AI

MDPI

Perspective

AI-Driven Telerehabilitation: Benefits and Challenges of a Transformative Healthcare Approach

Rocco Salvatore Calabrò [1,*] and Sepehr Mojdehdehbaher [2]

[1] Neurorehabilitation Unit, IRCCS Centro Neurolesi "Bonino-Pulejo", Cda Casazza, SS113, 98124 Messina, Italy
[2] Department of Mathematics and Computer Sciences, Physical Sciences and Earth Sciences, University of Messina, 98124 Messina, Italy; sepehrbaher@gmail.com
* Correspondence: roccos.calabro@irccsme.it

Abstract: Artificial intelligence (AI) has revolutionized telerehabilitation by integrating machine learning (ML), big data analytics, and real-time feedback to create adaptive, patient-centered care. AI-driven systems enhance telerehabilitation by analyzing patient data to personalize therapy, monitor progress, and suggest adjustments, eliminating the need for constant clinician oversight. The benefits of AI-powered telerehabilitation include increased accessibility, especially for remote or mobility-limited patients, and greater convenience, allowing patients to perform therapies at home. However, challenges persist, such as data privacy risks, the digital divide, and algorithmic bias. Robust encryption protocols, equitable access to technology, and diverse training datasets are critical to addressing these issues. Ethical considerations also arise, emphasizing the need for human oversight and maintaining the therapeutic relationship. AI also aids clinicians by automating administrative tasks and facilitating interdisciplinary collaboration. Innovations like 5G networks, the Internet of Medical Things (IoMT), and robotics further enhance telerehabilitation's potential. By transforming rehabilitation into a dynamic, engaging, and personalized process, AI and telerehabilitation together represent a paradigm shift in healthcare, promising improved outcomes and broader access for patients worldwide.

Keywords: artificial intelligence; telerehabilitation; innovative approaches

check for updates

Academic Editor: Giovanni Diraco

Received: 22 January 2025
Revised: 3 March 2025
Accepted: 12 March 2025
Published: 17 March 2025

Citation: Calabrò, R.S.; Mojdehdehbaher, S. AI-Driven Telerehabilitation: Benefits and Challenges of a Transformative Healthcare Approach. *AI* **2025**, *6*, 62. https://doi.org/10.3390/ai6030062

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Artificial intelligence (AI) encompasses the machine emulation of human intelligence processes, in particular computer systems [1]. These processes include learning (the ability to improve performance over time), reasoning (the ability to make decisions based on available data), and self-correction (the capacity to identify and rectify errors) [2]. ML, a branch of AI, is a key driver in the field of telerehabilitation because it allows a system to continuously learn from large sets of patient data and make a forecast of the outcome, propose interventions, and tailor treatment plans without continuous human intervention [3]. Telerehabilitation, on the other hand, is the delivery of rehabilitation services using telecommunication technologies, enabling remote patient monitoring, virtual consultations, and therapeutic exercises. Patients access these services from the comfort of their own homes, often using digital tools, such as smartphones, wearable devices, or virtual reality (VR) systems [4].

By incorporating AI into this workflow, such technologies progress from basic platforms to complex platforms that can provide individualized, data-centered care that is responsive to the conditions of the patient in real time [5]. Nonetheless, the demand for

these innovative solutions is underscored by the significant disparities in access to conventional rehabilitation services. Globally, millions of people face geographical, socioeconomic, or physical barriers that prevent them from receiving adequate rehabilitation [6].

The World Health Organization (WHO) states that more than one billion individuals globally need assistive technology, commonly involving rehabilitation services; however, an alarming 90% of those in low-income nations do not have access [7]. In advanced countries, rural and underserved populations face significant shortcomings in access to rehabilitation, resulting in postponed recovery and reduced quality of life [8]. For example, around 60 million individuals in the United States reside in rural regions where access to specialized healthcare, such as rehabilitation, is restricted [9,10]. This difference underlines the pressing necessity for accessible, scalable solutions that can connect the void in rehabilitation service provision. Traditional rehabilitation, although beneficial, typically entails regular face-to-face appointments, presenting difficulties for patients with movement limitations, individuals in isolated regions, or those with busy lifestyles [11]. Additionally, in traditional environments, the capacity to track patient progress consistently and modify treatment plans immediately is frequently restricted. This is where AI-enhanced telerehabilitation provides a groundbreaking method. By facilitating remote monitoring, healthcare providers can follow patients' adherence to exercises, evaluate functional progress, and identify possible complications in advance [12]. Research indicates that remote monitoring can greatly enhance patient outcomes, decrease hospital readmissions, and boost patient satisfaction [13–15]. The advantages go beyond ease, providing the possibility for more tailored and data-informed care. For instance, AI algorithms can evaluate movement information from wearable devices to deliver immediate feedback, adjust exercise intensity, and recognize patterns that could suggest a requirement for intervention [16,17]. This ongoing, data-informed feedback process is essential for enhancing rehabilitation results and ensuring that patients access the appropriate care at the appropriate moment. Fundamentally, the integration of AI and telerehabilitation signifies a transformational change in healthcare services, merging advanced computational technologies with the accessibility and fairness of remote patient oversight. This integration could transform the rehabilitation process by offering tailored, flexible, and highly effective treatment interventions, thereby enhancing access and results for millions across the globe.

Rationale, Objective, and Theory Framework

The above introduction highlights the transformative ability of combining AI with telerehabilitation to fill significant voids in healthcare accessibility and provision. As depicted, the integration of these technologies provides a gateway to personalized, data-driven, and accessible rehabilitation care, especially for marginalized populations. However, as promising as the future of AI-based telerehabilitation is, it is important to have a comprehensive knowledge of its current status, limitations, and possible directions in order to successfully apply and disseminate it.

Therefore, the rationale for this narrative review is to synthesize and assess the literature on the use of AI in telerehabilitation. The review aims to present a comprehensive overview of the topic, from technological developments and clinical uses to results, with an emphasis on patients. Through a comparison of various research findings and opinions, we aim to identify prevailing trends, successful uses, and areas needing more research. This narrative review is guided by the technology acceptance model (TAM) and person-centered care (PCC) model [18,19]. The TAM is used to explore factors that shape the adoption and acceptance of AI-enhanced telerehabilitation technologies among patients and healthcare practitioners. In particular, the review takes into account perceived usefulness and perceived ease of use as central predictors of technology acceptance [18]. The PCC model,

however, guarantees that the assessment prioritizes the patient's experience, autonomy, and overall well-being. The model directs investigation into the ways in which telerehabilitation supported by AI can be personalized to address the unique needs, preferences, and values of individual patients, thus enhancing patient participation and compliance [19].

