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THE RAPID EVOLUTION OF TELEMEDICINE: A LITERATURE REVIEW ANALYSIS

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Abstract

Telemedicine, in the field of healthcare, is not a recent technology innovation. In fact, it has been in existence for the last 20 years, but it was recently introduced to both health care professionals and those seeking healthcare. On March 2020, when the COVID-19 virus was declared as a pandemic, telemedicine services received widespread attention. The pandemic in fact created a solid base for telemedicine and today it is one of the prominent services offered by hospitals and health care centers worldwide. This paper focuses on how collaboration between telemedicine, Point of Care Testing (POCT) and mobile health units can reduce the spread of the virus among both patients and healthcare providers by providing healthcare of the highest quality. The methodology includes reviews of different opinions of authors based on their experiences obtained during the pandemic situation and review of literatures and relevant articles of recent years related to the activities and shortcomings of telemedicine. Awareness, infrastructure, utilization, POCT devices, internet connectivity, and Health Information Management Systems (HIMS) are some of the scope and gaps observed during the literature reviews. Telemedicine services is of prime importance during this on-going pandemic and its intensity by combining with artificial intelligence is essential in this hour of need.

Keywords: Covid -19, Pandemic, Point of Care Testing, Healthcare

INTRODUCTION

Due to the emergence of the COVID-19 pandemic, the use of telemedicine services has become more prevalent. Before the outbreak, health systems worldwide were working to prevent the spread of non-communicable diseases. The establishment of policies and procedures aimed at preventing the spread of non-communicable diseases such as diabetes and cardiovascular diseases have become more important **[1]**. The question that arises is whether the use of telemedicine services has been neglected in the fight against non-communicable diseases. However, this is not the case as the use of these services has been highly supported during the pandemic. The concept of providing healthcare for all has become very important to many nations. They are striving to provide the best possible healthcare to their citizens. Due to the complexity of the situation caused by the pandemic, it has become a daunting task for health care facilities to maintain their services. Due to the nature of the COVID-19 virus, which can constantly mutate, it has been known that variants can still spread new infections. The use of telemedicine services has become more important as the pandemic has made it difficult for

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health care facilities to maintain their services. This article aims to explain the importance of increasing the scope of telemedicine services and how they can be utilized by healthcare providers. It also explores the various initiatives that can be taken to improve the availability of telemedicine services at various levels of healthcare.

MATERIALS AND METHODS

The objective of the study was to conduct an exhaustive literature review in order to identify the various shortcomings and activities of telemedicine. The article aims to provide an overview of the various perspectives of the authors on the current pandemic situation. Literature that was used for the study was searched using terms such as COVID-19 and telemedicine. Articles related to the current scenario of telemedicine in developing nations were also included in the study.

What we have and what we need:

At present, telemedicine services have become popular in developing countries such as India and people living in the urban areas have become aware of this service **[2]**. A majority of government and private health care organizations are currently offering telemedicine consultations **[3–5]**. Free video apps such as Facebook, Skype, and Google+ are becoming more prevalent. Some of these provide end-to-end encryptions that are designed to prevent unauthorized access. There are also telemedicine applications available on google play store and apple store which cater to only telemedicine services such as PRACTO, Lybrate, Mfine, Tata Health, and Doctor 24X7 to name a few.

These applications are quite similar to video consultation apps like WhatsApp and Facebook, but these applications help in improving the patient's experiences, providing end to end digital medical service, have an integrated online payment system and secures patients confidential information **[6, 7]**. Private hospitals such as Apollo have come out with their own specialized telemedicine software applications which are sophisticated and built to ensure the confidentiality and privacy of patient's information, but the software is expensive to install, and patients may end up paying hefty fees for consultation. Government managed chain of primary health centers (PHC's) are the sole provider of health care services in villages and rural areas.

In rural areas, patients may not have the proper awareness about the various services that are available through telemedicine. This is why it is important that they are educated about the various aspects of the practice. The lack of proper planning and training regarding the various aspects of telemedicine is a major challenge that healthcare organizations in rural areas face. At present healthcare providers with the help of telemedicine services manage to provide various consultation services such as follow up for NCD's, all forms of psychiatric counselling, physiotherapy exercises, and food and diet advice from nutritionists, etc **[2,5,7-10]**.

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It is very difficult to effectively manage diseases through the use of telemedicine services. This can be done through the use of various investigations such as blood tests and drug monitoring. These are usually performed for initial patient evaluation and follow-up visits. In most cases, asymptomatic investigations are performed. These include blood tests, echocardiography, and electrocardiography **[11, 12]**.

There are various types of In Vitro Diagnostics (IVD) products available in the market that are FDA approved and can be used for testing various conditions, such as glucose. These products are easy to use and can be kept at home. Most of the manufacturers of point-of-care testing (POCT) products have videos on YouTube that explain their products **[2, 11-13]**. Though these equipments incur more expenses initially, but over time, this would save time and would work out cheaper and result in monetary savings in visiting hospitals. Similarly, there are various FDA approved ECG monitors which can send the results to a physician's mobile phone or personal computer **[20]**.

Online retailers such as Amazon have started renting out medical equipment such as monitors and holsters which seems to be a favorable initiative. The scope of the renting services will be widened to include the use of point-of-care testing (POCT) devices such as the i-STAT Alinity. In cases of complicated examinations, such as those involving blood tests, telemedicine services will be integrated with mobile health units **[14–19]**. Various scientific organizations have issued guidelines for the use of point-of-care testing in mobile health units. The guidelines and policies governing the use of point-of-care testing in mobile health units must be followed in order to ensure that they are in line with the needs of developing nations **[21 – 24]**.

