Journal of Health Innovation and Environmental Education
Vol. 2, No. 1, June 2025, pp. 1~10
ISSN: 3062-9632, DOI: 10.37251/jhiee.v2i1.1723

Utilization of Telehealth in Improving the Quality of Health Services During the Pandemic: Systematic Review

Khaeratunnafisah[1], Karani Lizbeth[2]
[1]Nursing Study Program, Alauddin State Islamic University Makassar, South Sulawesi, Indonesia
[2]School of Health and Biomedical Sciences, The Technical University of Kenya, Nairobi, Kenya

Article Info

Article history:

Received Apr 8, 2025
Revised May 22, 2025
Accepted Jun 20, 2025
Online First Jun 22, 2025

Keywords:

Health
Health Services
Systematic Review
Telehealth

ABSTRACT

Purpose of the study: This study aims to determine the use of telehealth in health services during the pandemic, and to determine the types of platforms used in health services during the pandemic.

Methodology: This study is a review using the Systematic Review method using the PRISMA 2009 checklist guidelines which was then followed by the Critical Appraisal Skills Programme (CASP).

Main Findings: A total of 10,384 articles were identified from four types of database searches, namely Pubmed, Scopus, Science Direct, and Proquest, which had been filtered with a publication limit of the last 3 years (2019-2021). However, after screening, 9,750 articles were found that did not match the research questions and objectives, leaving 10 articles that were similar to the research topic.

Novelty/Originality of this study: This study presents novelty by systematically summarizing various recent findings related to the use of telehealth as an innovative strategy in improving the quality of health services during the pandemic, especially in overcoming limited access and direct interaction between medical personnel and patients.

Corresponding Author:
Khaeratunnafisah
Nursing Study Program, Alauddin State Islamic University of Makassar, Jl. Sultan Alauddin No.63, Romangpolong, Somba Opu District, Gowa Regency, South Sulawesi 92113, Indonesia
Email: khrtnssaaa00@gmail.com

1. INTRODUCTION

The COVID-19 pandemic has been a major challenge to global public health since its emergence in Wuhan, China in December 2019. The virus spread rapidly, causing concern worldwide [1]-[3]. Governments in various countries immediately took mitigation measures such as social restrictions, self-isolation, and mass testing. Many countries formed special task forces to deal with the spread of the virus, as well as developing comprehensive prevention and control guidelines. This reflects a global collective effort to overcome an unprecedented health crisis. COVID-19 is caused by a new type of coronavirus that has not previously been identified in humans. This virus comes from a group of viruses commonly found in animals but has undergone a mutation that allows it to infect humans [4]-[6]. As of February 2021, the number of cases globally has reached more than 112 million with almost 2.5 million deaths. Many countries are experiencing a surge in cases, while their health systems are overwhelmed by the impact [7]-[9]. These numbers show how serious this pandemic is for the world's health systems.

Health facilities are at the forefront of handling the pandemic, but also face major challenges in maintaining the continuity of essential health services. These services include immunization, pregnancy check-ups, and treatment of chronic diseases such as diabetes and hypertension that continue to be needed by the

community. The balance between handling COVID-19 and basic health services is critical to prevent a spike in other diseases after the pandemic [10]-[12]. The global health system is required to adapt to emergency conditions without neglecting essential services. This effort is part of a strategy to maintain the resilience of health care systems around the world [13]-[15].

The quality of health services is a major issue amidst the pressure of the pandemic. Quality services are believed to be able to reduce mortality rates more effectively than simply expanding access [16]-[18]. Therefore, health workers around the world need to provide safe, effective, efficient services that are oriented towards patient interests. Services that are hampered by the risk of virus transmission create an additional burden on health facilities. For this reason, adaptive alternative solutions are needed so that services can still be provided optimally [19]-[21].

One solution that has been widely adopted globally is the implementation of telehealth in healthcare services during the pandemic [22]-[24]. Telehealth allows medical personnel to provide services using information and communication technology, without direct contact with patients. This helps maintain the quality of services while protecting patients and healthcare workers from the risk of virus transmission [25]-[27]. Many countries have legalized and encouraged the use of telehealth as part of the public health emergency response. Devices such as internet networks, communication applications, and digital platforms are important pillars in this service [28]-[30].

