Challenges and opportunities of using telemedicine during COVID-19 epidemic: A systematic review

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Abstract

Introduction: Covid-19 pandemic is spreading rapidly around the world. Given the high risk of transmission of the disease in order to curb the effects of the epidemic, governments and health care organizations must maximize the capacity of medical care, protective equipment and preventive measures. Therefore, in this study, the challenges and recommendations for the use and development of telemedicine technologies during the Covid-19 epidemic were examined.

Material and Methods: A systematic review of English-language studies was conducted by searching for keywords in the authoritative scientific databases. Studies related to the challenges and recommendations of telemedicine at the time of the Covid-19 epidemic were considered as inclusion criteria. Titles and abstracts were screened independently based on eligibility criteria. Complete texts were then retrieved and screened independently based on eligibility criteria. The checklist was used to extract data such as study title, first author name, year of publication, country, challenges and telemedicine recommendations during the Covid-19 epidemic.

Results: In this study, the existing challenges and recommendations for the use and development of telemedicine technologies were examined. Challenges studied in the studies were included three categories of human, managerial and technical challenges. Human factors, management factors and technical factors

Conclusion: The results showed that today human and managerial challenges play a more fundamental and important role than technical challenges. In addition, Covid-19 emergencies are effective in addressing telemedicine challenges, and efforts are underway to expand telemedicine more rapidly as a response to managing and controlling the outbreak of Covid-19 epidemics.

INTRODUCTION

Covid-19 pandemic was first reported on December 31, 2019; then, on January 30, 2020, the WHO declared it a public health emergency related to international concerns [1]. Corona virus is a single-stranded RNA virus. The virus can be immediately translated by its RNA messengers and incorporated into the host cell. After rapid proliferation, it infects the individual inside the cell [2].
requires extensive care services and the provision of resources and equipment, which has created a great challenge for all countries [4]. Among these, one of the most important innovative strategies for controlling epidemic control is remote social measures, and the most important one in crisis situations is telemedicine [5].

In addition to all the challenges, the outbreak of coronavirus is a new opportunity for countries to adopt and use telemedicine. However, the ultimate solution to controlling the outbreak of Covid-19 would be to use multidimensional solutions. But one of the most important solutions is telemedicine [6]. Telemedicine leads to maximum efficiency of health services in health care systems [7]. Although before the epidemic, telemedicine existed and its effectiveness was proven, but still faced many challenges and obstacles. With the advent of the Covid-19 epidemic, despite all the challenges, telemedicine has evolved and become more widely accepted [6]. In addition, telemedicine has provided fair, cost-effective and safe services for patients and health care providers during an epidemic [8]. As a result, the development and use of telemedicine has increased rapidly during the Covid-19 epidemic. At present, telemedicine has led to a decrease in face-to-face visits to outpatient and inpatient medical services [9], but there are still challenges in the development of telemedicine that need to be addressed [6]. A systematic review of the challenges and recommendations in the use and development of telemedicine was conducted as a guide for its implementation and use.

MATERIAL AND METHODS

This study was conducted on the basis of a systematic review of previous evidence and similar studies to provide an answer to the research question (What are the challenges and recommendations for the use and development of telemedicine during the Covid-19 epidemic?). Therefore, a systematic review of studies, by searching for related keywords in three categories of words related to Covid-19, telemedicine and challenges and recommendations in the title, abstract and keywords of studies in the authoritative scientific databases Embase, Web of Science, Scopus and PubMed was launched on November 24, 2021. The keywords searched are as follows:

2. "Telemedicine", "Telehabilitation", "telehealth", "Mobile Health", "eHealth", "mHealth"
3. "Barrier", "obstacles", "challenges", "Opportunities"

Table 1 shows the search strategy performed by each database.

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on the three main terms of telemedicine, Covid-19 and challenges or opportunities, articles published in reputable scientific journals, access to the full text of articles and studies that, based on title and content, provide a possible answer to the question. They had research. Exclusion criteria included articles published before 12/29/2019, full-text abstracts, the absence of one of the keywords in the title or text of the articles, and studies that did not provide any scientific, theoretical, laboratory, or statistical evidence.

