Role of Digital Healthcare in Rehabilitation During a Pandemic

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Introduction

Rehabilitation is always a very important part of treatment and considered primary. It enhances a person ability to be functional and independent and enriches the natural healing process [1]. Nowadays, the term digitalization has finally entered health care full of zeal with the ability to fulfill the best possible solutions [2]. Digital health is the technological setup created for the health care sectors by the brains of engineers to overcome the inability and inaccessibility regarding social and economic factors [3]. Digital health is the best solution for the organization presenting with absenteeism of employees with health care issues, places where the patient is unable to go to the health care center, or quality health care rehabilitation is not available at their center [4]. Since the development of digital sectors in health care, rehabilitation in digital health sectors has been introduced, where the proper applications are accessible to all smart phones [5]. According to the World Health Organization, digital health is innovating the health care sector providing transparency, accessibility, and availability of health care service everywhere. Digital health increased its efficacy during the pandemic, and it is now available in developing countries where the rehabilitation tool is accessible to the patients in their hands and can connect to their therapist at any moment [6]. The role of digital health on rehabilitation was maximally seen during Covid-19 and allowed patients to access care with their own device [7]. Globally, the pandemic caused by the coronavirus created the situation of unavailability of medical professionals everywhere and the accessibility was limited, thereby creating the need for improving earlier versions of digital rehabilitation, and the pandemic helped created trust on both the medical

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professional and patient's side. The outpatient rehabilitation suffered a lot during the Covid-19 pandemic, including acute to chronic conditions, and the inpatients suffered too, as rehabilitation requires teamwork and the medical professionals were unavailable. It was also difficult to bring the non-covid and covid patients under one roof and treat them with justice, ensuring prevention of spreading infections among them. Therefore, the platform of digital rehabilitation stepped up for not only the medical purpose but with due management of complete data associated with it [8–11]. Digital rehabilitation requires the technology of artificial intelligence to provide the space for the initiation of the robotic, virtual, and smart rehabilitation [12, 13].

Digital health has been introduced in specific areas of practice, such as Telemedicine, M-Health, E-health, and algorithmic medicine [14].

Different Digital Health Platforms in Rehabilitation

Telemedicine

In the 1980s, when personal computers introduced video conferencing, telemedicine emerged and acted in a supportive role to distant health care services, so as to work in places where the specialist was not available. Telemedicine provided teleconsultation in remote areas termed as telecare. In this, the patient and doctor are not in a face-to-face consultation, but the technology on hand created the articulation by involving multifaceted invisible work by medical professional and patient relationship to diagnose the symptoms and improvise the treatment. Digital telemedicine brings the clinic to the home [15–17]. The innovation of telemedicine stood as disaster management in the case of Covid-19 as a part of public health measures.

No telemedicine program can be begun in a short period and earlier constructed telemedicine technology created the sorting of the patients before arriving to the emergency rooms as a central health strategy of central health triage. Technology provides the patient centered environment and allows them to communicate with the doctor 24/7 regarding the symptoms and prevents spreading the infection to the other patients and clinicians [18–20].

Telemedicine had been increasing in rates but questions remained and development was according to countries, but Covid-19 accelerated the speed and questions to be answered in the last 2–3 years. Some of the barriers to trust patients and doctors face include that new physicians cannot be trusted on the telemedicine services compared to a physician that has treated the patient for years; in addition, trust is absent for the illiterate and senior medical professionals with less understanding of how to operate the software on the medical device and whether they can be trusted on the system for confidentiality and the affordance of cost associated with it. These were answered as availability of the telemedicine care, increasing the literacy rate to the extent to understand the software and making it easy to use, as well as making people aware and create trust by them using it in remote places as Covid-19 changing phases have created self-learning to some extent [21, 22]. Telemedicine was

used for the non-urgent cases to decrease the outpatient que. An increased use of telemedicine required increasing the government regulations so as to keep the data associated private and confidential, no resistance toward the quality of care on both ends, and infrastructure to be added at a large scale to create better digital data management [23].