Telehealth provides great benefits in monitoring patient conditions remotely and enabling early detection of worsening symptoms. In addition, this system reduces the need for in-person visits to healthcare facilities, which has a positive impact on the efficiency of the use of personal protective equipment and reduces the workload of medical personnel. The adoption of telehealth has also been well received by the global community due to its ease of access, lower costs, and convenience of use [31]-[33]. Various popular platforms have been used legally and in accordance with digital health security standards. This innovation drives digital transformation in the global healthcare system.

However, although various countries have implemented telehealth as an alternative health service during the pandemic, there have been few studies that systematically analyze the effectiveness of this implementation from various dimensions, such as service quality, coverage area, and diversity of platforms used [34]-[36]. Most previous studies were only descriptive or focused on one region or specific service system. This creates a gap in the comprehensive understanding of the contribution of telehealth globally in improving the quality of health services during the pandemic. The urgency of this study is also increasingly relevant considering the possibility of a global health crisis in the future that requires the readiness of the health service system to respond to emergency situations quickly and effectively. By understanding how telehealth has been used during the COVID-19 pandemic, policy makers and health practitioners can develop more adaptive and evidence-based strategies to face similar challenges in the future.

This study is novel because it was conducted through a systematic review approach using the PRISMA 2009 guidelines and the CASP article quality assessment method. Not only presenting descriptive data, this study also systematically summarizes various recent findings regarding the types of telehealth platforms used and their impact on service quality. Thus, the results of this study can provide scientific and practical contributions to the development of telehealth as part of the digital transformation of global health services.

The flexibility of telehealth extends the reach of health services to populations that were previously difficult to reach by conventional systems [37], [38]. By simply using devices that people already have, such as smartphones or laptops, services can be carried out quickly and effectively. This not only increases service capacity in the short term, but also opens up opportunities for long-term digital service development. Based on this background, this study aims to examine the use of telehealth in improving the quality of health services during the COVID-19 pandemic. This study was conducted through a systematic review approach to various relevant studies from various parts of the world. The purpose of this study was to determine the use of telehealth in health services during the pandemic, and to determine the types of platforms used in health services during the pandemic.

2. RESEARCH METHOD

The type of research used is a review using the Systematic Review method, namely a synthesis of systematic, clear, comprehensive literature studies, by identifying, analyzing, evaluating through the collection of existing data with explicit search methods and involving a critical review process in selecting studies. This study uses a systematic review to find out, summarize, evaluate, and systematically describe the effectiveness of using telehealth during a pandemic [39]-[41].

This review uses a systematic and critical way of thinking in examining various studies using the PRISMA 2009 checklist guidelines which are evidence-based reporting guidelines for systematic reviews and meta-analyses. Furthermore, the Critical Appraisal Skills Program (CASP) was used in this review to assess the eligibility of articles for inclusion in the study. The data used in this study are secondary data obtained not from

direct observation, but obtained from the results of research conducted by previous researchers. The source of the secondary data was obtained from a literature search in the PubMed, Scopus, ScienceDirect, and ProQuest databases.

Searching for articles or journals using keywords and Boolean operators (AND, OR) which are used to expand or specify the search, making it easier to determine the articles or journals used [42]-[44]. Research questions are formulated based on PEO (Population, Exposure, Outcome). PEO and keywords are based on the database (Table 1). The research question is formulated as: "How is the use of telehealth in health services during the pandemic?"

Table 1. PEO Strategy

Description of PEO (Population, Eksposure, Outcome)	
P	Patient OR Client OR User
E	Telehealth
O	Utilization OR Benefit

Researchers set inclusion and exclusion criteria in selecting the literature to be analyzed. The inclusion criteria used include articles published in the last three years (2019-2021), full-text articles relevant to the research objectives regarding the use of telehealth in health services during the pandemic, articles that have a clear identity such as ISSN or DOI and volume number, research using human subjects, and articles written in English. Meanwhile, the exclusion criteria include articles whose titles and abstracts do not match the focus of the research, articles that do not have clear research methods and designs, articles that are not equipped with abstracts or are not available in full-text versions, and articles that do not include scientific identity information such as DOI or ISSN. By applying these criteria, the selection of literature sources is expected to produce a valid and relevant review of the research topic.

