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Artificial Intelligence in Physiotherapy Rehabilitation: Current Applications and Future Directions

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Abstract:

AI has the potential to revolutionize physiotherapy rehabilitation through better movement assessment accuracy, personalized treatment, patient monitoring, and decision-making. The purpose of this review is to provide an overview of the current use of AI in physiotherapy rehabilitation. Specifically, the review considers the following domains in physiotherapy rehabilitation: movement analysis, exercise prescription based on machine learning, robotic rehabilitation, use of wearables, telerehabilitation, and predictive analytics. In addition, the review critically assesses the methodology underlying the research on developing and validating AI technology. According to the findings, AI has great potential to enhance objective movement assessment, improve rehabilitation programs, allow remote patient management, and enable data-driven decision-making in clinical practice. However, even though technological progress is promising, the evidence base is characterized predominantly by feasibility and technical studies and small-scale clinical trials, while there are only few studies proving the clinical effectiveness of these innovations through large randomized controlled trials. Some of the challenges in the field of AI in physiotherapy rehabilitation are lack of diverse datasets, algorithmic transparency, data protection issues, inequality in access to AI innovations, regulatory uncertainty, and insufficient trust and training of clinicians.

Keywords: Artificial intelligence; Physiotherapy; Rehabilitation; Machine learning; Movement analysis; Telerehabilitation; Wearable technology

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1. INTRODUCTION

For a long time now, physiotherapy has been using the clinician's "trained eyes" together with manual assessment methods and patient self-reports for decision-making purposes[1]. In the last ten years, however, there has been a change in approach because of the adoption of artificial intelligence technologies like machine learning, computer vision, natural language processing, and intelligent robotics.

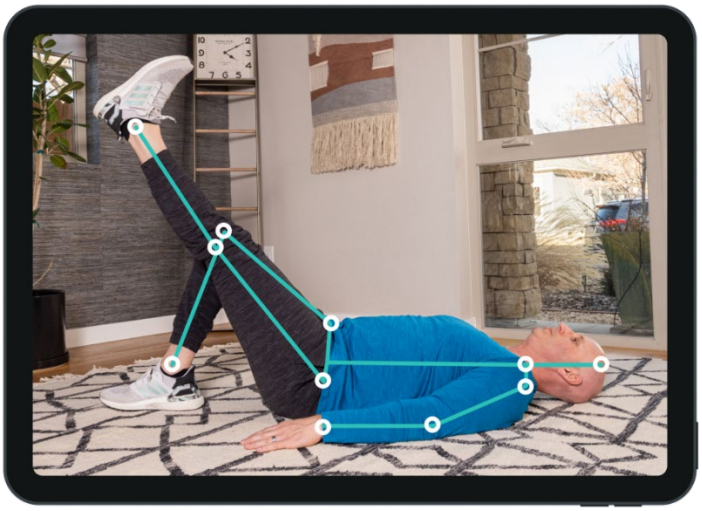

Figure 1: AI is changing physical therapy[2]

These tools promise to allow for the measurement of movement with a precision that may be hard to achieve using solely visual analysis techniques, as well as personalized exercise programs that have been designed through pattern recognition from massive data samples[3]. This introduction gives an overview of the context within which artificial intelligence has entered the physiotherapy practice, defines the objectives of this review and outlines why it is needed[4].

1.1 Background and Context

The traditional physiotherapy assessment is performed manually with the help of goniometry, gait analysis, muscle test, and outcome measures. Despite the significance of these assessments in the field, they lack objectivity, suffer from inter-rater variability, and pose difficulty in assessing subtle changes in patient movement[5]. On the other hand, lab-based motion capture systems allow for objective assessment of movements, yet the expensive nature and technical specifications render them impractical to use in the clinical setting[6].

In recent years, developments in the area of artificial intelligence (AI) such as machine learning, computer vision, wearable sensors, cloud computing, and smartphones have brought about the

possibility of objective movement assessment not only in clinical settings but also at home. This development helps address the increased need for healthcare due to aging populations, prevalence of musculoskeletal and neurologic diseases, and staff shortages[7].