RESULTS

Telemedicine can be effective by minimizing direct exposure to Covid-19 epidemics and rapid access to health care [10, 11]. However, there are obstacles and challenges that hinder the rapid advancement of telemedicine services.

In general, the main challenges of using and developing telemedicine studied in the studies include three categories of human, managerial and technical challenges (Table 2).

Each of Challenges and telemedicine recommendations are as follows:

Human challenges

Human challenges include user age (5, 15%), inadequate training (4, 12%), informed satisfaction (4, 12%), privacy and data security (12, 35%).

Age of users

In 5 cases (15%) of the studies, the effect of users’ age on the use of telemedicine was mentioned. Older patients, although accepting health care services, use significantly less telemedicine [3, 4]. Elderly patients are usually less educated and therefore need training on how to connect to telemedicine. However, the most users of telemedicine technologies were relatively young people between the ages of 20 and 44 [9]. Therefore, attracting young family members at the beginning of telemedicine implementation, especially in the case of video conferencing, can be helpful [4]. Education through social media and other inclusive operating systems is also recommended to increase the awareness of the elderly [12]. Recent research shows that an appropriate type of telemedicine technology for the elderly has been effective in health management [13].

Insufficient training

In 4 cases (12%) of the studies, the effective role of education in the use of telemedicine technology was investigated. Although studies have shown that patients tend to use telemedicine, due to its complexity and incompetence, patients lead to resistance in use and reduce their interest in technological changes [14]. The provision of education to health care providers and patients is of particular importance [13]. In addition, achieving this requires that health systems, hospitals, employers and the media work to address this shortage [15]. Therefore, in order to increase people's awareness of the benefits of telemedicine, face-to-face training, training booklets and step-by-step instructions play an essential role in how to implement and understand how telemedicine technology works [11].

Informed consent

In 4 cases (12%) of the studies, the effective role of informed consent in telemedicine services was mentioned. Patient satisfaction is very important in accepting and using telemedicine technologies. Therefore, in order to obtain their consent, they should be informed of the possible risks that may occur during the use and sharing of data during a telemedicine session. On the other hand, the laws regarding consent to the use of telemedicine vary from country to country. Some countries require the need for informed written consent and compliance with the General Data Protection Regulation (GDPR), and some countries are content with verbal consent. Therefore, the physician should check the patient’s consent according to the laws of his country [16-19].

Privacy and data security

In 12 cases (35%) of the studied studies, the essential role of privacy and confidentiality in the success of telemedicine was mentioned. Privacy and ensuring the protection of patients' personal data is one of the most important factors of public trust and medical success through is far away [8]. Telemedicine technology services require the collection and use of sensitive medical personal information between
physician and patient [20]. Patients will not be inclined to use telemedicine technology if they do not have confidence and understanding of privacy policies. For successful use of telemedicine, privacy issues and policies for accessing patient security data must be addressed.

The use of personal data in critical situations, considering the public interest, does not require patient consent and can be flexible [32]. However, telemedicine must address concerns about access protection and privacy and ensure that the benefits of telemedicine outweigh the risks by complying with standards and regulations [5]. The data reviewed in the studies were as follows:

Technical controls such as data encryption, use of authentication device, face-to-face authentication of patients, and application of HIPPA (Transportation and Health Insurance Act) rules compatible with telemedicine technology can be used [31]. In addition, a password can be set for each telemedicine session to be used only for the patient and the physician [33]. Also, to ensure the patient's privacy, telemedicine sessions should be held in a private, privately-owned space [34].

But another concern here was cybersecurity, which, if used online video conferencing, could jeopardize the patient's sensitive information and expose telemedicine to cybercrime [4, 27]. Other issues that put health information at risk include delays in security updates, use of public networks, and insecure connections [10]. In order to prevent the risk of cyber-attack, in addition to HIPPA regulations, encryption of patient sensitive information should be stored in a secure database [16, 24].

