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**SYSTEMATIC REVIEW OF THE EFFICIENCY OF TELEMEDICINE
DURING THE COVID-19 PANDEMIC**

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ABSTRAK

COVID-19 merupakan masalah kesehatan dunia yang menyebabkan terjadinya perubahan besar dalam sistem pelayanan kesehatan. Di masa pandemi COVID-19, diperlukan upaya untuk mengurangi penyebarannya. *Telemedicine*, sebagai teknologi jarak jauh, merupakan salah satu pilihan yang efektif untuk digunakan sebagai sistem pelayanan kesehatan saat ini. Penelitian ini bertujuan untuk mengeksplorasi efisiensi penggunaan *telemedicine* dalam pengendalian COVID-19. Penelitian systematic review ini menggunakan 4 database yaitu **PubMed, ScienceDirect, Proquest, dan Wiley**. Kata kunci yang dipakai adalah "telemedicine" atau "telehealth", atau "e-Health" dan "COVID-19", Kriteria inklusi yang ditetapkan adalah artikel yang membahas penggunaan telemedicine dalam pengendalian COVID-19, terbit tahun 2021 dengan Bahasa Indonesia atau Bahasa Inggris oleh jurnal yang terakreditasi, dan menggunakan metode penelitian observasional, deskriptif, atau *case study*. Dari 1.877 judul artikel yang diidentifikasi, 1.869 dikeluarkan karena tidak mempunyai relevansi dan tidak sesuai faktor inklusi. Total 8 artikel yang dimasukkan dalam analisa penelitian ini. Satu artikel menemukan efektivitas *telemedicine* untuk masyarakat rural yang sulit mengakses pelayanan kesehatan, 6 artikel menemukan telemedicine membantu mengurangi frekuensi kunjungan ke dokter/RS, mengurangi biaya transportasi, mengurangi waktu dan biaya rawat inap, mengurangi beban kerja tenaga Kesehatan, dan mengurangi penularan COVID-19. Satu artikel menuliskan efektivitas telemedicine untuk pasien PPOK dengan COVID-19. Telemedicine sebagai system pelayanan kesehatan merupakan upaya yang cukup menjanjikan di masa pandemi COVID-19 dan memiliki potensi yang besar untuk membantu mengurangi beban biaya kesehatan.

Kata kunci: Efisiensi, telemedicine, COVID-19, Telehealth, systematic review

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ABSTRACT

COVID-19 is a world health problem that has caused significant changes in the health care system. During the COVID-19 pandemic, some efforts are needed to reduce the spread of the. Telemedicine, as a remote technology, is one of the effective options for use in the healthcare system today. This study aims to explore the efficiency of using telemedicine as one of the facilities in the context of controlling COVID-19. This systematic review research uses 4 databases: **PubMed, ScienceDirect, ProQuest, and Wiley**. The keywords used are "telemedicine" or "telehealth," "e-Health," and "COVID-19". The inclusion criteria are the articles that contain telemedicine in the control of COVID-19, published in 2021 in Indonesian or English by accredited journals, and using observational, descriptive, or case research. About 1,877 article titles were identified, and 1,869 were excluded because they were irrelevant and did not match the inclusion factor. A total of 8 articles were included in the analysis of this study. One article found that the effectiveness of telemedicine for rural communities is difficult to access. Six articles found that telemedicine reduces the frequency of visits to doctors/hospitals, reduces transportation costs, reduces hospitalization time and costs, reduces the workload of health workers, and reduces the transmission of COVID-19. One article listed the effectiveness of telemedicine for COPD patients with COVID-19. Telemedicine as a health care system is a promising effort during the COVID-19 pandemic and has excellent potential to help reduce the burden of health costs.

Keywords: Efficient, telemedicine, COVID-19, Telehealth, systematic review



INTRODUCTION

Corona Virus Disease 2019 (COVID-19) is a disease caused by *severe acute respiratory syndrome coronavirus 2* (SARS-CoV-2). The disease first appeared in Wuhan, China, in December 2019 and has spread globally¹. The SARS-CoV-2 virus can infect the human respiratory tract². Patients confirmed with COVID-19 will show symptoms of cough, fever, fatigue, shortness of breath, and muscle pain (myalgia)³.