In addition to the increased use of tele-rehabilitation, the uptake of AI technology in physiotherapy has also been greatly enhanced. Nevertheless, the development of AI in physiotherapy has largely focused on musculoskeletal and neurological areas while there have been few developments in the cardiorespiratory, pediatric, and geriatric areas. It is for this reason that it would be very important to conduct a thorough review of the present AI applications[8].

1.2 Objectives of the Review

- To examine the current applications of artificial intelligence in physiotherapy rehabilitation, including movement analysis, exercise personalization, robotic and wearable technologies, telerehabilitation, and predictive analytics.
- To review the methodological approaches used in the development and evaluation of AI-based rehabilitation technologies.
- To critically evaluate the strengths, limitations, and clinical effectiveness of existing AI applications in physiotherapy.
- To identify the current research gaps and challenges that limit the widespread clinical adoption of AI in physiotherapy rehabilitation.

1.3 Importance of the Topic

The understanding of the present situation with the use of AI in physiotherapy is important for multiple practical reasons[9]. Firstly, from a clinical standpoint, physiotherapists are being asked by health organizations to evaluate, choose, and use artificial intelligence in their work despite a lack of a consolidated evidence base on this matter. From the perspective of the health care systems, AI-assisted physiotherapy is presented as a possible solution to the problem of capacity, while the level of evidence in this context is highly heterogeneous. From the educational perspective, the integration of the topics of digital health into the education program of physiotherapists is underway, and thus the analysis of the evidence on the topic will be beneficial for further curricula planning. Moreover, considering the enthusiasm for AI technology and its commercial application, there is an evident need for a critical perspective on this issue[10].

Table 1. Indicative Scope of Artificial Intelligence Applications Considered in This Review[11]

Domain	Representative AI Technique	Typical Rehabilitation Context	Current Maturity
Movement analysis	Computer vision / markerless pose estimation	Gait, posture, and joint range-of-motion tracking	Emerging to established
Exercise personalisation	Supervised learning / reinforcement learning	Home exercise programme design and progression	Emerging

Robotic-assisted therapy	AI-driven adaptive control systems	Neurological and post-surgical rehabilitation	Established in specialist centres
Wearable sensor systems	Inertial measurement units with ML classification	Real-time feedback and adherence tracking	Established
Telerehabilitation platforms	AI coaching agents, chatbots, natural language processing	Remote monitoring and virtual consultation	Emerging to established
Predictive analytics	Prognostic machine learning models	Outcome forecasting and risk stratification	Early-stage

2. APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN PHYSIOTHERAPY REHABILITATION

It represents the major portion of this paper which presents the synthesis of the existing evidence on the utilization of artificial intelligence in five interrelated areas of physiotherapy[12]. The analysis of each theme gives a brief overview of the representative research directions within this area, provides the description of the methodology and results obtained in the current literature, and provides a critical evaluation of the strengths and limitations of the corresponding area of application.

2.1 AI-Enabled Movement Analysis and Assessment

One of the most advanced uses of AI in physiotherapy includes the use of markerless motion tracking. Machine learning algorithms using extensive data from videos can detect the location of joints in two-dimensional videos[13]. In this way, physiotherapists can determine joint angles, movement symmetry, and temporal gaits without the need to physically attach any markers to the patients. Such technology is being used for gait analysis, postural assessments, functional movement screenings, and sports movements, and some of these have even reached near-laboratory optical motion capturing techniques.

The clinical potential of this method derives from its simplicity: one camera or smart phone could potentially take the place of all the laboratory equipment and skilled technician needed before now. Movement analysis became possible to perform in ambulatory care facilities, community settings, or even within a patient's home. Benefits cited include decreased time spent assessing patients, decreased variability in scoring when compared to visual observation, and improved tracking of subtle shifts in the quality of movements during recovery[14].

Despite this, there are several drawbacks which detract from its utility. It tends to be inaccurate when used on fast or very small movements, in situations involving occlusion, and with inconsistent light or camera positions. The validation work has been done using a small number of healthy young adults, who may not represent the diversity of the population actually requiring rehabilitation

treatment, such as patients with abnormal gaits, the use of assistive devices, or large variations in body size.