2. Technology's Role in Modern Telerehabilitation

The progress of telerehabilitation has been significantly influenced by technological advancements, directly responding to the urgent demand for effective and accessible remote healthcare. Modern methods utilize different digital tools to connect patients with healthcare providers. Crucially, the implementation of wearable sensors, like accelerometers and gyroscopes found in smartwatches or dedicated apparel, allows for thorough, constant tracking of patient movement and activity levels [20,21]. These sensors collect information on walking patterns, mobility range, and exercise compliance, offering healthcare providers immediate insights into functional advancement [22]. VR setups using head-mounted displays and motion tracking technology generate immersive settings for therapeutic treatments [23]. These systems have the capability to replicate real-life situations, boosting patient involvement and enthusiasm while promoting motor skill growth via interactive activities [24]. Additionally, mobile apps created for patients and healthcare professionals enhance communication via secure messaging and video calls, offer educational materials through interactive modules and video tutorials, and provide tailored feedback using AI analytics, ensuring smooth care coordination and empowering patients [25,26]. The incorporation of new technologies, such as 5G, the Internet of Medical Things (IoMT), and robotics, is starting to change telerehabilitation practices, expanding the limits of remote care [27,28]. For example, the low latency and high bandwidth of 5G enable real-time, high-quality video consultations, permitting thorough visual evaluations and remote operation of robotic devices [29]. This allows clinicians to offer accurate instructions during intricate rehabilitation activities, like fine motor skill development or gait correction, even remotely. Multiple clinical trials are presently assessing the effectiveness of these technologies. Recent research showed the practicality of employing 5G-enabled robotic exoskeletons for remote rehabilitation of upper limbs in stroke sufferers. The research revealed notable enhancements in motor skills, evaluated through the Fugl-Meyer Assessment, and higher patient involvement in contrast to conventional therapy [30,31].

Dual Edge of IoMT: Enhancing Care and Ensuring Security

Current studies are investigating the utilization of IoMT platforms to gather and examine large datasets from wearable sensors, environmental sensors, and smart home devices [32,33]. This information allows for tailored treatment modifications via predictive analytics, including the early identification of possible issues, like falls or declines in functional ability [34]. These platforms additionally enable the remote tracking of vital signs, sleep habits, and medication compliance, offering a comprehensive perspective of the patient's well-being [35]. However, the quick deployment of the technologies presents potential threats that need to be addressed comprehensively [36]. Cyber threats of IoMT networks are a major threat case in point. The connected status of the devices transmitting personal medical information, often by wireless networks, exposes them to breaches of personal information, threats of ransomware, and third-party access without their knowledge, potentially jeopardizing the confidentiality of the patient and the integrity of key medical information [37]. Having strong protection measures, like end-to-end encryption, multi-factor authentication, secured information storage, and regular audits, is imperative to reducing threats to them. Additionally, the usage of AI algorithms to provide personalized treatment advice creates challenges of ethics with respect to information

biases, transparency of the algorithms, and patient choice [38]. Fairness, responsibility, and transparency of AI-driven telecare are imperative to gain the trust of the public to provide equal access to care for all individuals regardless of their vulnerabilities.

3. The Role of Artificial Intelligence in Enhancing Telerehabilitation Outcomes

AI is not just a supplement to telerehabilitation; it is a revolutionary power altering its core structure. Utilizing ML, deep learning, and predictive analytics, AI enables telerehabilitation platforms to provide interventions that are both tailored and adaptively responsive to the changing requirements of patients [39]. AI's ability to analyze and combine extensive datasets obtained from wearable sensors, patient-reported outcomes, and environmental information facilitates the development of highly personalized treatment strategies [40]. This degree of personalization goes beyond mere modifications in workout intensity or frequency; it includes the capability to customize the entirety of the rehabilitation experience to the individual physiological, psychological, and social circumstances of every patient [41]. Consider, for instance, the BrightBrainer Grasp (BBG) device. A usability study showed that the BBG's AI-powered dynamic difficulty adjustment in games illustrates the potential for developing engaging and adaptable rehabilitation experiences. The system's capability to adjust to personal motion ranges using baselines demonstrates AI's potential to tailor treatment on a fundamental level. The initial usability study, carried out with healthy individuals, highlights the need for thorough clinical validation, yet it offers essential proof-of-concept for AI-based personalization in motor rehabilitation. The AI embedded in the BBG is not just a passive instrument; it learns actively from the user's actions, adjusting the challenge to keep users involved and encourage the best development [42]. This kind of dynamic adjustment is essential in rehabilitation, where patient motivation and compliance are crucial. The influence of AI goes further than just simulated settings to actual clinical uses. A randomized crossover trial using the IoT-supported tenodesis-induced-grip exoskeleton robot (TIGER) in chronic stroke patients showed that AI-driven rehabilitation outperformed conventional techniques. The TIGER robot's capacity to modify its support according to live feedback from the patient's actions underscores AI's significance in improving motor recovery. Through constant observation and assessment of movement behaviors, the TIGER robot is able to modify its assistance to suitably challenge the patient, encouraging neuroplasticity and enhancing functional advancement. This research offers strong proof that interventions powered by AI can result in clinically meaningful results for patient groups [43]. The 'Ricominciare' pilot study reinforces the promise of AI in distant rehabilitation. The study assessed the ARC telerehabilitation platform in individuals with disabilities due to COVID-19 or Parkinson's disease, showing the viability and safety of AI-powered home rehabilitation. The ARC platform employs AI algorithms to tally exercise repetitions and deliver immediate feedback, showcasing how AI can improve patient involvement and compliance. This objective assessment of exercise performance guarantees that patients execute exercises properly while offering essential information for clinicians to track progress and modify treatment plans from a distance. The study's results of strong adherence and marked clinical enhancements highlight the ability of AI to provide successful rehabilitation in a home environment [44].

Meeting User Preferences: AI-Driven Customization in Remote Rehabilitation

The proper integration of AI into telerehabilitation needs a thorough comprehension of user preferences and needs. Involving both patients and physiotherapists with ethnographic research and conversations generates key information regarding the drivers of successful rehabilitation. Users stress the need for well-instructed exercise sessions,

personalized feedback, and a feeling of familiarity with their therapists. AI reinforces these areas by allowing real-time analysis of information, providing personalized feedback, and enabling the smooth interaction between healthcare providers and patients [45]. For instance, AI-powered chatbots can render immediate replies to queries by the patient, while VR can provide interactive exercise sessions that are both enjoyable and engaging [46]. Moreover, AI algorithms have a unique capability to monitor patient performance metrics, like movement patterns, levels of compliance, and patient outcome measures, thus unveiling patterns and anticipating potential pitfalls. With this forecasting potential, healthcare providers can act preemptively by tweaking treatment protocols prior to complications emerging [47]. For example, if AI algorithms signal a reduction in patient compliance levels or a spike in levels of pain, healthcare providers can call the patient, provide added support, or change the exercise program accordingly [48]. It is this quality of personalized anticipatory care that is the key to maximizing the effectiveness of the results of the rehabilitation program while maintaining optimal patient satisfaction levels. AI is revolutionizing the area of telerehabilitation by enabling the delivery of treatment that is highly personalized, responsive, and evidence-backed. With the aid of AI to analyze vast amounts of data, personalize treatment strategies, and provide immediate feedback, the potential exists to enhance patient engagement and clinical results and expand access to rehabilitative treatment. Nevertheless, the successful deployment of AI is contingent upon a well-integrated plan that combines clinical knowledge, advancements in science, and a thorough examination of user requirements.