The SARS-CoV-2 virus can spread rapidly through the patient's contact with a healthy person through the air or droplet⁴. The rapid spread causes losses in terms of human life, especially across sectors, which can complicate human survival (5). There is a rapid spread of COVID-19, so several policies, such as *physical distancing* and self-isolation, are carried out to break the chain of disease transmission⁶. The current COVID-19 pandemic has also made interactions between doctors and patients difficult. These changes enable doctors to adapt to the current situation, one of which is telemedicine as a medium to provide remote health services⁷.

Telemedicine is the use of telecommunications and information technology to support the efficient delivery of remote health services^{8,9}. While Telehealth has a broader definition, it includes telemedicine and tele-educational clinical care for research, disaster planning, and primary health care in distant and geographically poor areas⁸. Telemedicine during a pandemic can decrease the spread of the disease. Telemedicine has benefits such as cost-effectiveness and increasing access to immediate medical care in chronic patients' treatment can be done virtually at home. Telemedicine can also be used as a medium to provide health care information not only for infected patients but also for non-infected people⁹.

METHOD

Search four databases, PubMed, ScienceDirect, ProQuest, and Wiley, to identify relevant articles. For systematic analysis, we used Prisma literature search guidelines^{10,11}. Keywords used include "telemedicine" or "COVID-19" or "telehealth", or "eHealth".

The inclusion criteria in this analysis are as follows: 1) journal articles that discuss the use of telemedicine in the control of COVID-19; 2) articles are limited to journals published in 2021; 3) searches are restricted to journals in English, 4) journal articles with observational research methods of study, descriptive studies, and case studies; and 5) articles published in accredited journals.

RESULTS AND DISCUSSION

Process selection Study aforementioned Done use Diagram flow PRISMA get views in Figure 1.

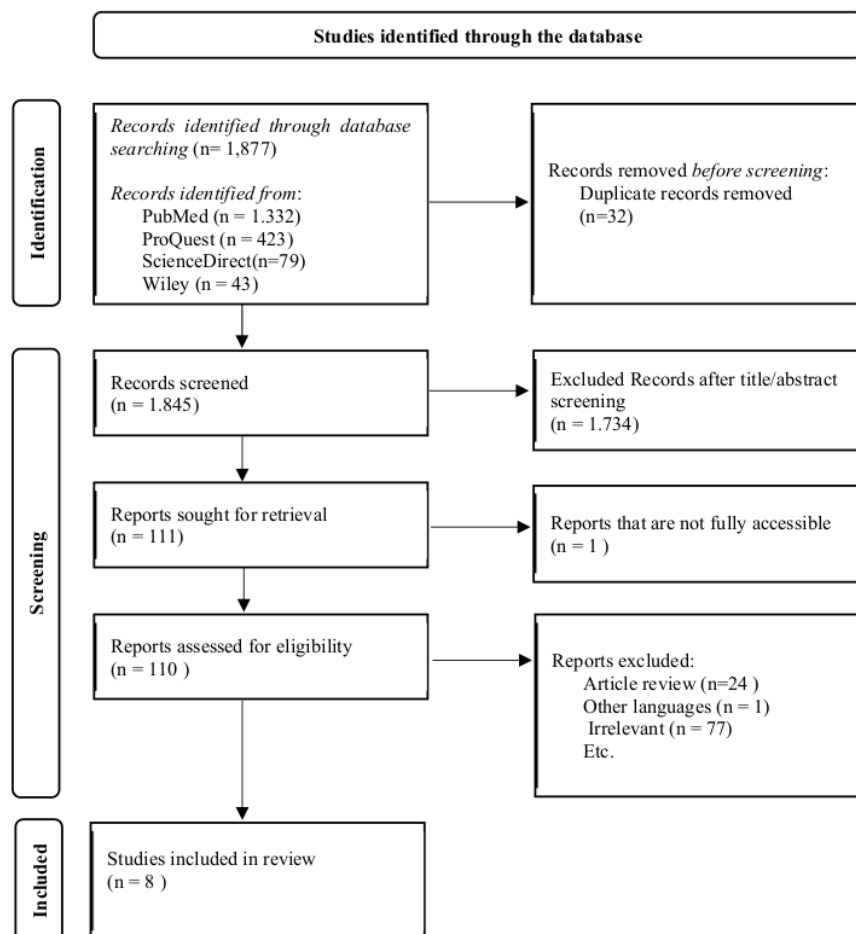


Figure 1. The Selection Process of the Study was Systematically Reviewed Using a Prisma Flow Chart.