2.2 Machine Learning for Personalised Exercise Prescription

The second broad category concerns the use of machine learning for personalised exercise prescription. Unlike traditional approaches where all individuals suffering from a particular health condition receive a prescribed protocol, these approaches seek to personalise the choice of exercises, their difficulty level, volume, and progression by utilising data on patient performance and responses[15]. Techniques vary from relatively straightforward adaptive approaches based on rule-sets to more complex reinforcement machine learning techniques which change the difficulty of an exercise in real-time based on patient performance during the exercise.

These techniques have been investigated for a wide variety of health conditions including chronic low back pain, knee osteoarthritis, orthopaedic recovery after surgery and stroke rehabilitation. Benefits mentioned included improved matching between the difficulty of an exercise and capacity of a particular patient, increased adherence because patients find exercise programmes to be adapted to their needs, and detection of suboptimal performance or lack of compliance on the part of a patient. Some studies show that such adaptive digital programmes can deliver similar outcomes as conventional treatment delivered by therapists for certain musculoskeletal conditions when used as an adjunct rather than a substitute for therapist involvement[16].

The limitations of this application field are worth mentioning. In general, machine learning models need a significant amount of training data to function effectively, while many of the proposed models are created and validated using small clinical datasets, making one doubt their generalisability and possible overfitting. Moreover, the inner workings of more sophisticated models are often quite hard to understand for clinicians, thus making these algorithms somewhat opaque. Personalisation algorithms trained primarily based on data from specific demographics can also have problems with generalisation when applied to patients of different age, having other health issues or being from other cultures.

2.3 AI-Integrated Robotic and Wearable Rehabilitation Systems

Rehabilitation devices that make use of robotic arms and exoskeletons employ AI-based adaptive control mechanisms that help adjust the degree of assistance by making use of indicators like electromyographic activity, applied force, or kinematics of motion. The idea behind an adaptive system is that it will challenge the user without subjecting him/her to any unnecessary physical stress[17]. Most research in this area has focused on neurological subjects such as stroke and spinal cord injury rehabilitation[18].

(a) (b)

Figure 2: Wearable Rehabilitation Systems[19]

Together with these more complex robots, wearable sensor devices utilizing inertial measurement units and surface electromyography have found application in gait training, balance rehabilitation, fall-risk identification, and biofeedback-driven motor skill relearning[20]. Usually, machine learning-based classifiers are used to analyze raw data from the sensors and provide meaningful feedback in form of information on asymmetrical loading and postural corrections needed while performing the particular function.

Positive functional outcomes, such as gait velocity improvements, better balance, and increased independence in performing activities of daily living, have been observed in several patient groups when applying these technologies, especially when robotic/wearable-assisted training complements conventional treatment rather than substitutes it. Nevertheless, important shortcomings exist. Cost and size of the sophisticated robots make them applicable primarily in specialized rehabilitation centers and academic medical institutions, thus reducing generalizability to other settings. Moreover, considerable time needs to be spent on training therapists in proper operation of the equipment, and there is no clear evidence on whether robotic/wearable devices are more effective than conventional treatment if similar intensity is provided[21].

2.4 Virtual Reality, Gamification, and AI-Driven Telerehabilitation

The combination of virtual and augmented reality technologies with artificial intelligence-based movement tracking technologies has led to an emerging class of gamification-enabled rehabilitation tools[22]. Such systems use computer vision and/or wearable technology for monitoring the movements of a patient during exercises implemented in a game format and offering real-time feedback for movement correction as well as dynamic adjustment of exercise complexity based on patient performance. Other related innovations involve virtual coaching agents and conversational bots that use AI technologies for supporting adherence to at-home exercises, answering patient questions, and reporting concerns to clinicians in tele-rehabilitation systems.

Benefits reported for this particular field revolve around user engagement and motivation. Feedback and exercise adaptation in a game format are often linked to better adherence rates as opposed to printed at-home exercise programs. Some researchers also find positive effects on the level of enjoyment and self-efficacy, especially in younger and orthopaedic/sports injury recovery patients. AI-enabled tele-rehabilitation systems can also decrease the burden of travel for patients from remote locations.

