

Emerging Technological Trends in Rehabilitation Science and Clinical Practice

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Mini Review

The pandemic has led to some seismic changes in the present-day healthcare system. Similarly, the field of rehabilitation has been experiencing some groundbreaking technological innovations, influencing overall healthcare outcomes.

One of these changing paradigms is the shift of focus from the care provider to the healthcare consumer. While traditionally, the clinicians and payors were the significant decision-makers, we now see a pivot toward patient-centric service models, which is the core of the participatory medicine model [1]. Patients are now more self-aware and expect similar experiences in their healthcare journey as in other areas of service in their day-to-day affairs. This model reflects collaboration between the clinician and patient on the guiding principles of trust, mutual respect, and responsible information sharing. (The society for participatory medicine manifesto) "E-health" - one of the catchwords in contemporary health practice is described as a joint effort between the health tech and hi-tech champions to effectively utilize the benefits of collaboration between the internet and health care [2].

This collaboration between technology, traditional healthcare, and business has changed how we had perceived traditional healthcare as it existed before and modified the dynamics between patients and healthcare providers (HCP). With this access to information, patients and healthcare providers are increasingly engaged and relatively well equipped in their wellness journey. Patients no longer acknowledge their physicians as the "gatekeepers" to knowledge and feel empowered with information about their conditions that encourage a dialogue with the HCPs. In addition, patients feel "more prepared and ethically responsible" during consultations and are proactive in decision-making with available treatment options [3].

AARP research in 2021 points to some significant health tech trends, including new behavior patterns with emerging technological reliance and incorporation into our daily lives. Data demonstrated that older adults upped the usage of their tech devices. For example, smartphone usage increased from 28% to 40% for communication with healthcare providers [4]. Let's look at some of these evolving tech trends in orthopedic rehabilitation.

Video Platforms

Tele rehab, including video chats, is one of the pandemic-catalyzed tech trends that have become more important and relevant since 2020. We saw a sharp rise in prescription and adoption of telerehabilitation during the pandemic, making delivery of intervention possible despite the social distancing mandate. A study from 2021 used tele rehab and tech tools such as wearables, internet, virtual reality, and telephone for providing care to patients with varied pathological conditions. It aimed to improve motor outcomes through a home exercise program and education incorporating healthy behavior and lifestyle. This mode of delivery turned out to be clinically positive and comparable to the conventional rehabilitation approaches offering in-person care. However, communication and adherence were some of the factors considered for successful implementation by professionals [5].

Virtual home assessments

Home assessments are vital in occupational therapy practice for safe discharge to living spaces. A study explored the use of digital technology by Occupational therapists in carrying out home assessments using virtual visits via smartphone to follow up with recently discharged patients from a hospital. It highlighted the practicality of using digital solutions in customized patient care, reducing costs, and the acceptance of patients and therapists while adopting the approach. It also called for further exploration of the application and success of digital solutions in other settings [6].

Virtual reality

Medical virtual reality is gaining increasing traction as an intervention tool for various conditions, including surgical, psychological, and educational tools for improving patient experience. VR has also been used in hand rehabilitation using sensory gloves for guiding corrective exercises [7].

Robotics and Exoskeletons

With encouraging results, soft robotic exoskeletons have been used to rehabilitate crush, burns, stroke, and multiple fractures in hand injuries. This robotic device assists in carrying out the movement of digits to facilitate function and recovery [8].

Wearables

Wearables sensors are proving to be quite valuable in diagnostics and rehabilitation for assessing various impairments and collecting data that can likely be used for further analysis of pathological conditions. The use of wearables in musculoskeletal disorders such as osteoarthritis and rotator cuff tears had demonstrated promising results in monitoring shoulder kinematics for collecting clinical data and the potential application for understanding shoulder pathology [9].

Smartphone devices

Smartphone devices are extensively used for various applications, from scheduling appointments to conducting tele rehab sessions and documentation, and also as a tool for clinical intervention and assessment. For example, smartphone device use demonstrates

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Received: 02-Aug-2022, Manuscript No: omha-22-71581; **Editor assigned:** 05-Aug-2022, Pre-QC No: omha-22-71581 (PQ); **Reviewed:** 19-Aug-2022, QC No: omha-22-71581; **Revised:** 22-Aug-2022, Manuscript No: omha-22-71581 (R); **Published:** 30-Aug-2022, DOI: 10.4202/2329-6879.1000421

Citation: Asegaonkar A (2022) Emerging Technological Trends in Rehabilitation Science and Clinical Practice. *Occup Med Health* 10: 421.

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promising results and reliability for joint measurements comparable to a traditional goniometer [10]. Furthermore, smart device-based apps have shown positive outcomes in treating various conditions in hand therapy interventions. In addition, these apps improved patient engagement and motivation as an adjunct to traditional clinical practices in treating pathological hand conditions [11].

Therapist and patient perception of the use of technology

Occupational engagement is one of the core principles in rehabilitation interventions. Technology offers the opportunity to maintain access and adherence to therapy outside of the traditional therapy sessions through innovative means. Therapists are generally positive in their perception of using technology such as video games in their clinical sessions. The acceptance of these innovations is also influenced by their relative advantage, compatibility, complexity, adaptation, and ability to induce change [12]. Patients have similarly demonstrated preference and adherence to the use of technology such as mobile-based home exercise programs over traditional paper handouts and have shown an overall positive outlook towards technology adoption [11, 13].

Rehabilitation therapists are first-hand consumers and providers of technology-based interventions and are uniquely positioned to provide insight and make meaningful collaborations with our patients [14]. As a result, there's a need for therapists, more than ever, to join the tech conversation to help patients navigate the complexities of the deluge of information and empower them to make informed decisions for a positive health outcome.

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