Not only did the pandemic disrupt rehabilitation for outpatient patients but inpatients also experienced an unavailability of therapists, which stood to be a disaster, although telemedicine saved it to some extent for both the therapist and patients. The initial barriers were overcome and rehabilitation through telemedicine was the tool to save lives and maintain the quality of life. Telemedicine in rehabilitation in Covid-19 was initially used as a research tool, but when required it expanded to clinical practice [24, 25].

The technology of telemedicine has shown to be functional for rehabilitation in the pandemic period and even post that. The synchronous visit is captured in tele-rehabilitation. This reduced the cost of traveling, inability to travel, and time saved from traveling, especially in remote places. Prior to using telemedicine, there is the requirement of the software program behind it and permission to be granted from the government licensing to prevent malpractices as telemedicine is a part of public health in a few developed countries and yet to be a part in a few. The connect ability and association of telemedicine over the landline telephone is to prevent malpractices by leaking of the confidential personal information. The next step oriented with tele-rehabilitation for conducting a visit is where the staff makes the medical professional understand the software prior to connecting with the patient. Assessment is done on the virtual purpose with the help of the virtual applications allowing a few to many parameters to be assessed, as many are still under research for the assessment. As a part of the delivery, the protocols are suggested and explained to the patient and their family depending on the patient orientation. Documentation is the primary tool to be utilized in the medical practice to work ethically and in a synchronous manner. Telemedicine provides data documentation many ways, from chief complaint to each assessment group, and manage it in a narrative and descriptive manner to prevent mistakes [26–30].

Mobile Health

The World Health Organization defines mobile health as medical and public health operated by mobile devices. In this decade, people have become dependent on mobile technologies for day-to-day activities, which initiated the innovation of the applications related to health inside your phone that are being added to day by day. Mobile devices are in the hands of most of the population of the developed and developing countries, and because they are essential necessities, the addition and programming of the health applications makes it easier for health professionals to monitor and consult. The interest in and awareness of the applications in the mobile devices are also initiating a step ahead in awareness to health with the help of M-health applications [31–33].

The technology associated with M-health is recent and promotes health and motivates people to monitor their daily activities. Sensors associated devices are linked with applications associated with the mobile device having your health records, where the sensors that are worn on the wrist allow the device to read location, walk, sleep, and anxiety according to your vital signs. These sensors monitor the status of the body. These devices not only provide the data for the medical professional or the follow up but also for understanding and adjusting the lifestyle according to the imbalance that is created such as disturbed cycle, sedentary lifestyle with limited number of activities, poor nutrition, and improper intake of water. These can be a self-rehabilitation tool to keep up to date in private life that is documented and presented graphically to show how much it has been improved [34–36].

In the Covid-19 era, M-health had a triple role such as connecting to citizens, digitally relating health issues, and controlling health with the innovation of applications. Traditionally, M-health during the pandemic had advantages such as promoting a heathy lifestyle, awareness and motivation with active participation with technologies, facilitating the doctor–patient communication without a structured work environment setup such as a clinic, monitoring in the remote areas, and ensuring social distancing is properly followed. With the situation of the pandemic, the potential of mobile devices in the health sector is boosted and new boundaries are approached not only for the health benefits but also for contact tracing during the pandemic; in addition to increased memory and better computing capacity, tethering, photoelectric sensors, barometers and many more [37–40].

The role of M-health in rehabilitation is broad spectrum nowadays because mobile devices are in the hands of every age from child to senior citizen and the pandemic made it a more essential tool of life. Mobile health is promoting rehabilitation by making a more comfortable and easier way to adapt and break the absenteeism of young adults who are prevented from meeting the therapist due to the workload but the accessibility of the medical professional is just a touch away on the phone and the control by the applications make the track record easier to document. The treatment sessions are administered by videoconferencing with the help of mobile applications or defined by the mobile applications according to the body type, gender, physical activity, comorbidities, and so many other assessments differ in applications. After looking at this type of technology, the hospital setup has initiated the personal M-health applications that not only works with the therapist and the patient but also the complete hospital, even with the pharmacy, such that all information regarding health data is incoming and so the data is managed and made easier for the patient and medical professional [41–43].