However, some other limitations have been reported on multiple occasions. First of all, users' motivation to use the gamified technology might fade with time due to diminishing novelty effect, while the number of studies examining long-term adherence to such applications remains relatively small[23]. There is also less evidence on the effectiveness of such technology among elderly people or those with low computer literacy, and the issue of unequal access to appropriate equipment, internet connection, and privacy for exercising might become one of the important barriers to using this approach. Most importantly, trials examining such applications have a limited follow-up period.

2.5 AI in Predictive Analytics and Clinical Decision Support

However, a new but increasingly popular application is that of applying machine learning techniques to predictive analytics in physiotherapy. Models have been created to predict the likely path of recovery for patients suffering from ailments such as low back pain, to predict transition from acute to chronic pain status, to predict time of return to sport after an injury, and also to enable patient stratification into high and low intensity treatments based on risks and likely benefits[24].

The advantage of such models is that they will aid in earlier clinical decision making by allocating greater resources to patients who are expected to fare poorly under regular treatment protocols and those patients who have better chances under similar circumstances can be handled more effectively. However, the predictive accuracy of some of these models has been found to be quite good in relation to the data on which they were created[25].

Nevertheless, this area still represents the most immature among the five discussed application areas. A lot of predictive models are created and tested in retrospective on rather small and single-site cohorts without proper external validation in independent population. It has been identified that there is a potential threat for models, which have been constructed based on the non-representative sample, to demonstrate poor performance and even discriminate against the patients belonging to minority subgroups, in other words, embed current health care disparities into automation tools. For this reason, predictive analytics in physiotherapy should be regarded as an emerging field needing further rigorous validation.

2.6 Cross-Cutting Technical and Practical Considerations

In addition to the individual strengths and limitations in each domain of application mentioned above, there are some general problems, which affect all five fields. Interoperability is one of them: many AI-based rehabilitation technologies are built in proprietary systems, which cannot easily share the information they obtain with other applications, such as the electronic health records. Usability is yet another common problem – there were some cases when, despite the technical

accuracy of the system, it failed because of the unavailability of its user interface or due to the inconvenience of wearing the device for a long time.

Furthermore, the regulatory status of various AI-supported physiotherapy instruments continues to vary from one jurisdiction to another, where certain products are labeled as general wellness instruments as opposed to medical instruments, hence bypassing stricter evaluation methods used in the assessment of medical devices. Such inconsistencies make it difficult to create consistency in the level of evidential requirements in the area. Lastly, the rate of iterations itself becomes a methodology problem in the sense that once a particular AI system undergoes rigorous trials and results are published, chances are high that the underlying technology may no longer be the same due to iterations[26]. The above-mentioned problems partly explain why even with all the technological innovations, it has not been possible to create consistency in clinical guidelines on the use of AI in physiotherapy.

Table 2. Comparative Summary of Artificial Intelligence Application Domains in Physiotherapy Rehabilitation[27]

Application Domain	Primary Clinical Focus	Reported Benefits	Key Limitations
Movement analysis	Gait, posture, functional screening	Accessible, objective, reduces rater variability	Accuracy drops with complex movement, limited diverse validation
Exercise personalisation	Musculoskeletal and neurological rehab	Individualised dosage, potential adherence gains	Data-hungry models, limited interpretability
Robotic and wearable systems	Neurological and post-surgical recovery	Functional gains, adaptive assistance	High cost, limited access, training burden
VR, gamification, and telerehabilitation	Home-based and remote rehabilitation	Improved short-term engagement and access	Novelty effect, digital access inequities
Predictive analytics	Risk stratification and prognosis	Potential for targeted, efficient care	Small samples, limited external validation, bias risk

3. RESEARCH METHODOLOGIES IN THE AI-PHYSIOTHERAPY LITERATURE

Contrasting with the applications of the themes outlined above, the following section takes an analytical look at the nature of the research methodology behind the application of AI in physiotherapy rehabilitation. It is important to understand how such evidence was created, through what means of research design, how data and algorithms were created, and what outcomes measures

were applied to assess the credibility of such results. Therefore, in this section, methodology becomes an object of analysis on its own account, independent of the results presented in the main part of the essay[28].