### Management challenges

Management challenges include failure to regulate the legal framework (3%, 9%), health insurance and repayments (9, 26%), access to sufficient budget (3, 9%), coordination in licensing conditions (4, 12%), selection is the clinical leader (2, 6%), team building (2, 6%) and access to electronic medical records infrastructure (1, 3%).

#### Existing electronic medical records infrastructure

In one case (3%) of the studies, the existence of an audio-visual operating system (EHR) or EMR was mentioned as the main element of telemedicine infrastructure. Access to electronic medical record systems or electronic health records is the basic element of telemedicine infrastructure. However, if this portal or similar portal is not available, the use of audio-visual operating systems is necessary for replacement [4].

#### Licensing conditions

In four cases (12%) of the studies, licensing conditions were mentioned as one of the main barriers to telemedicine. These conditions usually indicate that the physician or service provider must be licensed at the location where they are located [23, 24]. Although it is important to consider this, in emergencies the government should use the necessary coordination to minimize geographical constraints to expedite telemedicine as a way to control the epidemic [14, 16].

#### Issues related to reimbursements and health insurance

In 9 cases (26%) of the studies, limited repayment and lack of telemedicine insurance were introduced as one of the main barriers to telemedicine admission. Most health insurance companies had

| Table 2: Challenges and telemedicine recommendations during the Covid-19 epidemic |
|-----------------------------|-----------------------------|-----------------------------|
| Ref | kind | Ref | kind | Ref | kind |
| [12, 25] | Create a team |
| [12, 28] | Selecting a clinical leader |
| [15, 35] | Budget availability |
limited repayment and no investment in telemedicine. But the advent of the Covid-19 pandemic revolutionized telemedicine rapidly, with US insurance policies supporting geographical restrictions on repayment by expanding their coverage in response to the epidemic [4, 16, 23, 24, 29, 30].

Lack of legal framework
In three cases (9%) of the studied studies, the lack of a complete legal framework in the use of telemedicine was introduced as one of the obstacles to the development of telemedicine [15]. Governments should provide the necessary financial assistance and support to support telemedicine as an effective tool in controlling and reducing the rate of the Covid-19 epidemic by establishing the necessary laws and regulations [16, 27].

Create a team
In two cases (6%) of the studied studies, it was pointed out that the effective establishment of telemedicine requires the coordinated efforts of a development team of people in different fields in hospitals and health systems [12, 25].

Selecting a clinical leader
In two cases (6%) of the studied studies, it was mentioned that the identification and application of one or more clinical leaders is necessary to facilitate the implementation of telemedicine technology [28]. Clinical leaders liaise with the development team to identify optimal remote care models. Regular communication between the clinical leader and the team increases telemedicine acceptance [12].

Budget availability
In three (9%) of the studies, budgeting and reimbursement was identified as a major barrier to the implementation of telemedicine technology [35]. Providers and patients [36] deploying telemedicine technology is a time-consuming process, and its public organization requires investment support [15].

Technical challenges
Technical challenges include reduced access to IT infrastructure (6, 18%), quality bandwidth (6, 18%). Is as follows:

Lack of access to information technology infrastructure
In six cases (18%) of the studied studies, lack of access to information technology infrastructure was mentioned as one of the telemedicine challenges. The high cost of Internet access, lack of access to information technology infrastructure and lack of technology resources are one of the main problems for acceptance. Telemedicine technology is evolving in some countries [10, 14]. Lack of equal access to telecommunications facilities for the general public is another obstacle to telemedicine admission [8]. However, some studies have shown that most patients already have access to the required hardware, including desktops, laptops, cell phones, and telephones. They are smart or old computers and have partially removed the initial obstacles to the implementation of information technology [4, 21] but technical concerns should still be considered as part of the implementation challenges [22].