4. Real-Time Adaptation and Model Transparency: Technical and Ethical Strategies in AI Telerehabilitation

The incorporation of AI into telerehabilitation must have a robust system that optimizes clinical effectiveness and confronts the underlying technical and ethical problems [49]. At the core of this is the requirement to reduce algorithmic bias, and thus, prejudicial impacts upon vulnerable groups. To achieve this, several training datasets must be employed. These datasets should have a wide spectrum of demographic, socioeconomic, and clinical characteristics to ensure that AI models are trained on representative populations. In addition, the use of transparent AI models, like decision trees or rule-based systems, enhances interpretability so that clinicians and patients know the reasons for AI-driven suggestions [50]. Transparency instills trust and responsibility, key elements in AI-guided rehabilitation adoption. The real-time modulation of rehabilitation plans, the strength of AI-powered telerehabilitation, is dependent on advanced ML algorithms. Methods like reinforcement learning, where algorithms are trained through trial and error, and time-series analysis, where trends in patient data over time are recognized, are crucial to dynamically adjust treatment schedules [51,52]. For example, reinforcement learning can refine exercise routines by incorporating real-time feedback from wearables, whereas time-series analysis can forecast upcoming plateaus in recovery and cause anticipatory tweaking of the rehab protocol [53]. All these technical difficulties call for close collaboration between healthcare practitioners and AI practitioners to the effect that the algorithms are optimized as much as possible, along with being informed by clinical best practices.

Integrating AI into Healthcare Systems: EHRs and Telemedicine Platforms

Besides algorithmic elements, effectively implementing AI into telerehabilitation depends on addressing adoption obstacles faced by patients and healthcare professionals [54]. User perceptions, shaped by personal evaluations of usability, trust in technology, and worries about data privacy, play a crucial role in determining technology adoption [55,56]. The obstacles are intensified by device compatibility issues, internet access limitations, and

users' digital literacy levels. To address these issues, principles of user-centered design must be integrated into the design process [57]. This entails performing comprehensive user testing, offering sufficient training and assistance, and ensuring that interfaces are accessible to various user groups and user-friendly. Integrating AI into current healthcare systems, including electronic health records (EHRs) and telemedicine platforms, is crucial for its broad acceptance [58]. This integration allows for secure patient data exchange, remote monitoring, and consultations, while also enhancing the provision of AI-assisted rehabilitation services [59]. For instance, AI can assess EHR data to pinpoint patients qualified for telerehabilitation, whereas telemedicine platforms serve as a means for carrying out remote exercise sessions and online consultations [60]. This integration enhances the efficiency of healthcare delivery and allows AI-driven interventions to be easily integrated into the patient's care plan. The ethical and security dimensions of AI in telerehabilitation go beyond just data privacy and include concerns about algorithmic accountability and the risk of unforeseen outcomes [61]. For instance, employing AI in diagnostic tools raises concerns regarding the risk of algorithmic mistakes causing misdiagnosis or unsuitable treatment. To address these risks, strong validation procedures, the ongoing monitoring of AI effectiveness, and the creation of well-defined accountability measures are crucial [62]. Additionally, regulatory supervision, via the establishment of guidelines and standards for AI in healthcare, is essential to guarantee that AI-based rehabilitation is secure, efficient, and fair [63]. This regulation should harmonize innovation and patient safety, creating a structure for the responsible development and use of AI.

5. Discussion

5.1. Navigating the Landscape of AI-Driven Telerehabilitation

The union of telerehabilitation and AI presents a promising revolution, offering both enormous potential and intricate challenges. As we have discussed, AI offers data-driven, individualized intervention, with increased accessibility through the promise of improved patient outcomes [64]. Still, an honest viewpoint requires equal-handed consideration of both advantages and disadvantages, especially as compared to more conventional methods of rehabilitation. Accessibility and scalability are two of the most notable strengths of telerehabilitation led by AI. As mentioned above, geographical and financial barriers usually deny access to traditional rehabilitation therapy [65]. AI uses digital platforms to democratically offer access and reach individuals in underserved populations effectively [66]. This is especially important in bridging the global rehabilitation gap, as millions of patients receive insufficient support. Furthermore, the possibility of continuous, remote monitoring with AI provides the opportunity for a more nuanced understanding of patient improvement [67]. Conventional rehabilitation, though successful, depends on sporadic monitoring, potentially overlooking subtle yet significant shifts in the condition of a patient. Nevertheless, this shift to AI-assisted treatment is not without issues. Dependence on technology also brings the potential for digital divides, since differences in access to hardware and internet services have the capability to widen existing inequalities [68]. Moreover, the intrinsic complexity of AI algorithms also poses transparency and interpretability issues. Although we adhere to open models, the transparent "black box" of certain deep learning models can hinder clinical insights and erode patient trust [69]. This is different from conventional rehabilitation, where clinicians are directly in contact with and observe patients, instilling a sense of comfort and confidence. The distinctions between AI-facilitated telerehabilitation and conventional models necessitate a close analysis of the very nature of 'care' in an online environment. It is crucial to recognize that technical proficiency alone cannot explain the complex dimensions of therapeutic practice. The affective and interpersonal components involved in face-to-face therapy, primarily the building of a therapeutic relationship through

interpersonal contact, are vital elements that AI, no matter how advanced, has issues replicating completely [70,71]. Therefore, thorough analyses of the efficiency of AI must consider these seemingly insignificant but very powerful elements. In what specific ways can we regularly incorporate the examination of these qualitative, human-centered factors into our quantitative assessments of AI-based telerehabilitation outcomes? In addition, the incorporation of AI means a fundamental change in the role of healthcare professionals. This goes beyond learning new computer software skills and requires a change in attitude toward data-driven decision making [72]. To sufficiently train clinicians for this change, a holistic reappraisal of existing education paradigms is required. Moreover, the ethical ramifications, especially in terms of algorithmic accountability, call for immense discourse and the formulation of well-established systems of accountability [73]. With the explosive growth of AI, what steps should be taken to ensure that training programs and regulation systems are resilient and capable enough to stay nimble with impending challenges? Clinical effectiveness is the highest priority in assessing the feasibility of AI-assisted telerehabilitation. In spite of early trials with encouraging results, the external validity of these findings for diverse patient populations over long durations needs to be established through large-scale, long-term trials.

5.2. Addressing Complexity and Ensuring Balance: Key Considerations for AI in Telerehabilitation

The very complexity of unique cases and the nature of human healing pose insurmountable challenges. Also, the urgent issue of data privacy and security, particularly for networked IoMT devices, needs to be fortified with robust safeguarding mechanisms from unauthorized manipulation and access [74]. What are the optimal ways to ensure data privacy and algorithmic transparency in an environment where data interconnectivity and complexity are increasing? Finally, the successful integration of AI into telerehabilitation relies on achieving a fine balance. It entails establishing a symbiotic relationship where technology enhances, but does not replace, human-centered care. Extending such technologies to all indiscriminately, irrespective of digital literacy or socioeconomic status, is also crucial [75]. AI for telerehabilitation development needs to be based on a policy of continual betterment, founded on evidence-driven research and cyclical feedback mechanisms. This involves technical advancement but also sensitivity to user experience and the socio-cultural environment within which these technologies are deployed. We must establish a culture of critical assessment, in which the possible benefits of AI are offset against the possible harms, and the views of patients, clinicians, and researchers are given equal weight. This will ensure that AI-based telerehabilitation is an empowering force and a source of increased well-being, not an inequality or unintended harm force [76]. Forward advancement mandates adherence to inter-disciplinary coordination, strong ethical foundations, and a relentless interest in patient-centric outcomes. This will ultimately determine the effectiveness and viability of AI in reshaping the practice of rehabilitation care. The pros and cons of the application of AI in this expanding area are presented in Table 1 [77–86]. The black box framework of AI models is displayed in Figure 1.

