient interaction | 1 | 1.7 | 13 | 21.7 | 31 | 51.7 | 15 | 25.0 | 15 | 25.0 |

Table 3. Barriers of AI applications in physiotherapy practices

AI, Artificial Intelligence







Figure 2. Where did you source information about applying artificial intelligence in physiotherapy?



Figure 3. What do you think is the most important essence of artificial intelligence in physiotherapy practice.



Figure 4. Opinions on Usefulness of artificial intelligence in physiotherapy practice



Figure 5. Can the application of artificial intelligence replace physiotherapist?



Figure 6. Which of the artificial intelligence tools listed do you think would have the best impact on patients?

DISCUSSION

The use of AI in healthcare, including increased physiotherapy, has rapidly recently owing to advancements in machine learning, wearable devices, and data analytics. AI can revolutionize improving physiotherapy by diagnostic accuracy, optimizing treatment plans, and enhancing patient outcomes. However, integrating AI into clinical practice is not without challenges. This study aimed to assess AI application in physiotherapy practices in Anambra State, Nigeria, specifically identifying the facilitators and barriers. By analyzing the perceptions and

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experiences of 60 physiotherapists, this study aims to provide valuable insights into the factors that influence the integration of AI in physiotherapy and its potential to improve clinical practices.

This study comprised 60 participants, with more than half of the participants being females and a modal age group of 30–39 years. The demographic profile of the participants is crucial for understanding their potential openness and exposure to AI. Most participants held a bachelor's degree, and more than half of the participants were junior physiotherapists with less than 3 years of experience. These findings align with the

growing educated trend of young, professionals entering the healthcare workforce, which is often associated with higher adaptability to new technologies.¹⁴ However, the relatively low years of experience may also limit the depth of their exposure to AI technologies, as their practices are still in the early stages of professional development. The younger age group (30-39 years) suggests that these physiotherapists may be more technologically savvy and open to AI adoption, as they are generally more accustomed to digital tools and technologies in their personal and professional lives.³ However, their limited experience in the field could also hinder their ability to fully appreciate the potential benefits of AI if they have not encountered advanced AI-based tools in their practices. This demographic context is consistent with findings from studies in other countries, where younger physiotherapists exhibit а greater willingness to embrace AI, though they still face barriers such as a lack of training and resources.^{15–16}

This study found that most participants had never used AI tools during treatment. This suggests that despite the growing awareness of AI technologies globally, their adoption in physiotherapy practices in Anambra State remains limited. Several factors mav contribute to this lack of application. One possibility is the relative novelty of AI in physiotherapy. While AI has been used in like diagnostic imaging areas and rehabilitation in other parts of the world,¹⁶ it has not become a mainstream tool in physiotherapy, particularly in regions with limited access to cutting-edge technology.

Similarly, a study conducted in Turkey found that AI in physiotherapy was underutilized,¹⁷ primarily owing to limited awareness and the cost of AI-based equipment. This is likely the case in Anambra State, where the infrastructure for AI adoption is still developing. Furthermore, the limited availability of specialized AI training for physiotherapists could explain why few participants have used AI tools. This highlights a gap in education and professional development, which could be addressed through workshops, seminars, and other forms of continuous education.

Regarding information sources, more than half of the participants indicated that social media was the primary platform for learning about AI in physiotherapy. This finding underscores the role of social media as a key knowledge dissemination tool, especially in regions where access to formal educational resources may be limited.¹⁵ While social media is a valuable resource for initial awareness. it also carries risks of misinformation or incomplete knowledge. Therefore, the need for structured, reliable, and accredited training programs for physiotherapists is crucial to bridge this gap. This study found that more than half of the participants viewed the primary benefit of AI in physiotherapy as its ability to provide thorough assessments. This finding is consistent with previous research that highlights AI's capacity to analyze large volumes of data quickly and accurately, better-informed facilitating clinical decisions.^{18,19} AI tools, such as those used in neurology and rehabilitation, can help physiotherapists identify subtle changes in patient progress that may be overlooked in

traditional assessments. Most participants who identified neurology as the most promising area for AI use reflect the growing trend of AI applications in complex fields like neurological rehabilitation, where detailed monitoring and analysis are crucial for effective treatment planning.²⁰

Furthermore, majority of the participants that AI cannot agreed replace physiotherapists, a sentiment that aligns with broader global perceptions of AI in healthcare. AI is a complementary tool that enhances the physiotherapist's capabilities rather than replacing human expertise. Some studies have similarly reported that AI in physiotherapy is expected to support, rather supplant, than human practitioners, emphasizing the importance of maintaining the human element in patient care.^{3,20}

Several facilitators were identified as essential for integrating AI into physiotherapy. This study found that most participants affirmed that workshops, seminars, and training programs were critical for AI integration. This finding is supported by a study that reported that training and education are central to overcoming resistance to new technologies in healthcare.¹⁴ In Switzerland, educational initiatives aimed at teaching healthcare professionals about AI have successful rates.19 adoption Therefore. increased investing in educational programs for physiotherapists in Anambra State could significantly boost AI integration.