Technology Based Strategies:

To be regarded as a justifiable solution, telemedicine services require strong technological support. As the name suggests telemedicine requires an internet enabled communication device. Developing countries should start investing in improving their communication infrastructure in order to prevent another pandemic like COVID-19 **[25]**. In order to maintain a resilient and secure communication infrastructure, developing countries should ensure that all their PHCs have internet connectivity regardless of their geographical location. This should be started immediately in order to prevent another pandemic like COVID-19 from happening in the future.

A unified (HIMS) should be developed for every nation consisting of large databases for storing the entire populations health records. The records of each individual can be linked to their Aadhar card number or to their respective health insurance policy number. Protocols and policies must be clearly established to access the collected and stored health records by a registered practicing physician registered with a governing medical council belonging to either a private or public healthcare organization. Patients' confidentiality and information security must be maintained through safe authentication procedures as shown.

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The next big thing in drone technology is mass production. This will require establishing sufficient control rooms to monitor the drone traffic. The drones should be dispatched for a speedy delivery of prescription medications to patients and for pickup of patient samples such as urine and blood samples packed in suitable storage containers **[26]**. Face recognition and biometric data or QR code-based software must be installed for identifying the patients before making drone-based deliveries and pickups. To meet the increasing demand of telemedicine, virtual software technology has been significantly improved and updated to provide quality medical opinions to outpatient departments even at distant locations during COVID-19 pandemic. A short literature survey explaining the advantages and disadvantages of the many aspects of telemedicine undergone in various countries like Africa, Australia, China, India, Norway, and USA are shown in the Table – 1 **[27-42]**.

Table 1: Literature reviews of the earlier studies related to telemedicine adaptation

Sl. no	Author & year	Conclusion/Remarks
1.	Hong Z, et al (2020)	Through this article, the author explained how 5G network can be used to improve the efficiency of Western China's remote medical facilities.
2	Bokolo A J (2010)	Factors such as the availability of virtual software platforms, data privacy, and training workforce integration are some of the factors that have influenced the adoption of telemedicine.
3	Jnr B A (2020)	The authors of this book have presented a practical guide on how to use virtual care during the pandemic. Aside from the usual issues, such as lack of funds and inadequate equipment, the authors also highlighted the various gaps in the system.
4	Mouchtouri's, Nikolaos et al (2020)	This study describes the various ways that telemedicine can be utilized in the field of surgery to improve the efficiency of surgery.
5	Mishra S K et al (2009)	They have also mentioned the various training programs that are available for students in the area of telemedicine.
6	Yadav S K et al (2021)	The authors of this study focused on the use of tele-education in surgery in India. They suggested that this could be incorporated into the curriculum of medical education.
7	Rakesh Datta, et al (2021)	The authors analyzed the guidelines for the use of telemedicine in India in 2020 and identified the need for education and training regarding the provisions and skills needed to avoid medico-legal issues.
8	Nidhi Kaeley, et al (2021)	The authors have focused on the need for effective collaborations between healthcare facilities to deliver telemedicine services in remote and hilly areas.
9	Carlo Drago, et al (2021)	The authors present a set of semantic cores that represent the various outcomes of telemedicine. These cores will help in the analysis of the literature and in the implementation of policies related to the field.
10	Kori S. Zachrison, et al (2021)	The authors analyzed the various aspects of telemedicine, including its use in emergency situations and the payment policies from various financial institutions. They also talked about the various components of the field, such as ease of interstate credentialing.
11	Paul Adepoju (2020)	This article focuses on the increasing use of telemedicine in most African nations during the pandemic.

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12	Michael L Barnett, et al (2019)	The concept of telemedicine was suggested as a way to improve the efficiency of healthcare by allowing patients to access medical facilities from a distance.
13	Jake Luo, et al (2021) **et al (2021)**	The study focused on the factors that influence the adoption of telemedicine in Wisconsin. It identified various reasons for this phenomenon, such as race and education level.
14	Sonu Bhaskar, et al (2020)	The authors highlighted the lack of infrastructure and regulations in India as the main factors that hindered the use of telemedicine in the country. They also noted the potential of the technology in improving the health systems.
15	Bonnie Kaplan (2020)	The author provides an in-depth analysis of the various ethical and legal issues involved in the utilization of telemedicine in the US. He also addresses the need for an effective informatics infrastructure and cyber security.
16	Clayton Davis, et al (2020)	A study was conducted in Virginia, USA, to determine the use of telemedicine by patients. The study revealed that around 82% of the individuals surveyed used telemedicine to get medical attention during the flu season.

CONCLUSION

For a telemedicine practice to be successful, it is essential that combinations of technology and medical science is included. Aside from technology, education, and awareness about the benefits of telemedicine are also important factors that can help improve the practice. Inclusion of technology in the curriculum of medical and allied medical schools is also important. Due to increasing number of patients and need for healthcare workers in urban areas, many developing countries are relocating their healthcare workers to urban areas. These re-locations are also beneficial for rural communities as they allow them to receive better healthcare services. Unfortunately, many primary healthcare facilities do not have necessary equipment and facilities to accommodate telemedicine. This can be solved by having internet-enabled conferencing rooms in the facilities. Due to increasing technological advancements in biomedical sciences, it is expected that telemedicine will eventually become a field of medical science. Today, it is very important that all parties involved in development of new technologies collaborate to improve the existing telemedicine practices.

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