Table 1. The pros and cons related to the use of AI in telerehabilitation.

Aspect	Pros	Cons/Challenges	Potential Solutions
Personalization	Tailored rehabilitation plans based on real-time patient data [77].	Risk of algorithmic bias leading to suboptimal care for underrepresented groups [77].	Use diverse and representative training datasets; implement regular audits for bias detection and correction [77].

Table 1. *Cont.*

Aspect	Pros	Cons/Challenges	Potential Solutions
Patient Engagement	Immersive VR and gamified environments boost motivation and adherence [78].	High cost of advanced technologies, like VR systems and AI-enabled wearables [78].	Seek cost-effective alternatives; explore funding options and partnerships with tech companies to lower costs [78].
Accessibility	Enables home-based care, reducing the need for travel [79].	Digital divide limits access for rural and underserved populations [79].	Implement mobile-friendly platforms and low-cost devices; provide subsidies or support for disadvantaged populations [79].
Clinician Support	Provides precise feedback, enhancing decision making [80].	Risk of over-reliance on AI, potentially reducing the clinician's role [80].	Promote a hybrid approach combining clinician expertise with AI insights to ensure that AI complements rather than replaces clinical judgment [80].
Data Insights	Analyzes large datasets for trends, improving evidence-based practices [81].	Privacy and security concerns with sensitive health data storage and transmission [81].	Strengthen encryption methods, comply with regulations, and use secure cloud platforms for data storage [81].
Efficiency	Automates administrative tasks, freeing up clinicians for patient care [82].	Integration into existing workflows requires training and resistance to change [82].	Provide comprehensive training programs; create user-friendly AI tools that fit seamlessly into current clinical workflows [82].
Collaboration	Centralized platforms enable interdisciplinary teamwork [83].	Inconsistent standards across platforms and healthcare settings hinder interoperability [83].	Develop universal standards and protocols for AI in telerehabilitation; foster collaboration between tech developers and healthcare providers [83].
Real-Time Monitoring	Wearable sensors detect subtle progress or setbacks during exercises [84].	Ensuring reliability and accuracy of AI-powered devices remains a technical challenge [84].	Regular calibration and testing of wearable devices; continuous refinement of AI algorithms to improve accuracy [84].
Scalability	AI enables a wider reach of rehabilitation services [85].	Ethical concerns over transparency and decision-making processes [85].	Implement explainable AI models and ensure clinical oversight; involve patients in decision making where possible [85].
Future Potential	Integration with IoMT, robotics, and 5G for enhanced capabilities [86].	High development and maintenance costs; requires continuous innovation and investment [86].	Partner with tech companies for joint ventures, reduce development costs through collaboration, and secure funding for ongoing innovation [86].

Legend: Virtual reality (VR), artificial intelligence (AI), Internet of Medical Things (IoMT).

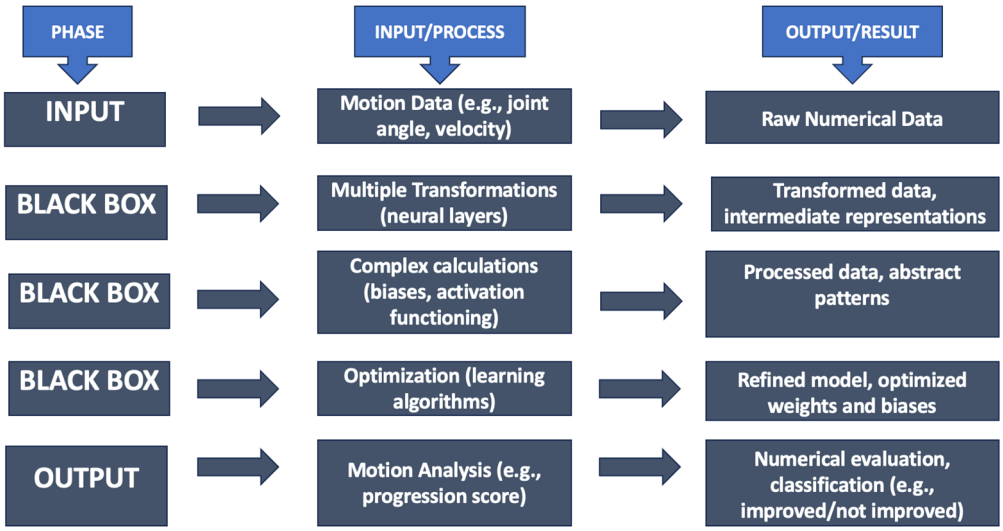


Figure 1. Black box framework of AI models.

5.3. Illuminating the Black Box: Future Directions for Explainable AI in Telerehabilitation

Considering the ongoing trend in AI-based telerehabilitation, future research should be focused on creating adaptive AI models that constantly adjust treatment protocols based on continuous physiological and psychological feedback. This requires a transition from fixed algorithms to systems with continuous learning and adaptation, more akin to the dynamic process of human recovery. Future studies should investigate the use of multimodal data sources, such as neuroimaging and genomics, to improve the predictive performance of these models. This has the potential to result in highly individualized therapies that are specifically aimed at individual neural circuits or genetic characteristics, which can greatly benefit patient outcomes. Also important are advancements in explainable AI in order to push forward with trust and transparency. Future studies should aim to build AI systems capable of delivering explicit, clinically interpretable explanations of their recommendations, thereby empowering both clinicians and patients. This is about creating usable interfaces that reveal the decision process of AI algorithms, making informed consent and joint decision making possible. Explaining why an AI intervention should be recommended will be crucial for tackling ethical questions and facilitating dissemination. The seamless implementation of AI into current healthcare infrastructure is also another essential focus. Future developments need to be targeted at building interoperable systems capable of transferring information securely across telerehabilitation platforms, electronic health records, and wearable technology. For this purpose, standardized data protocols and formats are necessary, alongside aggressive cybersecurity options, in order to secure patient privacy. Second, it is critical to develop AI-based clinical decision support systems capable of analyzing large datasets to determine which patients would gain the most from telerehabilitation to maximize resource allocation and increase access to care. Also essential is the development of culturally appropriate AI models for global access to telerehabilitation therapy. Future research should investigate the impact of cultural and linguistic variations in patient participation and adherence and develop AI algorithms that are context-aware. This entails developing multilingual interfaces, incorporating culturally appropriate content, and training AI models on diversified data to reflect the diversity in the patient population. Finally, robust regulatory frameworks must be put in place to govern the ethical development and deployment of AI in telerehabilitation. Furthermore, future studies should focus on creating uniform AI evaluation metrics for telerehabilitation. This involves setting standards for algorithmic precision, clinical effectiveness, and user satisfaction, facilitating comparative research and meta-analyses. In particular, metrics

must evaluate how AI models can adapt to various patient groups and clinical settings, guaranteeing fair results. Additionally, standardized protocols are essential for assessing the incorporation of multimodal data sources, including neuroimaging and genomics, to confirm their influence on predictive accuracy. Longitudinal studies ought to monitor long-term patient results, evaluating the durability of AI interventions and their effects on quality of life. In the future, emphasis must be placed on creating evidence-based standards and guidelines for addressing data privacy, algorithmic bias, and clinical safety concerns. This will require multisectoral cooperation among policymakers, clinicians, researchers, and patients to make sure that AI-driven telerehabilitation is not only effective but also ethical. The future of telerehabilitation with AI support will involve the development of smart, responsive, and moral systems that will empower patients and enable more effective delivery of personalized care. Keeping these top priority research areas in the limelight will enable us to release the full potential of AI in transforming the practice of rehabilitation and improving billions of lives across the world.