3.1 Study Designs Employed in the Reviewed Literature

The methodology of AI-based physiotherapy research is mainly characterized by a combination of feasibility studies, validity studies, and pre-interventional single-arm studies. Feasibility studies usually explore the possibilities of applying one or another AI system in a clinical or at-home environment, with emphasis being placed not on its clinical efficiency but on feasibility, reliability, and acceptability to patients or clinicians. In their turn, validity studies involve comparison of measurements provided by an AI system, e.g., joint angles calculated through computer vision, with the reference measurement method, which is mainly optical motion capture performed in a lab environment.

Randomised controlled trials, which are regarded as the gold standard methodology for determining clinical effectiveness, are relatively uncommon within this body of literature, especially for novel uses of AI, such as predictive analytics and tele-rehabilitation coaching via AI. When randomised studies do exist, they are mostly confined to the evaluation of mature technologies, such as particular types of robot-assisted therapy equipment, rather than novel uses of machine learning to personalise or predict patient outcomes. Systematic and scoping reviews have also become increasingly prevalent in recent years as the primary literature has grown, as more attempts are being made to synthesise a rapidly growing and fragmented field of knowledge. Studies that examine patients' and clinicians' perspectives of AI-enabled rehabilitation devices through qualitative and mixed methods fall into the smaller but important category of literature within this field.

Table 3. Overview of Recent Literature on Artificial Intelligence in Physiotherapy Rehabilitation

Author(s) & Year	Study Type / Focus	Key Findings
Abedi et al. (2024) [29]	Scoping Review	Reviewed AI-driven virtual rehabilitation for community-dwelling individuals. Reported that AI-based virtual rehabilitation improves accessibility, remote monitoring, patient engagement, and rehabilitation outcomes, while emphasizing the need for stronger clinical evidence and standardized implementation.
Yang et al. (2024) [30]	Scientometric Analysis	Mapped global research trends in AI and rehabilitation science. Identified rapid growth in publications, with major research areas including machine learning, robotics, wearable devices, telerehabilitation, and predictive analytics.

Rasa (2024) [31]	Review Article	Discussed recent AI advancements in physical and mental rehabilitation, highlighting applications such as robotic rehabilitation, intelligent decision support, personalized therapy, virtual rehabilitation, and remote patient monitoring while addressing ethical and implementation challenges.
Cunha, Ferreira, & Sousa (2023) [32]	Overview / Review	Reviewed AI-assisted home-based shoulder rehabilitation systems. Reported that wearable sensors, computer vision, and AI-assisted exercise monitoring improve rehabilitation adherence, movement assessment, and home-based physiotherapy while reducing the need for frequent clinical visits.

The results of recent research on the inclusion of artificial intelligence into physiotherapy rehabilitation are shown in Table 3 below. Based on the reviewed literature, it can be said that AI application includes several areas such as virtual rehabilitation, home-based physiotherapy, wearables, robotics, and prediction. The majority of the researches underline the role of AI in improving movement analysis, patients' motivation, remote rehabilitation, and access to rehabilitation services.

This qualitative strand is especially significant because it raises some questions that cannot be answered by any technical or outcome-oriented research, such as what causes people to disengage with a correct system or why a clinician chooses not to apply a decision made by an algorithm despite the fact that technically speaking, the algorithm's output looks fine. The interview and survey-based qualitative studies have raised a number of concerns among practitioners regarding loss of their professional autonomy, uncertainty regarding their liability after making decisions based on the recommendations of the AI, and distrust as far as applicability of a system designed based on the data of other patients is concerned. On the side of the patients, there have been concerns about privacy issues, desire to keep human connection during the rehabilitation process, and varying levels of comfort with self-service technology.