E-health

The world wide web was introduced in the 1990s and created accessibility of the health care information to reach the public and their illness experiences. There are various sites such as health line and many more. The research conducted on E-health introduced the various experiences and helped to access the health information

online. There are various sites that support true health consultancy. Simply E-health is the platform for the digital information and communication to be improved and rechecked in health care [44]. During the Covid-19 pandemic, covid-related information was the most explored topic on the electronic platforms, where both true and false statements were presented. Guidelines were provided by the World Health Organization, national and international governments, but on the same link there were also a few fake health care facts that were providing no use treatments. The government and WHO came together to overcome this using E-health and used the platforms such as Facebook, Twitter, Instagram, and YouTube to provide the evidence-based information and increase the E-health literacy rate and for public health measures [45, 46].

E-health in rehabilitation is the knowledge tool used to notify about the disease or condition. E-rehabilitation came to be more common in new patients due to the inability to visit the place for treatment or small difficulties that can be understood and classified by the electronic health and can be discussed with the rehabilitation specialist with the help of the applications provided with mobile health.

E-health can obtain relevant information with the help of E-referral following the assessments, case study, history, and E-diagnosis and establishing the digital information and documenting the pathology. The therapist can easily draft all the information data management and ensure the quality of care, where the E-discharge summaries contain relevant and necessary information and are created quickly. The pros of E-health for rehabilitation specialists is the feedback system is quick and proper according to the session [47–49].

Algorithmic Medicine

Algorithmic medicine involves the increased capacity for storing, sharing, and producing in the era of big data. These algorithms have the capacity to filter and process data. This is the broader area of work aims of medical informatics and decision making, which are creating decision areas of test, assessment, diagnosis, and automatic control [50, 51]. Artificial intelligence plays a role where the neural network created artificially supports clinical decisions and creates the structure and user interface. Errors can be minimized by utilizing an automated algorithm and having the potential to reduce the errors and better score outcomes [52, 53] These algorithms create robotic, virtual, and smart rehabilitation using technology to support clinical decisions and adhere to the evidence-based guidelines. This provides a large aspect for rehabilitation. In various types of devices, using machine learning and sensors creates the environment where the digital computers transfer the current data the patient is carrying without being informed by the patient and assessment and digital diagnosis is taken even at the patient's home. This smart technology with artificial intelligence has moved from just consultation to robotic technology that can conduct robotic surgery even when the specialist surgeon is not with the patient at the hospital [54, 55]. During the pandemic, artificial intelligence with an algorithm interface introduced ease in the ongoing and planned surgeries, ongoing

rehabilitation as the interface for the robots or the devices that are inserted in the patient's body, or even the placement over the patient's body depending on the extent of the dependability, can be controlled by the medical professional during the session [56–58]. The algorithm interface is not yet found in the remote areas or even the underdeveloped countries because this interface is very expensive and so this protocol will take a few more years to enter into public health. The challenges so far are being answered with results, but overcoming the challenge to decrease the cost will create the availability for the medical algorithm to be utilized by more countries. This interface is not only to help patients or even the public be aware but also to help the medical professional to understand the significance behind the rehabilitation [59].

Technology such as the robots in rehabilitation, including MIT Manus, mirror image movement enabler, arm assisted rehabilitation measurement, machine learning in the rehabilitation have been mentioned in the research and the medical algorithms for the classification, prediction, and treatment planning. These devices not only have a role to play in the rehabilitation but also the classifier to predict the activity and potential of the patient [60, 61].