6. Conclusions

This narrative review has accentuated the transformational potential of integrating AI into telerehabilitation, presenting a field characterized by potential and complexity. While AI delivers unparalleled possibilities for personalized, accessible, and evidence-based care, its successful integration relies on overcoming a combination of technical, ethical, and socio-cultural challenges. If one looks at the short-term advantages and disadvantages, it is crucial to realize that the real impact of AI on telerehabilitation will be determined by its ability to enable a shift in healthcare services. Specifically, the effectiveness of telerehabilitation based on AI in the future will not only depend on the improvement of algorithms and technology but also on building a robust ecosystem focusing on human-centric design and ethical regulation. This ecosystem needs to include a cooperative framework that connects technological innovation with clinical practice, guaranteeing that AI tools are not only efficient but also smoothly incorporated into the workflows of healthcare practitioners. Moreover, the creation of standardized protocols and regulatory frameworks is crucial for guaranteeing the safety, effectiveness, and fair distribution of AI-supported rehabilitation services. Importantly, the progression of AI in telerehabilitation should be steered by a dedication to ongoing learning and adjustment, both concerning technological advancements and in our comprehension of the human experience in care. This requires a transition from a technology-focused viewpoint to a patient-focused strategy, in which AI acts as a facilitator of tailored, compassionate, and attentive care. By fostering a culture of critical assessment and cross-disciplinary collaboration, we can harness the change-making potential of AI to build a future where rehabilitation is not only more available and effective but also more personalized to the unique needs and aspirations of each individual. Essentially, the real gauge of AI's effectiveness in telerehabilitation will be its capacity to go beyond the constraints of conventional care approaches, fostering a more inclusive and fair healthcare environment. This necessitates a unified approach to tackle the intrinsic challenges and to capitalize on opportunities for innovation, guaranteeing that AI will act as a driver for beneficial transformation in the lives of millions around the globe.

Author Contributions: Conceptualization, R.S.C. and S.M.; methodology, R.S.C. and S.M.; validation, R.S.C. and S.M.; investigation, R.S.C. and S.M.; resources, R.S.C. and S.M.; writing—R.S.C. and S.M.; writing—review and editing, R.S.C. and S.M.; All authors have read and agreed to the published version of the manuscript.

Funding: This study was supported by Current Research Funds 2025, Ministry of Health, Italy.

Institutional Review Board Statement: As this perspective involves secondary data analysis from previously published studies, no new ethical approval was required.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Alkatheiri, M.S. Artificial intelligence assisted improved human-computer interactions for computer systems. *Comput. Electr. Eng.* **2022**, *101*, 107950. [CrossRef]
2. Bin Rashid, A.; Kausik, A.K. AI revolutionizing industries worldwide: A comprehensive overview of its diverse applications. *Hybrid Adv.* **2024**, *7*, 100277. [CrossRef]
3. Akinola, S. Advancing healthcare with AI: Designing frameworks for diagnostics, personalized treatment, and enhanced efficiency. *AIMS Med. Sci.* **2024**, *11*, 248–264. [CrossRef]
4. Brennan, D.M.; Mawson, S.; Brownsell, S. Telerehabilitation: Enabling the remote delivery of healthcare, rehabilitation, and self management. *Stud. Health Technol. Inform.* **2009**, *145*, 231–248. [CrossRef] [PubMed]
5. Lanotte, F.; O'brien, M.K.; Jayaraman, A. AI in Rehabilitation Medicine: Opportunities and Challenges. *Ann. Rehabil. Med.* **2023**, *47*, 444–458. [CrossRef]
6. McMaughan, D.J.; Oloruntoba, O.; Smith, M.L. Socioeconomic Status and Access to Healthcare: Interrelated Drivers for Healthy Aging. *Front. Public Health* **2020**, *8*, 231. [CrossRef]
7. World Health Organization; United Nations Children's Fund (UNICEF). *Global Report on Assistive Technology*; WHO: Geneva, Switzerland, 2022.
8. Layton, N.; Borg, J. (Eds.) *Global Perspectives on Assistive Technology: Proceedings of the GReAT Consultation 2019*; World Health Organization: Geneva, Switzerland, 2019; Volume 1.
9. National Institute of Dental and Craniofacial Research (US). *Oral Health in America: Advances and Challenges*; National Institute of Dental and Craniofacial Research: Bethesda, MD, USA, 2021. Available online: https://www.ncbi.nlm.nih.gov/books/NBK578297/ (accessed on 16 December 2024).
10. National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Health Care Services; Committee on Health Care Utilization and Adults with Disabilities. *Health-Care Utilization as a Proxy in Disability Determination*; National Academies Press: Washington, DC, USA, 2018. Available online: https://www.ncbi.nlm.nih.gov/books/NBK500097/ (accessed on 16 December 2024).
11. Andrade, R.M.; Santana, B.G.; Schmidt, A.V.; Barsotti, C.E.; Baroni, M.P.; Saragiotto, B.T.; Ribeiro, A.P. Effect of traditional rehabilitation programme versus telerehabilitation in adolescents with idiopathic scoliosis during the COVID-19 pandemic: A cohort study. *J. Rehabil. Med.* **2024**, *56*, jrm5343. [CrossRef]
12. Zhang, Y.; Jin, Q.; Ji, C.; Yuan, P.; Chen, L. Innovative Telerehabilitation Enhanced Care Programme (ITECP) in young and middle-aged patients with haemorrhagic stroke to improve exercise adherence: Protocol of a multicentre randomised controlled trial. *BMJ Open* **2023**, *13*, e072268. [CrossRef]
13. Serrano, L.P.; Maita, K.C.; Avila, F.R.; A Torres-Guzman, R.; Garcia, J.P.; Eldaly, A.S.; Haider, C.R.; Felton, C.L.; Paulson, M.R.; Maniaci, M.J.; et al. Benefits and Challenges of Remote Patient Monitoring as Perceived by Health Care Practitioners: A Systematic Review. *Perm. J.* **2023**, *27*, 100–111. [CrossRef]
14. Thomas, E.E.; Taylor, M.L.; Banbury, A.; Snoswell, C.L.; Haydon, H.M.; Rejas, V.M.G.; Smith, A.C.; Caffery, L.J. Factors influencing the effectiveness of remote patient monitoring interventions: A realist review. *BMJ Open* **2021**, *11*, e051844. [CrossRef]
15. Tan, S.Y.; Sumner, J.; Wang, Y.; Yip, A.W. A systematic review of the impacts of remote patient monitoring (RPM) interventions on safety, adherence, quality-of-life and cost-related outcomes. *NPJ Digit. Med.* **2024**, *7*, 192. [CrossRef]
16. Shajari, S.; Kuruvinashetti, K.; Komeili, A.; Sundararaj, U. The Emergence of AI-Based Wearable Sensors for Digital Health Technology: A Review. *Sensors* **2023**, *23*, 9498. [CrossRef] [PubMed]
17. Sabry, F.; Eltaras, T.; Labda, W.; Alzoubi, K.; Malluhi, Q. Machine Learning for Healthcare Wearable Devices: The Big Picture. *J. Healthc. Eng.* **2022**, *2022*, 4653923. [CrossRef] [PubMed]
18. Rahimi, B.; Nadri, H.; Afshar, H.L.; Timpka, T. A Systematic Review of the Technology Acceptance Model in Health Informatics. *Appl. Clin. Inform.* **2018**, *9*, 604–634. [CrossRef] [PubMed]
19. Santana, M.J.; Manalili, K.; Jolley, R.J.; Zelinsky, S.; Quan, H.; Lu, M. How to practice person-centred care: A conceptual framework. *Health Expect.* **2018**, *21*, 429–440. [CrossRef]
20. Bougea, A. Application of Wearable Sensors in Parkinson's Disease: State of the Art. *J. Sens. Actuator Netw.* **2025**, *14*, 23. [CrossRef]

