Mobile Health (mHealth) Applications for Stroke Rehabilitation: A mini review

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Abstract

Abstract:

Mobile Health (mHealth) applications are transforming stroke rehabilitation, through personalized care and data-driven insights. These applications employ AI-driven algorithms, tele-rehabilitation, wearable technologies, and gamification to enhance recovery process. The objective of this mini review is to explore the transformative role of Mobile Health (mHealth) applications in stroke rehabilitation, highlighting its capacity to transcend geographical barriers and establish extensive support networks connecting stroke survivors, caregivers, and healthcare professionals. Particularly in developing countries like Pakistan, where healthcare resources may be limited, mHealth offers a viable solution to bridge the gap in stroke care. By facilitating access to rehabilitation services, mHealth can significantly improve outcomes for stroke survivors in these regions. This integration of mobile technology with stroke rehabilitation not only promises personalized and more effective rehabilitation but also presents a unique blend of technology and compassion. This evolution in healthcare holds the potential to redefine stroke recovery, marking a significant milestone in the journey towards more inclusive, efficient, and compassionate care solutions.

Keywords: Mobile Health, mHealth applications, stroke rehabilitation, personalized interventions, and technology integration.

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Introduction

The COVID-19 pandemic resulted in an unprecedented global health and economic crises in many countries affecting millions of people. However, this period also marked a shift from traditional methodologies to digital solutions across various sectors notably health care and rehabilitation. The advent of digital health has revolutionized health care system and shifted from traditional stereotyped 'one-size-fits-all' approach towards real time tailored and personalized monitoring and therapeutic health care. Digital devices are concise and delicate which have capability to enhance the ability to measure accurately, diagnose correctly and provide appropriate treatment accordingly. Digital therapeutics is a technological assisted intervention through the latest high quality and appropriate software. The need for digitization in health system is gradually increasing to enhance the overall quality care and easy access to patients and community.[1]

Concept of mHealth applications

Mobile Health (mHealth) applications have revolutionized healthcare by leveraging mobile technology to offer services, information, awareness, and support directly to users. These applications offer health monitoring, disease management, promotion, awareness, and education for specific conditions, enabling innovative solutions across geographical boundaries and time constraints.[2] It is facilitating the transition from a generic 'one-size-fits-all' approach to a more dynamic, real-time, personalized monitoring and therapeutic care.

A systematic review conducted by (Rintala et al in 2023) supports the applications of mHealth in stroke survivors and is considered a useful and beneficial approach for outcome-based recovery.[3] These mobile based apps offer better and effective communication, active engagement, and specific awareness regarding the complications. mHealth apps are effective tools to provide a customized and tailored training plans through real time feedback and effective than ever before by seamlessly integrating individualized exercises, and interactive resources.[4]

Mobile apps for health-related purposes

Mobile Health (mHealth) applications, often known as health apps, are software programmes designed to run on smartphones, tablets, and other mobile devices with the purpose of improving health and well-being. These applications act as a link between modern technology and healthcare, allowing people to effortlessly access a variety of health-related services, resources, diagnosis, prevention, and interventions from the palm of their hand.[5]

mHealth applications may include a wide range of features like health monitoring, disease management, fitness tracking, prescription reminders, mental health support, and more. These apps collect data, give real-time feedback, and promote communication between users and

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healthcare providers by leveraging the features of mobile devices such as sensors, GPS, cameras, and connection.[6]

Importance of mHealth in stroke rehabilitation

A scoping review of randomized controlled trials from 2010 to 2020 was done on 1453 stroke survivors in 18 RCTS in which it was reported that secondary stroke prevention can be handled using mHealth based interventions.[7] The traditional stroke rehab approaches have certain barriers including the lack of follow up, lack of motivation and active engagement of patients, poor monitoring, costly both direct and indirect and limited in measuring the recovery progress.[8] That is the point where mHealth applications comes in light, as they provide a transformational approach to overcoming these obstacles and reimagining the recovery experience.[7]

Challenges that stroke survivors face in traditional rehabilitation settings

Stroke sufferers frequently face various challenges during their recovery phase in traditional rehabilitation settings. These challenges are:

1. Limited Accessibility: Geographical distance, transportation difficulties, and mobility issues can all make it difficult for stroke survivors to visit rehabilitation centers on a regular basis.[8]
2. Lack of Personalization: Traditional rehabilitation programmes may use a broad approach that does not completely address the particular requirements, progress, and limits of individual stroke survivors.[9]
3. Adherence Barriers: The monotonous nature of exercise can become tedious for the patients, lowering their motivation and making adherence to therapy schedules a challenge for the rehabilitation professionals.[10]
4. Lack of Immediate Feedback: Traditional in-person therapy sessions often do not offer real-time feedback mechanisms, making it difficult for stroke survivors to change their techniques of exercise and assess their progress efficiently.[10]
5. Diminished motivation and active engagement: The same training approach without any incentive activity led to the development of a tedious and dreary attitude.[9]

Leveraging technology for remote and personalized care

MHealth applications emerge as a transformative solution to these issues. mHealth apps provide stroke patients with unprecedented levels of remote and individualized care by capitalizing on the ubiquitous presence of cellphones and the possibilities of current technology.[11]