Digital Patient Management

Technology improvement stands to be the successful support in assessing and treating patients. The treatment is incomplete if the generation of the data supporting the management and occurrence, improvement, new techniques, and many more things are not analyzed. The role of data patient management is vital and required whether in the private sector or public health sector. It was never thought that this coronavirus would lead to a pandemic as stated in earlier statements, but when we look to the national and international data of patients, it makes us understand how disastrous it has been and will continue to be [62–64].

The digital mode of data management supported and created a lot of technology to resolve the disaster. The extent of this disaster was more easily tracked digitally with the information made public, and made it easy to document by downloading one application on the phone that made us aware of how many people were covid positive in our limited range of meters to kilometers, registering one's number, and becoming covid positive automatically generates the data to the public health sector to be aware of that region and create the zones [65].

Numbers prioritize the criteria defining what is urgent; as the number rose, it set the criteria of whom to admit, depending on how many ICU beds, oxygen beds, or home quarantine facilities are available. The registration of vaccine throughout the world was and still is a challenge, and the patient management supports how many jabs, the ratio, and when the vaccination will be completed according to the population and production of vaccination. This triage of digital patient management was the key to understanding [66–68].

The digital health transformation stood to be greatest in developing and implementing new ideology of care. Digital approaches emerged as a shield for

vulnerable patients by creating safety for the staff or patients coming to hospital. For example, software varies from country to country such as EMIS (Egton Medical information systems) in the UK, which keeps the records from primary care, including everything the patient carried, and so on [69].

NHS trusts are rushing to create this kind of setup as soon as possible for the remote areas as much as possible so the patient can be managed according to digital data such as digital methods of rehabilitation. Digital patient management is much needed but it was limited in public health. However, the pandemic led to the understanding of a limited number of working people so the technology can help manage data accurately and provide the data for the extent of how it will proceed such as new variants beginning in different areas, saturation presented by the numbers, ratio of lives saved, death and vaccinated people, the data created awareness of precautions to be followed and motivation by looking for improvement and a sense of winning over the disaster [70, 71].

Discussion

The Covid-19 pandemic made many ongoing research studies a part of clinical practice. Digitalization already existed but had not entered daily practice in the health care sector until it was introduced in clinical practice through a digital platform. The previous challenges and questions were put aside because of the disaster situation and the opportunity was presented to put trust and investment in the digital sector. This digital health care eased the management in patient care with full quality of care. This pandemic made us realize the digital platforms were not only made for office, education, and work but also the health care systems [72–74].

The pandemic created the fear of when and how to access the hospital sector whether with or without covid. However, the emergency was not completely turned off by the digitalization in health care, but ease was created to some extent, especially for non-covid patients [75]. Rehabilitation is the tool to heal completely and a first step to a solution for the discomfort converting to inability to illness, where the rehabilitation was carried out as a team collectively, including doctor, therapist, nurses, and other medical professionals completing the rehabilitation team [76]. The emergency of the disaster disturbed the management cycle created by them in the normal medical profession [77]. The pandemic exposed the limitation of the medical professionals and unlimited patients suffering with covid, non-covid and post covid, where all of them wanted equal attention and rehabilitation. Rehabilitation during the pandemic is a priority not only in the interface of the doctor to the patient but also all the other medical professional requirements [78, 79]. The studies mentioned different measures of the digital health structure, including telemedicine as the rehabilitation tool used, which followed the traditional digital platform followed from years earlier too, and E health as the measure for the awareness tool as the pandemic increased the valuation of life and comorbidities, and the effects of lockdown added the awareness to be careful toward the self and family health [80, 81].