Access to quality bandwidth or WiFi
In 6 cases (18%) of the reviewed articles, the effect of quality bandwidth on telemedicine reception was mentioned as one of the components of success. The effectiveness of telemedicine depends on the quality of video, audio and video data as well as integrated data connection [25]. To achieve this, sufficient bandwidth and secure connection are critical [4, 26-28]. In the study of Gillespie et al., It was mentioned that cooperation with telemedicine service providers for the development of safe, accessible bandwidth medical technology will improve technical issues [31].

Other telemedicine challenges and opportunities
Other barriers included lack of performance appraisal or lack of access to an accurate monitoring system and a lack of understanding and reliability of users, leading to a lack of participation and reluctance to use telemedicine effectively [23]. The distance achieved can be referred to the effect on medical education. During the Covid-19 epidemic, the main focus of health and academia systems is on patient care as it replaces clinical education. This negative impact of the Covid-19 epidemic on medical education is quite evident [37] but despite the distance medical systems, medical centers will be able to provide training for trainees in low-risk environments and meet their commitments to continuing trainee education [28].

DISCUSSION
Telemedicine has emerged as a key technology in facilitating health care delivery and reducing the prevalence of Covid-19 among patients and health care providers [26]. The aim of this study was to investigate the challenges and recommendations for the use and development of telemedicine technology during the Covid-19 epidemic.

Findings of this study: Challenges and recommendations to improve the use and development of telemedicine, respectively, of the
greatest impact, including privacy and security, health insurance and reimbursements, inadequate education, age of users, lack of access to information technology infrastructure, access to quality bandwidth. Conscious consent, licensing conditions, budget access, team building, lack of legal framework, clinical leader selection, and electronic medical records infrastructure. Although there are many challenges and obstacles in the development and implementation of telemedicine, many of these barriers were addressed; however, due to the Covid-19 emergency situation, efforts are being made to remove these obstacles.

In line with the results of this study, Smith et al. provided a comprehensive guide to how telemedicine integrates rapidly during an epidemic that, by developing a toolkit, provided eight key components to the successful implementation of a telemedicine platform. The results of this study showed that the effective and efficient integration of a telemedicine program requires extensive training of health care providers and patients, accessory platform to facilitate audio and video communication and approval of billing codes contained in this tool [4].

Blandford et al., in their study "Opportunities and Challenges for Remote Health Within and Beyond an Epidemic," concluded that the pressures for adopting remote health solutions to support self-management are largely the emergence of the Covid-19 pandemic is on the rise [38].

Also, the results of a study by Mahajan et al. On the use of telemedicine during the Covid-19 epidemic showed that the training of medical professionals, the development of clear guidelines and the existence of good quality Internet service systems increase the acceptance of telemedicine in the Indian population. It has been very helpful [8].

The study by Bokolo et al., Which aimed to investigate the possibilities of telemedicine use as an appropriate initiative to reduce the prevalence of Covid-19 pandemic, showed that social, technological and organizational factors affect telemedicine.

Telemedicine also has great capabilities in supporting social distance and quarantine to control the spread of Covid-19 [27].

The limitation of this study was that only studies published in scientific journals were included in this study; therefore, it does not cover articles published in the gray literature.

CONCLUSION

This study examines the challenges and recommendations of telemedicine as an innovative solution to reduce the epidemic of Covid-19, which can be a beacon for the development and implementation of telemedicine technology. The results of systematic review show that today human and managerial challenges play a more fundamental and important role than technical challenges. In addition, Covid-19 emergencies are effective in addressing telemedicine challenges, and efforts are underway to expand telemedicine more rapidly as a response to managing and controlling the prevalence of Covid-19 epidemics. Reducing the risk of transmitting the virus and protecting patients and health care providers from spreading the infection can help.

AUTHOR’S CONTRIBUTION

All authors contributed to the literature review, design, data collection and analysis, drafting the manuscript, read and approved the final manuscript.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this study.

FINANCIAL DISCLOSURE

No financial interests related to the material of this manuscript have been declared.

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