The total number of articles obtained is 1,877 based on searches in 4 different databases mentioned above. A total of 32 duplicated articles were deleted before the screening. A total of 1,734 studies were excluded after screening because they were irrelevant to the title or abstract. One study is not fully accessible, so it is not reviewed, so the total study that can be fully accessed and then carried out due diligence is as many as 110. A total of 8 studies were finally included in this systematic review after conducting due diligence and excluding 102 articles.

The characteristics of the study in this systematic review can be seen in Table 1. The studies included in this study were conducted in several different countries, namely Saudi Arabia, Pakistan, Libya, Mexico, India, and the United States, and two studies were conducted in Spain.



Table 1. Characteristics of the Study Included in the Study.

Writer	Country	Research Design	Telemedicine Type	Service	Resulting Effects
¹²	Saudi Arabia	Qualitative (semi-structured interviews) and Quantitative (questionnaire-based surveys)	mHealth and Telehealth (Telemonitoring)	<ul style="list-style-type: none"> - Telehealth is used for the exchange of information. The patient must communicate it to the medical representative. - mHealth is used for information exchange and remote diagnosis via a mobile application 	<ul style="list-style-type: none"> - Survey results show mHealth is rated slightly more effective than Telehealth - Interview results show Telehealth is somewhat more effective than mHealth - mHealth and Telehealth effectively provide remote care for COPD patients infected with COVID-19 at home.
¹³	Spanish	Retrospective Cohort Studies	Telemedicine and Telemonitorization Assistant (TELEA) (Telemonitoring)	The app allows patients to send messages, questionnaires, clinical parameters, or videos to their medical records.	<ul style="list-style-type: none"> - Reduction of hospital load, mortality rate, average, and length of hospitalization,
¹⁴	Pakistan	Cross-sectional retrospective studies	Telemedicine/ tele-triage application through telephone interviews using proforma to provide C-Score (Realtime Telemedicine)	<ul style="list-style-type: none"> - Triage services include patient-doctor interaction in e-health, assessing the symptoms of COVID-19, and selecting patients remotely to determine the patient's condition and the treatment needed. - This telemedicine service is carried out by requesting information related to demographics, Covid-19 symptoms, recent travel contacts, and work that can categorize telemedicine 	<ul style="list-style-type: none"> - Supporting patients by providing triage services, thus preventing many unnecessary hospital visits and helping to protect health professionals during a global pandemic - Can triage patients with COVID-19 symptoms to ease the burden in the emergency department - Limiting the spread of infection by allowing patients to receive medical advice from their respective homes - Telemedicine has great potential to help patient populations in low- and middle-income countries.



Writer	Country	Research Design	Telemedicine Type	Service	Resulting Effects
				users based on risk factors to determine the C-score. - After the C-score results are known, it is followed up by telephone to determine whether telemedicine users need to take a Covid test and whether the symptoms have subsided.	
¹⁵	Libya	Cross-sectional study	<ul style="list-style-type: none"> The doctor-patient interviews through video and audio can provide health care services and promote the welfare of temporary individuals. (Realtime Telemedicine) 	The study explains some consultation services and health care for Covid-19 patients.	<ul style="list-style-type: none"> - Telehealth services can substantially replace in-person consultations and prevent nosocomial infections during the COVID-19 pandemic. - Telehealth services are helping to reduce the workload of doctors and reduce direct contact with patients during the COVID-19 pandemic. - Help address healthcare costs, improve access to immediate medical care and follow-up evaluations and reduce the risk of covid-19 transmission. - Telehealth systems provide an effective means of communication when using healthcare - Users feel comfortable using the telehealth system, can express themselves effectively, are familiar with the telehealth system,