Mobile technology was introduced to daily life years ago as the tool for communication, but the smart phones added the applications, and as the pandemic disoriented the life structure, people became more dependent on the digital devices to survive as an essential aspect [82]. Therefore, this essential aspect can also be used as a health tool creating the accessibility to a healthy life whether ill or just improvement of lifestyle to prevent disorders and a sedentary lifestyle, which have increased a lot during this period apart from Covid-19; rehabilitation awareness helps a person to prevent becoming a patient with the accessibility of the rehabilitation specialist at one touch. The sessions oriented with the mobile phones acted as the structure for the M-health technology and allowed medical professional handheld accessibility without the excuse of unavailability, as this tool was the most bought and appreciated during the pandemic [41, 83].

Algorithmic medicine is the proposal for smart rehabilitation where the rehabilitation is not stuck to the applications but beyond the thought of understanding the digital aspect in health care. According to the studies, these type of intelligent robots play a vital role in improvement of the patient, where return to life is faster. The role of robots and high-end technology is required, but due to the cost of the technology, it is still under research to be accessible to developing and underdeveloped countries. The research is turning into clinical practice in certain countries for this type of rehabilitation. Results oriented with this type of technology are quite promising [84, 85]. There has been an evolution from rehabilitation to digital rehabilitation; according to a study by Jones in 2020, the transformation of medical rehabilitation is evident. Although the benefits of rehabilitation are well established, inefficiencies in the current system of care are also clearly documented. These inefficiencies are influenced by the growing demand for services, continued changes in reimbursement to contain cost, pivoting service delivery models, and increasing provider shortages. Today's priorities in medical rehabilitation are containing costs, improving access, and increasing the amount of time spent on actual rehabilitation. It has been suggested that the transformation toward the greater use of digital health technologies will lead to better outcomes, greater value in care, better patient experiences, and more empowered rehabilitation stakeholders [4, 86, 87]. One of the biggest advantages of digital health care in rehabilitation has been its ability to bring quality care to more people who need it. Add to this the fact that online searches for queries like "physiotherapy," "physical therapy," "back pain exercises," etc., are over 4 million per month. Regarding continuity of care, most patients and providers understand that physical therapy is not restricted to the session at the doctor's clinic. Using digital health, this care can be extended from the clinic to the patient's home. Tools such as tele-rehab or using telehealth for physical rehabilitation allows providers to guide and support their patients to recovery [5, 88]. Rehabilitation requires trust, where the patient is first trusting the software to be opened and then the medical professional doing the consulting because, generally, the medical professional is different on the digital platform [89]. The consultation is not the only part of the health sector to be thought of, where all the management takes place from appointment, visit, billing, session, feedback and reappointment, and so on, depending on the extent of the health sector. This management is carried out by the professionals

handling the digital sector and work to be licensed oriented, even in personal practice or public health, as medical data has major importance in the health sector, so the documentation needs to be managed in a similar manner [90, 91]. Data management is not the only task but the patient too, as there are many patients that require rehabilitation management. The introduction of the technology in the health sector did not remove the toughness and emergency mode of the pandemic, but increasing trust in the digital sector is reducing the stress of being surprised by the disaster, as the management is improving in the current situation and varying from country to country, including in their remote areas [92, 93].

Some of the barriers to digital rehabilitation are because health professionals sometimes feel threatened by new technologies. However, the digital transformation should be seen as a tool to complement the professional's service and not as a replacement, as well as helping them to optimize their time. According to Mapfre, only 3 out of 10 public hospitals are adapted to digital transformation while 6 out of 10 private hospitals have a digital transformation plan. At present, only 1% of health expenditure in the autonomous communities is allocated to new technologies and, in order to achieve the necessary standard, health business models should be restructured, and innovation should be a priority. Each technological advance leads to research and development work. This can sometimes be costly, and there is not always a willingness to pay, both on the part of public administrations and on the part of patients [94–96].

Conclusion

This chapter included the aspects of the pandemic on rehabilitation and how the evolution of digital rehabilitation can act as the tool to continue the rehabilitation. Various research studies have been oriented toward efficacy of digital rehabilitation, which has proven to be safe, and the trust aspect, where the studies indicated significant improvement and overcoming the challenges, with many barriers overcome and some needing further attention.

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