After collecting data and information, all data and information are selected to be relevant using the Critical Appraisal Skills Program (CASP) instrument used in this review to assess the eligibility of articles for inclusion in the study. To present the problems to be discussed, the collected data is analyzed using a grid synthesis table. A total of 10,384 articles were identified from 4 types of database searches, namely Pubmed, Scopus, ScienceDirect, and Proquest, which had been filtered with a publication limit of the last 3 years (2019-2021). However, after screening, 9,750 articles were obtained that did not match the research questions and objectives, leaving 10 articles that had similarities with the research topic. Of the 10 articles, several articles were excluded because the articles were in the form of theses, unpublished and not in full text or still in manuscript form. So there are 10 articles that meet the inclusion criteria. The flow diagram of the literary search from four databases, namely Pubmed, Scopus, ScienceDirect, and Proquest can be seen in Figure 1.

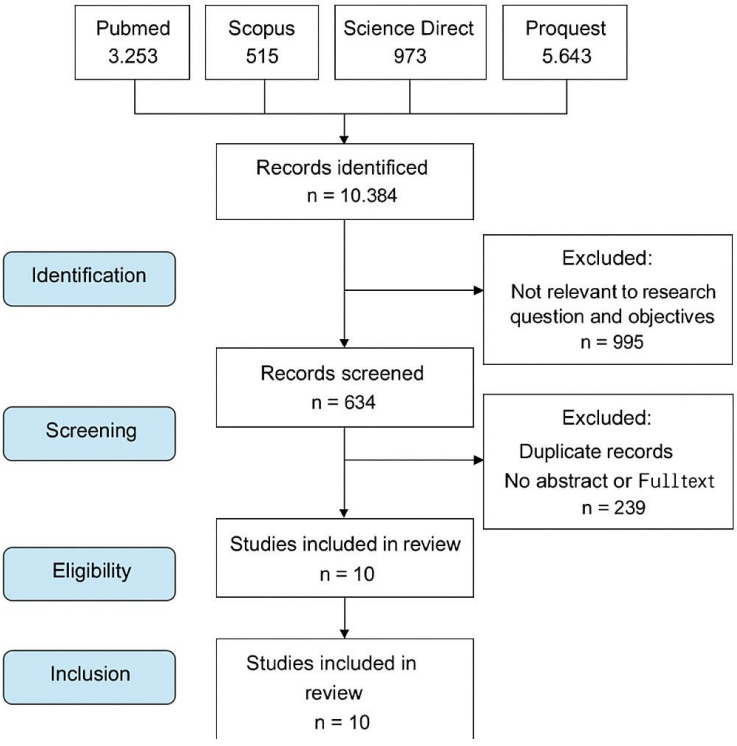

Figure 1. Literature Search Diagram

3. RESULTS AND DISCUSSION

Literature search with keywords according to Mesh was conducted through four databases, namely Pubmed, ScienceDirect, Scopus, and Proquest. The journals obtained from the search results were 10,384 and only 10 journals were in line with Pustaka's research. So this study involved 10 articles that met the inclusion criteria. The literature related to the systematic review collected was then analyzed using the Critical appraisal table to answer the objectives of this study.

Table 2. Research Results

No.	Author Name/Country/Year	Implementation of Telehealth in Health Services during the Pandemic	Types of Platforms Used in Health Services During the Pandemic
1.	Goenka et al., [45] /New York/2021	Implementing telehealth for consultations in the field of oncology.	Using Two-way Audio Video (Video Conferencing)
2.	Biase et al., [46] /Florida/2020	Implementing telehealth for consultations on neurosurgery patients.	Using Two-way Audio Video (Video Conferencing)
3.	Gilbert et al., [47] /Great Britain/2020	Implementing telehealth for patient consultations in orthopedic hospitals.	Phone Audio Call
4.	Jiménez-Rodríguez et al., [48] /Spanyol/2020	Implementing telehealth for patients with chronic diseases.	Using Two-way Audio Video (Video Conferencing)
5.	Nicholas et al., [49] /Australia/2021	Implementing telehealth for adolescent mental health care.	Using Two-way Audio Video (Video Conferencing)
6.	Newman-Casey et al., [50] /United States of America/2021	Implementing telehealth for patients with tele ophthalmology.	Using Two-way Audio Video (Video Conferencing)
7.	Bannell et al., [51] /Australia/2021	Implementing telehealth for physiotherapy patients, by providing individual and group classes with Pilates programs, Good life with Osteoarthritis, low back pain, postpartum care, and prenatal care.	Using Two-way Audio Video (Video Conferencing)
8.	Hron et al., [52] /United States/2020	Implementing telehealth for inpatients with covid and non-covid in the form of updates on laboratory test results, teleconsultation for subspecialists, patient consultations with nutritionists, pharmacists, children, and other non-physician providers. As well as monitoring patients who are quarantined at home, education on exercise classes such as asthma, diabetes and also operating room consultations.	Using Two-way Audio Video (Video Conferencing)
9.	Manyati & Mutsau [53] /South Africa/2021	Implementing telehealth to diagnose patients, trace close contacts and treat covid-19 patients.	Using Two-way Audio Video (Video Conferencing)
10.	Shafi et al., [54] /New York/2020	Implementing telehealth for spinal patient care.	Using Two-way Audio Video (Video Conferencing)