Writer	Country	Research Design	Telemedicine Type	Service	Resulting Effects
					and can easily communicate with doctors through the telehealth system - The efficiency of the telehealth system is similar to face-to-face consultation - Telehealth services offer more flexibility in securing appointments and are more convenient for individuals living away from healthcare facilities, especially cancer patients or individuals with chronic diseases who may have an increased risk of severe COVID-19
¹⁶	Spanish	Retrospective descriptive study	Doctor-patient teleconsultation application by tertiary hospitals to <i>follow-up</i> pediatric patients confirmed or suspected of being infected with SARS-CoV-2. (Telemonitoring)	<ul style="list-style-type: none"> - Telephone consultation services are carried out between doctors-patients until the patient's symptoms improve or are asymptomatic. Services are provided to patients with mild symptoms or children discharged from the hospital. - Services provided include filling out a questionnaire that explores the symptoms and treatments included in <i>the e-health</i>. Telephone consultations are carried out by pediatricians from the Department of Infectious 	<ul style="list-style-type: none"> - Supports proper and secure remote consultations - Reducing the frequency of in-person visits to see a doctor - It is an alternative to managing mild cases of Covid-19 and for follow-up of patients after being hospitalized. - Bias in interpreting the symptoms and severity of the patient increases due to the subjective perception of the family members interviewed.



Writer	Country	Research Design	Telemedicine Type	Service	Resulting Effects
				Diseases of Pediatrics.	
¹⁷	Mexico	Observational retrospective study	Doctor-patient teleconsultation app called Sofia (Realtime Telemedicine)	The services provided include video consultations that can be used to triage, test, treat and <i>follow-up</i> up remote patients with mild Covid-19 symptoms.	<ul style="list-style-type: none"> - It lowers health care costs through transportation costs to visit healthcare providers. - We are improving the efficiency of medical care, especially for patients living at home or in remote locations.
¹⁸	India	Qualitative research through structured interviews with open and closed questions	Telecommunication application of remote health care providers between two parties using information and communication technology (ICT) (Realtime Telemedicine)	The services provided are in the form of remote consultations for people suffering from chronic diseases and acute diseases, as well as facilitating the initial evaluation, diagnosis, prevention, and treatment related to COVID-19 by doctors in remote locations	<ul style="list-style-type: none"> - The creation of cost-effective remote health care facilities in remote areas - Reducing the risk of transmission of COVID-19 during the provision of health services - People feel the ease of accessing health services through Telehealth
¹⁹	United States	Retrospective Cohort Studies	Student-led telemedicine clinic with Massachusetts public hospital (Realtime Telemedicine)	The services provided include assessing and evaluating patients with acute respiratory symptoms and severe disease risk factors and giving appropriate COVID-19 counseling and triage to those with higher levels of care.	<ul style="list-style-type: none"> - Helping to fight the ongoing pandemic - It can serve as a model for the implementation of similar clinics to reduce the burden on the increased health care system

Most studies used a telemedicine service in real-time, where interactions between doctors and patients were carried out directly over the phone through several different applications. Studies in Mexico ²⁰ say there is an application called Sofia to run a telemedicine program by providing services in the form of triage, testing, treatment, and follow-up of patients with symptoms of covid-19²⁰. This type of telemedicine can be in the form of doctor-patient interviews to reduce the risk of transmission of COVID-19, which can be done through video and audio. The study in Pakistan¹⁴ listed triage services for telemedicine users based on users' health data so they could find out the C-score. In the United



States¹⁹, a student-led telemedicine program with Massachusetts General Hospital has been developed, referred to as a telemedicine clinic. The telemedicine clinic was conducted by contacting patients by making phone calls and providing facilities for covid-19 symptoms, counseling, and patient triage.

The study, conducted in Saudi Arabia¹², discussed two types of telemedicine in his research; telemonitoring and real-time telemedicine. Telemonitoring will remotely monitor the patient's condition after Covid-19 treatment and vaccination. In this case, it takes patient health data entered in the mobile application. mHealth and Telehealth applications can provide adequate health services because patients can provide accurate and daily health data. Telemonitoring is considered more effective if it is carried out directly between patient doctors, where doctors can contact patients to collect data and provide feedback. This facility can be obtained through Telehealth.