Additionally, most participants agreed that reliable internet access and AI-powered software platforms are crucial for implementing AI-based physiotherapy. This is consistent with findings from a study in

the Netherlands, where the adoption of AI was contingent on the availability of robust infrastructure.¹⁶ Limited internet digital access and inadequate technological infrastructure can pose significant barriers to AI adoption in low-resource settings, which is likely a challenge in Anambra State. AI tools that offer treatment plans and patient monitoring were also seen as facilitators by majority of the participants. This is consistent with the increasing use of AIdriven rehabilitation tools in countries like Singapore and Switzerland, where such tools help monitor patient progress and adjust protocols accordingly.19,20 treatment Integrating AI into patient care workflows improve efficiency can and patient outcomes, and this potential is recognized by physiotherapists in Anambra State.

Moreover, in this study, most participants believed that creating awareness about AI's benefits would facilitate broader acceptance. This finding echoes the sentiment in other countries, where awareness campaigns have been crucial in increasing understanding of AI's potential in healthcare.¹⁸ Awarenessraising efforts that highlight AI's positive impact on patient outcomes and treatment efficacy could be key to overcoming resistance to its adoption in physiotherapy.

Several barriers to AI adoption were identified, including the inability of AI to manage all health conditions, the high cost of AI equipment and treatments, and the insufficient knowledge and skills among physiotherapists. These barriers are consistent with those found in other regions. A study conducted in Saudi Arabia identified high costs and a lack of training as significant barriers to AI adoption in

physiotherapy.¹⁵ The inability of AI to fully replace human expertise in complex cases also reflects a global concern regarding its limitations in meeting the diverse needs of patients.¹⁶

The cost of AI tools was highlighted by most participants in this study. This is a significant concern, particularly in lowincome regions where the financial for acquiring advanced resources technologies may be limited. A study conducted in Turkey similarly highlighted the financial barriers to AI integration, suggesting that without sufficient funding, AI adoption may be constrained.¹⁷

Moreover, most participants in this study identified the lack of acceptance and adoption of AI among patients and physiotherapists as a barrier. This is a common challenge globally, as healthcare providers and patients often show resistance to new technologies, particularly those perceived as complex or intimidating. This finding mirrors studies conducted in Norway and Saudi Arabia, where attitudes toward AI skeptical were initially but gradually improved with increased exposure and training.^{15,21}

Notably, limited therapist-patient interaction was not seen as a significant barrier, suggesting that participants in Anambra State may view AI as a tool that can enhance. rather than replace. interpersonal interactions. This contrasts with some international studies that have raised concerns about the potential loss of human touch in healthcare when AI is overly relied upon.¹⁸

The findings in Anambra State may indicate a more balanced view, where AI is seen as a supportive adjunct to traditional physiotherapy practices rather than a replacement for the essential human touch in patient care. This perspective aligns with emphasizing trends global the complementary role of AI in enhancing the capabilities of healthcare professionals while preserving the critical interpersonal aspects of treatment. Studies conducted in Australia and Denmark highlight that AI can streamline clinical processes, such as diagnostics and monitoring, without diminishing the value of direct therapistpatient interactions.^{3,18} Such a balanced perspective may stem from the participants' acknowledgment of the limitations of AI, including its inability to address the full spectrum of human health conditions or replicate the empathy and adaptability of human physiotherapists. This underscores the importance of positioning AI to augment clinical decision-making and treatment efficacy while reinforcing, rather than substituting, the human element in care.

This study had some limitations. First, the sample size of 60 physiotherapists limits the generalizability of the findings to the broader population of physiotherapists. Additionally, using a convenience sampling technique may have introduced selection bias, as only those who were readily available and willing to participate were included. The reliance on self-reported data through questionnaires poses the risk of response bias, which may affect the accuracy of the responses. Furthermore, the study focused primarily on general perceptions of AI without evaluating

specific AI tools or their practical application in clinical settings, thereby limiting the depth of insight into implementation challenges. The crosssectional design of the study also restricts the ability to establish causal relationships between the identified factors.

CONCLUSION

This study explored the facilitators and barriers to the application of AI in physiotherapy practices in Anambra State. The findings revealed limited utilization of AI tools among physiotherapists, despite a general awareness of their potential benefits in enhancing clinical assessment, treatment planning, and patient monitoring. Key facilitators identified include the need for training programs, reliable internet access, availability of AI-powered platforms, increased awareness, and adequate funding. However, significant barriers such as insufficient knowledge and skills, high costs, limited infrastructure, and concerns about AI's ability to handle complex health conditions hinder widespread adoption. While physiotherapists generally do not view AI as a replacement for human practitioners, they acknowledge its potential to complement and enhance physiotherapy services. Addressing these barriers through strategic investment in education, infrastructure, and policy support is essential for the successful integration of AI in physiotherapy practice.

Competing interests

The authors declare no competing interests.

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