1. Accessibility: These applications enable survivors to engage in rehabilitation exercises and activities from the comfort of their own homes, removing geographical barriers and the need for frequent travel.[11]
2. Personalization: MHealth apps offer customized exercise programmes tailored to individual requirement of the patient , ensuring that rehabilitation efforts are directed towards specific goals and progress.[11]
3. Enhancement of Adherence: The interactive features of mHealth apps, such as gamified exercises and progress tracking, increases motivation and adherence to therapy.[11]
4. Real-Time Feedback: Smartphone sensors and wearables provide immediate feedback on movement and performance, allowing stroke survivors to alter their activities as needed.[11]
5. Research Potential of Data Collection

Advances in mobile technology have not only transformed the way stroke survivors approach rehabilitation, but have also ushered in an era of extraordinary research potential through the gathering and analysis of data generated by mHealth applications.[12]

Research data is a critical component in stroke rehabilitation. MHealth applications collect a wealth of useful data, including exercise performance record and adherence patterns, as well as daily activity levels and vital signs. This data provides researchers with a once-in-a-lifetime opportunity to get previously unattainable insights into the complexities of stroke recovery.[13]

Data obtained anonymously from mHealth applications can be combined and analyzed to drive comprehensive rehabilitation outcome studies. Researchers can find trends, correlations, and factors that influence rehabilitation effectiveness by monitoring the progress and outcomes of a diverse pool of stroke survivors. This collection of data contributes in the refinement of rehabilitation protocols and the development of therapies suited to individual requirements.[14]

The data generated by mHealth applications allows researchers to have a comprehensive picture of the recovery process. Patterns of improvement, plateaus, and setbacks emerge, allowing healthcare providers and stroke survivors to formulate reasonable expectations.[15] This

sophisticated understanding of the rehabilitation process contributes to the creation of evidence-based therapies that are compatible with the dynamic character of stroke recovery. Looking at the data can give new ideas for helping stroke patients recover. Researchers can find things that need to be improved, change the ways they're helping, and come up with new ideas that use modern technology. This makes the treatments for stroke recovery better because they're based on real information. These treatments can also change to fit the needs of each person who had a stroke.[12]

Recommendation for Future Development: Enhancing Stroke Rehabilitation Through Innovative mHealth Apps.

The landscape of stroke rehabilitation is changing, and mobile health (mHealth) apps will play an important role in moulding its future. Here, we highlight a few innovative strategies that have the potential to transform the area of stroke rehabilitation.

AI-Personalized Plans: Integrate cutting-edge AI to create unique rehabilitation programmes for each stroke survivor, modifying interventions based on ongoing performance. The efficiency and effectiveness of therapy are improved by this personalization.

Multilingual Support: Offer mHealth apps in multiple languages, including Urdu, to ensure accessibility for a broader population of stroke survivors who might be more comfortable using their native language. Lack of language options could limit adoption among non-English speakers.

Literacy Levels: Address varying literacy levels among stroke survivors. Use simple and clear language, along with visual aids, to ensure that instructions and educational content are understood by all.

Data-Driven Insights: Collect extensive data to reveal stroke recovery patterns. Analyzing this data enables mHealth apps to deliver evidence-based information to patients and healthcare providers while also enhancing treatment options.

Privacy and Data Manipulation: Data privacy is a concern in today's connected world. There is a need to prioritize the protection of sensitive health information to maintain user trust and comply with ethical standards.

Gamification and Social Interaction: Incorporate gamification elements and social interaction features within apps. This not only makes therapy enjoyable but also fosters a sense of community among stroke survivors, reducing isolation.

Wearable Integration: Wearables can be seamlessly integrated to monitor real-time movement data. This holistic perspective enables therapists to successfully change strategies and track progress.

Collaborative Care Ecosystem: Create collaborative mHealth ecosystems that connect survivors, caregivers, and healthcare providers. This promotes collaborative decision-making, coordinated care, and comprehensive support networks.

The mHealth Apps in Pakistan

In the context of Pakistan, a developing country, the integration of mHealth applications in stroke rehabilitation encounters specific hurdles such as widespread technological and digital literacy gaps, inconsistent internet connectivity, and diverse linguistic needs. it is important to design mHealth solutions that are accessible offline and user-friendly across various literacy levels, incorporating interfaces in multiple local languages, including Urdu, to ensure broader usability.

Engaging community health workers to facilitate app dissemination and user education can significantly improve accessibility and adoption. Incorporating culturally tailored gamification and social interaction elements can further enhance user engagement and adherence to rehabilitation programmes. Establishing a collaborative framework involving technology developers, healthcare professionals, and policymakers can drive the development and implementation of mHealth apps tailored to the unique landscape of Pakistan.

Conclusion

The fusion of mobile technology and stroke rehabilitation holds immense promise in the evolving healthcare landscape. Mobile Health (mHealth) applications are set to revolutionize stroke recovery by offering personalized approaches, data-driven insights, immersive experiences, and collaborative platforms. Looking ahead, the future of mHealth in stroke rehabilitation envisions customized care, improved outcomes, and a seamless integration of technology and compassion.

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