3.2 Data Collection and Algorithm Development Approaches

The performance of all AI-driven rehab systems is highly dependent on the datasets used to build and train such tools. In existing literature, training datasets come from diverse sources like motion-capture lab data for correct/incorrect movements, wearable sensor data obtained through supervised clinic sessions, video datasets of exercise performance, as well as rarely structured data from electronic medical records for predictive purposes. The use of supervised learning algorithms, where the system learns from correct/incorrect movements' examples, is common among the existing literature on movement analysis and exercise personalization, whereas reinforcement learning is more commonly found in robotic control and adaptive exercises[33].

One consistent problem has been the size and nature of the data sets used for developing the algorithms. There are many cases when researchers work with a smaller number of cases that are collected at one clinical centre or laboratory; therefore, the range of movement styles, body types, ages, and pathologies represented in the training data set remains rather limited. One common approach is cross-validation, which involves splitting a data set into two parts—training and test—and repeating this procedure several times. However, no matter how useful it may be, cross-validation cannot replace true external validation using another data set.

3.3 Outcome Measures and Validation Approaches

Measures of effectiveness of physiotherapy interventions based on artificial intelligence can be separated into two groups - technical and clinical. In technical validation statistical comparison of results measured with the help of artificial intelligence algorithms is performed with reference to a gold standard using correlation coefficients, mean absolute error or accuracy, sensitivity, and specificity of classification[34]. Clinical validation implies patient-centered outcomes, like standardized scales for measuring function, pain intensity, quality of life, adherence rate or sometimes return to work or sport timelines[35].

There is a tendency of domination of technical validation studies among the available literature, i.e. many times AI tools proved themselves to measure movement correctly but not necessarily improve patient outcomes when compared with standard interventions. For clinical evaluation, there are used control groups consisting of usual or standard therapist-based interventions, although in some cases quality of interventions performed in a control group is not equal to the intervention provided with the help of AI. Moreover, follow-up periods in studies are usually quite short and limited to the period of active intervention.

3.4 Critical Appraisal of Methodological Quality

Overall, these issues relating to the methodological nature of this literature are important to consider when looking at its findings. First of all, small sample sizes are prevalent throughout studies on AI technologies[36]. This means that they can be associated with a low level of statistical power and an increased chance for a random finding and overfitting in reporting the performance of algorithms. Secondly, blinding is not always possible due to the visual nature of the technology and devices used in this case, thus performance and detection biases can be introduced[37]. Furthermore, heterogeneity of outcome measures, populations studied, and technology specifications make it impossible to perform a meta-analysis and compare studies.

Moreover, there is evidence of publication bias towards positive findings concerning technological advancements and this might give the false impression about the maturity of certain applications. Performance of the algorithms is also usually reported inconsistently, with lack of information about training data and validation techniques[38]. Overall, it seems that, despite showing technical feasibility or initial success in certain fields, these studies have not yet achieved the appropriate methodological quality to provide grounds for confident and widescale use of AI technologies in physiotherapy[39].

4. DISCUSSION

This part of the paper synthesizes the results of the thematic analysis of AI uses and the review of the methodology used in the literature to make sense of the evidence base that exists at the moment and what it means for physiotherapy practice[40]. The clinical, practical, and ethical implications of the discussed results are considered, along with the gaps that need to be filled in the future studies. Furthermore, the general state of technology preparedness for clinical implementation is reviewed.

4.1 Interpretation of Findings

When viewed collectively, the results of the present review indicate a recurring trend in terms of technology readiness among the applications: technical feasibility has exceeded solid evidence of clinical effectiveness. Movement analysis and wearable sensors constitute the most methodologically advanced applications, having a relatively good evidence base in terms of validation and some information about outcomes, while predictive analytics is the least mature of the four, mostly represented by small-scale retrospective single-centre research. In turn, exercise personalisation and robotics fall somewhere in between, having promising but not quite conclusive evidence of superior clinical effects compared to properly delivered conventional treatment.

It would not be surprising if the above described trend was caused by the natural development of any new technology – from proof of concept through feasibility into larger-scale trials. However, this observation does imply that today's clinical and commercial excitement about the use of AI in physiotherapy should be balanced by a realistic appreciation of technology readiness of each application.