Meanwhile, mHealth is only limited to entering data into the application. This can be a drawback because patients may not regularly enter their health data, and this causes remote monitoring to be ineffective. When that happens, Telehealth can handle it. Therefore, Telehealth is considered more effective than mHealth. Both mHealth and Telehealth monitor Covid-19 patients with COPD remotely after treatment or vaccination. Monitoring was carried out on exercise tolerance, patient comorbidities, oxygen levels, blood pressure, sugar levels, and other factors.

Telemonitoring was also discussed in studies conducted in the country Spain¹³. The study said there is already a telemedicine tool (telemedicine tool) as part of electronic medical records, namely Telemedicine and Tele monitorization Assistant (TELEA), which allows monitoring patients at home such as from virtual wards, and will able patients to send messages, questionnaires, clinical parameters or videos to their medical records. Health services can evaluate information in real-time, communicate with patients, and act according to the information obtained. Another study conducted in Spain¹⁶ also discussed telemedicine in the form of telemonitoring to monitor the condition of patients diagnosed with confidence or likely to have Covid-19. Monitoring is carried out on pediatric patients with the sars-COV-2 infection every 48 hours by phone until symptoms disappear, then weekly for up to 14 days without symptoms. Communication by telephone call with the patient is carried out by a pediatrician from the Department of Pediatric Infectious Diseases²¹.

All the effects aim to reduce the burden on the health care system during the COVID-19 pandemic. Telemedicine services can help reduce doctors' workload and direct contact with patients during the COVID-19 pandemic so that telemedicine can substantially replace in-person consultations and prevent nosocomial infections during the COVID-19 pandemic. In addition, this system can reduce healthcare costs by transportation costs to visit healthcare providers.

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This study aims to explore the efficiency of using telemedicine as one of the facilities in the context of controlling COVID-19. The literature reviewed in this article discusses the types of telemedicine and the services and effects produced in handling COVID-19.



The high number of COVID-19 cases worldwide has led to the need for access to adequate health services in various regions. However, on the other hand, the use of health service facilities public's has decreased and is further exacerbated by the COVID-19²². People are reducing activities outside the home to prevent the transmission of COVID-19, including visiting health care facilities. Remote information exchange using *telemedicine* applications is considered effective in providing care to COVID-19 patients, especially those living in remote areas, as reported in several studies (16)(15)¹⁷. In addition, studies have also reported increased people's access to medical care during the COVID-19 pandemic using *telemedicine*¹⁵.

The Utilization of emergency installation services during the COVID-19 pandemic has increased (21). However, studies report that *telemedicine* as a means for early triage of COVID-19 patients may help reduce the workload of emergency installations and help limit the spread of infection¹⁴. In addition, the benefits of *telemedicine* that are also reported by some studies are a decrease in the length of hospitalization of COVID-19 patients, which indirectly helps to reduce health care costs and the burden of hospital costs (17)(11)(13)^{15,17}. This is also in line with research by McLean et al. (2013), which reported greater clinical effectiveness in patients with more severe illnesses against hospitalization rates and the number of deaths intervened using *telehealthcare*²⁴.

The high number of hospital visits can lead to an increase in the density of medical facilities so that *burnout* cases among medical personnel also become increasing^{25,26,27}. Khairat et al. (2020)²⁸ report that using remote medical consultations can reduce the density of medical facilities and thus able to control the spread of disease. Several studies report the use of *telemedicine* which is beneficial in reducing the workload of doctors because it reduces the frequency of in-person visits and is an alternative in managing COVID-19 cases with mild symptoms¹⁶. Although the treatment provided is not direct, the study's results mentioned effectiveness in handling COPD patients infected with COVID-¹².

CONCLUSION AND SUGGESTIONS

The use of telemedicine during the COVID-19 pandemic is quite useful and helps health workers carry out health services. Telemedicine itself can be a breakthrough in the management of COVID-19 patients. The benefits of telemedicine are early triage in emergency installations, reducing the workload of doctors and the frequency of direct visits to hospitals, limiting the spread of infection, and decreasing the length of hospitalization of COVID-19 patients to reduce the cost of treatment. In the next study, it is expected that will be expanded-the data search year. The future research about telemedicine could be more exploring the beneficial and efficiency telemedicine for elderly and individuals with specific need, because most participants on those study were young who have more experience using the technologies.



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