21. Jolly, A.; Pandey, V.; Sahni, M.; Leon-Castro, E.; Perez-Arellano, L.A. Modern Smart Gadgets and Wearables for Diagnosis and Management of Stress, Wellness, and Anxiety: A Comprehensive Review. *Healthcare* **2025**, *13*, 411. [CrossRef]
22. George, A.S.; Shahul, A.; George, A.S. Wearable sensors: A new way to track health and wellness. *Partn. Univers. Int. Innov. J.* **2023**, *1*, 15–34. [CrossRef]
23. Bateni, H.; Carruthers, J.; Mohan, R.; Pishva, S. Use of Virtual Reality in Physical Therapy as an Intervention and Diagnostic Tool. *Rehabil. Res. Pract.* **2024**, *2024*, 1122286. [CrossRef]
24. Kouijzer, M.M.T.E.; Kip, H.; Bouman, Y.H.A.; Kelders, S.M. Implementation of virtual reality in healthcare: A scoping review on the implementation process of virtual reality in various healthcare settings. *Implement. Sci. Commun.* **2023**, *4*, 67. [CrossRef]
25. Oluwaseyi, J.; Olanite, E. Patient Engagement: AI Tools That Enhance Patient Communication, Education, and Adherence to Treatment Plans. 2024. Available online: https://www.researchgate.net/publication/384774304_Patient_Engagement_AI_tools_that_enhance_patient_communication_education_and_adherence_to_treatment_plans (accessed on 16 December 2024).
26. Haleem, A.; Javaid, M.; Singh, R.P.; Suman, R. Telemedicine for healthcare: Capabilities, features, barriers, and applications. *Sens. Int.* **2021**, *2*, 100117. [CrossRef]
27. Wickramasinghe, N.; Andargoli, A. The enabling role of 5G in the digital transformation of healthcare. In *Digitalization and the Transformation of the Healthcare Sector*; IGI Global: Hershey, PA, USA, 2024. [CrossRef]
28. Osama, M.; Ateya, A.A.; Sayed, M.S.; Hammad, M.; Pławiak, P.; El-Latif, A.A.A.; Elsayed, R.A. Internet of Medical Things and Healthcare 4.0: Trends, Requirements, Challenges, and Research Directions. *Sensors* **2023**, *23*, 7435. [CrossRef] [PubMed]
29. Georgiou, K.E.; Georgiou, E.; Satava, R.M. 5G Use in Healthcare: The Future is Present. *JSLS J. Soc. Laparosc. Robot. Surg.* **2021**, *25*, e2021.00064. [CrossRef]
30. Yeh, S.-J.; Wang, Y.-C.; Fang, W.-C.; Huang, S.-C.; Yang, Y.-S. Effectiveness of Powered Hand Exoskeleton on Upper Extremity Function in People with Chronic Stroke. *Actuators* **2025**, *14*, 67. [CrossRef]
31. Calafiore, D.; Negrini, F.; Tottoli, N.; Ferraro, F.; Ozyemisci-Taskiran, O.; de Sire, A. Efficacy of robotic exoskeleton for gait rehabilitation in patients with subacute stroke: A systematic review. *Eur. J. Phys. Rehabil. Med.* **2022**, *58*, 1–8. [CrossRef]
32. Alturki, B.; Abu Al-Haija, Q.; Alsemmeari, R.A.; Alsulami, A.A.; Alqahtani, A.; Alghamdi, B.M.; Bakhsh, S.T.; Shaikh, R.A. IoMT landscape: Navigating current challenges and pioneering future research trends. *Discov. Appl. Sci.* **2024**, *7*, 26. [CrossRef]
33. Wagan, S.A.; Koo, J.; Siddiqui, I.F.; Attique, M.; Shin, D.R.; Qureshi, N.M.F. Internet of medical things and trending converged technologies: A comprehensive review on real-time applications. *J. King Saud Univ. Comput. Inf. Sci.* **2022**, *34 Pt B*, 9228–9251. [CrossRef]
34. Ahmed, S.F.; Bin Alam, S.; Afrin, S.; Rafa, S.J.; Rafa, N.; Gandomi, A.H. Insights into Internet of Medical Things (IoMT): Data fusion, security issues and potential solutions. *Inf. Fusion* **2023**, *102*, 102060. [CrossRef]
35. Sarkar, M.; Lee, T.-H.; Sahoo, P.K. Smart Healthcare: Exploring the Internet of Medical Things with Ambient Intelligence. *Electronics* **2024**, *13*, 2309. [CrossRef]
36. Mazhar, T.; Shah, S.F.A.; Inam, S.A.; Awotunde, J.B.; Saeed, M.M.; Hamam, H. Analysis of integration of IoMT with blockchain: Issues, challenges and solutions. *Discov. Internet Things* **2024**, *4*, 21. [CrossRef]
37. Premakanthan, N. Cyber Security Threats and Mitigations in the Healthcare Sector with Emphasis on IoMT Security and Software Defined Networking. 2024. Available online: https://www.researchgate.net/publication/377382276_Cyber_Security_Threats_and_Mitigations_in_the_Healthcare_Sector_with_emphasis_on_IoMT_security_and_Software_Defined_Networking (accessed on 11 January 2025).
38. Mennella, C.; Maniscalco, U.; De Pietro, G.; Esposito, M. Ethical and regulatory challenges of AI technologies in healthcare: A narrative review. *Heliyon* **2024**, *10*, e26297. [CrossRef] [PubMed]
39. Varnosfaderani, S.M.; Forouzanfar, M. The Role of AI in Hospitals and Clinics: Transforming Healthcare in the 21st Century. *Bioengineering* **2024**, *11*, 337. [CrossRef]
40. Johnson, K.B.; Wei, W.; Weeraratne, D.; Frisse, M.E.; Misulis, K.; Rhee, K.; Zhao, J.; Snowdon, J.L. Precision Medicine, AI, and the Future of Personalized Health Care. *Clin. Transl. Sci.* **2021**, *14*, 86–93. [CrossRef] [PubMed]
41. Gayathri, K.; Bella, K.M. Role of Artificial Intelligence Technology and Its Impact on Transformation of Human Resources Management. 2023. Available online: https://www.researchgate.net/publication/376580780_ROLE_OF_ARTIFICIAL_INTELLIGENCE_TECHNOLOGY_AND_ITS_IMPACT_ON_TRANSFORMATION_OF_HUMAN_RESOURCES_MANAGEMENT (accessed on 11 January 2025).
42. Burdea, G.; Kim, N.; Polistico, K.; Kadaru, A.; Grampurohit, N.; Roll, D.; Damiani, F. Assistive game controller for artificial intelligence-enhanced telerehabilitation post-stroke. *Assist. Technol.* **2021**, *33*, 117–128. [CrossRef] [PubMed]
43. Kuo, L.-C.; Yang, K.-C.; Lin, Y.-C.; Yeh, C.-H.; Su, F.-C.; Hsu, H.-Y. Internet of Things (IoT) Enables Robot-Assisted Therapy as a Home Program for Training Upper Limb Functions in Chronic Stroke: A Randomized Control Crossover Study. *Arch. Phys. Med. Rehabil.* **2023**, *104*, 363–371. [CrossRef]