4.2 Implications and Significance

Implications of the findings of the current review are:

1. **Tool for Clinical Decision Making:** Based on existing literature, it seems that AI works best as a supporting tool for clinical decision making but not as a replacement for physiotherapists.
2. **Education and Training:** For successful implementation and supervision of AI-based rehabilitation tools, there is a need for proper education and training of physiotherapists.
3. **Data Privacy and Security:** Increasing utilization of AI-based systems for collecting data about patients' movements and health status calls for proper data privacy and security measures.
4. **Equity and Fairness:** AI algorithms should be developed using representative samples to avoid bias.
5. **Affordability and Access to Technology:** High costs and uneven availability of sophisticated AI-based rehabilitation systems might increase disparities in access to AI.
6. **Liability and Accountability:** Proper regulatory framework and ethical guidelines should be developed for addressing legal issues related to clinical use of AI-based assessment and treatment.

4.3 Gaps and Future Research Directions

Here are some significant gaps and future directions identified in the review:

- **Multicentre Clinical Trials:** There is a need for more multicenter, well-powered randomized controlled trials with extended follow-up to validate the clinical efficacy of AI-rehabilitation interventions.
- **Diverse Training Datasets:** In future, training datasets of diverse populations of all ages, conditions, body builds, and socioeconomic background should be used for building and validating AI models.
- **Consistent Reporting:** Consistent reporting guidelines for AI rehabilitation should be followed to make the studies more comparable and reproducible.
- **Application in Real Clinical Practice:** Further research is needed to assess the performance of AI technologies in physiotherapy settings.
- **XAI Development:** Explainable artificial intelligence systems should be further developed in the future research.
- **Cost-Effectiveness Analyses:** Further economic evaluations should be performed to estimate the cost-effectiveness of AI-assisted rehabilitation compared to conventional physiotherapy.
- **Implementation Study:** Long-term patient compliance and outcome measures of the implementation of AI technology in real-world healthcare settings should be explored.

This presentation in point format is more concise and easier to comprehend.

5. CONCLUSION

This review has analyzed the state-of-the-art of artificial intelligence techniques in the physiotherapy field as far as their clinical application and the methodology used to provide the evidence behind those applications. The final part of this paper brings together all of the threads discussed and highlights the importance of this review in practice.

5.1 Summary of Main Insights

AI technology is currently applied within several different aspects of physiotherapy rehabilitation including movement analysis without markers, feedback provided through wearable sensors, adaptive robotics for therapy, gamification within tele-rehabilitation, and prediction analytics in the early stages. While technical feasibility is relatively well-established in all of these areas, the technology's ability to analyze movements with adequate precision is currently increasing. Clinical effectiveness research, on the other hand, is much more inconsistently developed, and is most advanced for movement analysis and wearable feedback applications, while least advanced for prediction analytics. Methodological nature of the underlying literature, which mainly includes small feasibility and validity studies, not large comparative studies, further contributes to this conclusion.

5.2 Importance of the Review

This review is significant due to the following reasons:

- It offers a thorough review of the existing AI applications in the rehabilitation of physiotherapy.

- It critically assesses the application as well as the methods used in the AI-based rehabilitation studies.
- It differentiates between clinically proven technology from those requiring more research.
- It identifies the strengths, weaknesses, and gaps in the existing literature.
- It enables evidence-based decision-making by the clinicians, researchers, and healthcare policy makers.

5.3 Recommendations

On the basis of the findings of this literature review, the following suggestions are made:

- **For Clinicians:** Make use of AI technology as an assistive tool in clinical practice by exercising good clinical judgment and assessing the evidence.
- **For Researchers:** Perform larger and longer term multicenter research with transparent and adequate reporting and a variety of participants.
- **For Technologists:** Work with physiotherapists and patients when developing new AI systems by focusing on transparency and usability of such systems and using training datasets from a diverse population.
- **For Policy Makers**: Formulate guidelines for AI technologies for physiotherapy concerning such aspects as privacy and ethical use, regulatory approval, liability, and availability.
- **For Future Practice:** Promote incorporation of AI technologies that have been scientifically validated in the daily practice of physiotherapy.

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