44. Capecci, M.; Cima, R.; Barbini, F.A.; Mantoan, A.; Sernissi, F.; Lai, S.; Fava, R.; Tagliapietra, L.; Ascari, L.; Izzo, R.N.; et al. Telerehabilitation with ARC Intellicare to Cope with Motor and Respiratory Disabilities: Results about the Process, Usability, and Clinical Effect of the "Ricominciare" Pilot Study. *Sensors* **2023**, *23*, 7238. [CrossRef]
45. Amorim, P.; Paiva, J.; de Lima, J.S.; da Fonseca, L.P.; Martins, H.; Silva, P.A. Lessons learned from investigating patients' and physiotherapists' perspectives on the design of a telerehabilitation platform. *Disabil. Rehabil. Assist. Technol.* **2024**, *19*, 2377–2388. [CrossRef]
46. Khalid, U.B.; Naeem, M.; Stasolla, F.; Syed, M.H.; Abbas, M.; Coronato, A. Impact of AI-Powered Solutions in Rehabilitation Process: Recent Improvements and Future Trends. *Int. J. Gen. Med.* **2024**, *17*, 943–969. [CrossRef]
47. Dixon, D.; Sattar, H.; Moros, N.; Kesireddy, S.R.; Ahsan, H.; Lakkimsetti, M.; Fatima, M.; Doshi, D.; Sadhu, K.; Hassan, M.J. Unveiling the Influence of AI Predictive Analytics on Patient Outcomes: A Comprehensive Narrative Review. *Cureus* **2024**, *16*, e59954. [CrossRef]
48. El-Tallawy, S.N.; Pergolizzi, J.V.; Vasiliu-Feltes, I.; Ahmed, R.S.; LeQuang, J.K.; El-Tallawy, H.N.; Varrassi, G.; Nagiub, M.S. Incorporation of "Artificial Intelligence" for Objective Pain Assessment: A Comprehensive Review. *Pain Ther.* **2024**, *13*, 293–317. [CrossRef]
49. Wei, M.; Meng, D.; He, S.; Lv, Z.; Guo, H.; Yang, G.; Wang, Z. Investigating the efficacy of AI-enhanced telerehabilitation in sarcopenic older individuals. *Eur. Geriatr. Med.* **2024**, *16*, 115–123. [CrossRef] [PubMed]
50. Yang, G.; Ye, Q.; Xia, J. Unbox the black-box for the medical explainable AI via multi-modal and multi-centre data fusion: A mini-review, two showcases and beyond. *Inf. Fusion* **2022**, *77*, 29–52. [CrossRef]
51. Swarnakar, R.; Yadav, S.L. Artificial intelligence and machine learning in motor recovery: A rehabilitation medicine perspective. *World J. Clin. Cases* **2023**, *11*, 7258–7260. [CrossRef]
52. Celesti, A.; Celesti, F.; Fazio, M.; Villari, M. Improving tele-rehabilitation therapy through machine learning with a NoSQL graph DBMS approach. In Proceedings of the IEEE Global Communications Workshop, Taipei, Taiwan, 7–11 December 2020; pp. 1–6. [CrossRef]
53. Wood, J.M.; Kim, H.E.; Morton, S.M. Reinforcement Learning during Locomotion. *eNeuro* **2024**, *11*, 1–12. [CrossRef]
54. Wubineh, B.Z.; Deriba, F.G.; Woldeyohannis, M.M. Exploring the opportunities and challenges of implementing artificial intelligence in healthcare: A systematic literature review. *Urol. Oncol. Semin. Orig. Investig.* **2024**, *42*, 48–56. [CrossRef]
55. Al-Kfairy, M.; Alomari, A.; Al-Bashayreh, M.; Alfandi, O.; Tubishat, M. Unveiling the Metaverse: A survey of user perceptions and the impact of usability, social influence and interoperability. *Heliyon* **2024**, *10*, e31413. [CrossRef] [PubMed]
56. Shoabjareh, A.H.; Ghasri, M.; Roberts, T.; Lapworth, A.; Dobos, N.; Burken, C.B.-V. The role of trust and distrust in technology usage: An in-depth investigation of traffic information apps usage for mandatory and non-mandatory trips. *Travel Behav. Soc.* **2024**, *37*, 100816. [CrossRef]
57. Lawrence, E. User-Centered Design to Enhance Accessibility and Usability in Digital Systems. 2024. Available online: https://www.researchgate.net/publication/386339454_User_centered_design_to_enhance_accessibility_and_usability_in_digital_systems (accessed on 11 January 2025).
58. Bajwa, J.; Munir, U.; Nori, A.; Williams, B. Artificial intelligence in healthcare: Transforming the practice of medicine. *Futur. Healthc. J.* **2021**, *8*, e188–e194. [CrossRef] [PubMed]
59. Tsvetanov, F. Integrating AI Technologies into Remote Monitoring Patient Systems. *Eng. Proc.* **2024**, *70*, 54. [CrossRef]
60. David-Olawade, A.C.; Olawade, D.B.; Ojo, I.O.; Famujimi, M.E.; Olawumi, T.T.; Esan, D.T. Nursing in the Digital Age: Harnessing telemedicine for enhanced patient care. *Inform. Health* **2024**, *1*, 100–110. [CrossRef]
61. Tilala, M.H.; Chenchala, P.K.; Choppadandi, A.; Kaur, J.; Naguri, S.; Saoji, R.; Devaguptapu, B. Ethical Considerations in the Use of Artificial Intelligence and Machine Learning in Health Care: A Comprehensive Review. *Cureus* **2024**, *16*, e62443. [CrossRef]
62. Mahmood, U.; Shukla-Dave, A.; Chan, H.-P.; Drukker, K.; Samala, R.K.; Chen, Q.; Vergara, D.; Greenspan, H.; Petrick, N.; Sahiner, B.; et al. Artificial intelligence in medicine: Mitigating risks and maximizing benefits via quality assurance, quality control, and acceptance testing. *BJR Artif. Intell.* **2024**, *1*, ubae003. [CrossRef]
63. Pantanowitz, L.; Hanna, M.; Pantanowitz, J.; Lennerz, J.; Henricks, W.H.; Shen, P.; Quinn, B.; Bennet, S.; Rashidi, H.H. Regulatory Aspects of Artificial Intelligence and Machine Learning. *Mod. Pathol.* **2024**, *37*, 100609. [CrossRef] [PubMed]
64. Gala, D.; Behl, H.; Shah, M.; Makaryus, A.N. The Role of Artificial Intelligence in Improving Patient Outcomes and Future of Healthcare Delivery in Cardiology: A Narrative Review of the Literature. *Healthcare* **2024**, *12*, 481. [CrossRef]
65. Willingham, T.B.; Stowell, J.; Collier, G.; Backus, D. Leveraging Emerging Technologies to Expand Accessibility and Improve Precision in Rehabilitation and Exercise for People with Disabilities. *Int. J. Environ. Res. Public Health* **2024**, *21*, 79. [CrossRef] [PubMed]
66. Jungherr, A. Artificial Intelligence and Democracy: A Conceptual Framework. *Soc. Media Soc.* **2023**, *9*, 1–14. [CrossRef]
67. Yelne, S.; Chaudhary, M.; Dod, K.; Sayyad, A.; Sharma, R. Harnessing the Power of AI: A Comprehensive Review of Its Impact and Challenges in Nursing Science and Healthcare. *Cureus* **2023**, *15*, e49252. [CrossRef]

68. Lythreatis, S.; Singh, S.K.; El-Kassar, A.-N. The digital divide: A review and future research agenda. *Technol. Forecast. Soc. Change* **2021**, *175*, 121359. [CrossRef]
69. Rane, J.; Kaya, Ö.; Mallick, S.K.; Rane, N.L. Enhancing black-box models: Advances in explainable artificial intelligence for ethical decision-making. In *Future Research Opportunities for Artificial Intelligence in Industry 4.0 and 5.0*; Deep Science Publishing: Mumbai, India, 2024; pp. 136–180. [CrossRef]
70. Kornhaber, R.; Walsh, K.; Duff, J.; Walker, K. Enhancing adult therapeutic interpersonal relationships in the acute health care setting: An integrative review. *J. Multidiscip. Healthc.* **2016**, *9*, 537–546. [CrossRef]
71. Dolev, T.; Zilcha-Mano, S. The role of the therapeutic relationship in the association between interpersonal behaviors and outcome: Comparison of two competing models. *Psychother. Res.* **2019**, *29*, 553–564. [CrossRef]
72. Alowais, S.A.; Alghamdi, S.S.; Alsuhebany, N.; Alqahtani, T.; Alshaya, A.I.; Almohareb, S.N.; Aldairem, A.; Alrashed, M.; Bin Saleh, K.; Badreldin, H.A.; et al. Revolutionizing healthcare: The role of artificial intelligence in clinical practice. *BMC Med. Educ.* **2023**, *23*, 689. [CrossRef] [PubMed]
73. Díaz-Rodríguez, N.; Del Ser, J.; Coeckelbergh, M.; de Prado, M.L.; Herrera-Viedma, E.; Herrera, F. Connecting the dots in trustworthy Artificial Intelligence: From AI principles, ethics, and key requirements to responsible AI systems and regulation. *Inf. Fusion* **2023**, *99*, 101896. [CrossRef]
74. Bhushan, B.; Kumar, A.; Agarwal, A.K.; Kumar, A.; Bhattacharya, P.; Kumar, A. Towards a Secure and Sustainable Internet of Medical Things (IoMT): Requirements, Design Challenges, Security Techniques, and Future Trends. *Sustainability* **2023**, *15*, 6177. [CrossRef]
75. Kruk, M.E.; Gage, A.D.; Arsenault, C.; Jordan, K.; Leslie, H.H.; Roder-DeWan, S.; Adeyi, O.; Barker, P.; Daelmans, B.; Doubova, S.V.; et al. High-quality health systems in the Sustainable Development Goals era: Time for a revolution. *Lancet Glob. Health* **2018**, *6*, e1196–e1252. [CrossRef]
76. Wallace, P.J. Gaining Trust: Lessons and Opportunities for Artificial Intelligence in Health Care. *Perm. J.* **2024**, *28*, 168–171. [CrossRef] [PubMed]
77. Khan, B.; Fatima, H.; Qureshi, A.; Kumar, S.; Hanan, A.; Hussain, J.; Abdullah, S. Drawbacks of Artificial Intelligence and Their Potential Solutions in the Healthcare Sector. *Biomed. Mater. Devices* **2023**, *1*, 731–738. [CrossRef]
78. Arntz, A.; Weber, F.; Handgraaf, M.; Lällä, K.; Korniloff, K.; Murtonen, K.-P.; Chichaeva, J.; Kidritsch, A.; Heller, M.; Sakellari, E.; et al. Technologies in Home-Based Digital Rehabilitation: Scoping Review. *JMIR Rehabil. Assist. Technol.* **2023**, *10*, e43615. [CrossRef]
79. Borges do Nascimento, I.J.; Abdulazeem, H.; Vasanthan, L.T.; Martinez, E.Z.; Zucoloto, M.L.; Østengaard, L.; Azzopardi-Muscat, N.; Zapata, T.; Novillo-Ortiz, D. Barriers and facilitators to utilizing digital health technologies by healthcare professionals. *NPJ Digit. Med.* **2023**, *6*, 161. [CrossRef]
80. Maqbool, B.; Herold, S. Potential effectiveness and efficiency issues in usability evaluation within digital health: A systematic literature review. *J. Syst. Softw.* **2024**, *208*, 111881. [CrossRef]
81. Williamson, S.M.; Prybutok, V. Balancing Privacy and Progress: A Review of Privacy Challenges, Systemic Oversight, and Patient Perceptions in AI-Driven Healthcare. *Appl. Sci.* **2024**, *14*, 675. [CrossRef]
82. Frank, E.; Ok, E. The Role of Artificial Intelligence in Transforming Patient Care and Diagnostic Processes. 2024. Available online: https://www.researchgate.net/publication/383660380_The_Role_of_Artificial_Intelligence_in_Transforming_Patient_Care_and_Diagnostic_Processes (accessed on 16 December 2024).
83. Cingolani, M.; Scendoni, R.; Fedeli, P.; Cembrani, F. Artificial intelligence and digital medicine for integrated home care services in Italy: Opportunities and limits. *Front. Public Health* **2023**, *10*, 1095001. [CrossRef] [PubMed]
84. Kr, P.; Kinkar, R.; Kumar, G.; Anand, N.; Rama, K.; Singhal, P.; Sharma, A. Intelligent integration of wearable sensors and artificial intelligence for real-time athletic performance enhancement. *J. Intell. Syst. Internet Things* **2024**, *13*, 60–77. [CrossRef]
85. Esmaeilzadeh, P. Challenges and strategies for wide-scale artificial intelligence (AI) deployment in healthcare practices: A perspective for healthcare organizations. *Artif. Intell. Med.* **2024**, *151*, 102861. [CrossRef] [PubMed]
86. European Commission; Joint Research Centre; Rak, R.; Quinn, P. *Enhancing Digital Health Innovation in the EU with Effective Industrial Strategy Policies—A Focus on Wearable Medical Devices*; Ciui, B., Ed.; Publications Office of the European Union: Luxembourg, 2024; JRC138798. Available online: https://publications.jrc.ec.europa.eu/repository/handle/JRC138798 (accessed on 16 December 2024).

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.