3.1. Use of Telehealth in Health Services During the Pandemic

The world's healthcare system is changing the healthcare process in the face of the Covid-19 pandemic. Several large countries such as Europe, the United States, Australia, and Asia have closed their doors to patients who need face-to-face care or therapy. They are simultaneously trying to replace some meetings and consultations with virtual ones, namely by utilizing telehealth. The use of telehealth in health services during the pandemic has greatly simplified the health service process [55]-[57].

The telehealth implementation process is carried out by providing interventions guided by health workers, then the interventions can be carried out directly by the patient themselves. Assistance with applications or online intervention modules that doctors and other health workers have prepared. To support the telehealth implementation process to run effectively, there are several things that health workers need to pay attention to, including: In carrying out long-distance health consultations, several important things need to be considered to maintain the quality of communication between health workers and patients. First, maintaining a normal speaking speed is very important so that patients can understand the information clearly. Health workers are

advised to speak slowly enough and give a slightly longer pause than direct communication, to ensure that each message can be received well by the patient. Second, the use of words that show empathy is very helpful in building a positive relationship with the patient. This can be accompanied by full attention and gestures such as nodding the head when the patient speaks, to show that the health worker is really listening and cares. In addition, when conducting consultations via video conferencing, it is important to maintain the match between facial expressions and the words delivered, so that communication remains warm and human [58], [59].

Positive feedback was given by patients by saying a high level of satisfaction, ease of access in using telehealth, relatively low costs and reduced patient waiting time at health service centers. In addition, patients also said their difficulties in adapting to this technology included difficulty in building relationships with doctors and concerns about the possibility of medical errors as potential barriers to using telehealth. Telehealth is a new type of technology, therefore there are some negative aspects of this technology. Among them: telehealth technology does not make physical contact so that it is impossible to perform physical examination procedures on patients, and technological difficulties, such as lack of access for health workers and patients (especially for the elderly) [60]. Difficulties in using telehealth care technology, emphasized for certain patients who do not yet have access to resources and technology, low levels of confidence when using technology, between patients and health workers need support with hardware and software settings. Problems with outdated software (eg: using internet explorer or not having a cellphone/tablet or computer operating system software) [61].

3.2. Types of Platforms Used in Health Services During the Pandemic

3.2.1. Video Conference (Two-way audio-video)

The world of technology that is increasingly developing today, demands new advances to support a technology. One of them is in the world of the internet which is so developed. The internet can be used to support the use of telehealth through video conferencing. Online conference applications commonly used by health workers, such as zoom, google meet, and other applications are very useful media for coordination and collaboration during the pandemic [62]. The use of the internet to support the use of telehealth can be used for patient consultations, and also to diagnose diseases suffered by patients. Both in emergency and normal conditions, the internet is used as a means of communication between health workers. It is recorded that the number of downloads of video conferencing applications, in this case Zoom, has reached 94 million downloads in the period from April 1 to June 30, 2020. This explains the exponential growth in the use of video conferencing applications during the pandemic, because the application is one of the favorite choices used by patients in conducting health consultations. Video conferencing using telehealth is a video and telecommunications technology to send medical information (audio, video and graphics) between two or more patients or health workers. The process of sending images and data is carried out in real time or at the same time so that health workers can directly analyze and interact with patients [63].

The process of implementing telehealth using video conferencing is generally carried out with various platforms such as Zoom, Skype, Facetime, Physitrack, Coviu, and Palo Alto. Generally done with patients and health workers will be shared the same link and password then the patient will see the monitor, camera, and control devices (such as: mouse, keyboard), input devices (such as: document scanners, images displayed by health workers), and output and storage devices (such as: Printers, CD-ROM drives). The service process for each department may be different, depending on the needs when conducting a video consultation. The operating principle of telehealth video conferencing uses telecommunications technology to transmit medical information (audio, video, and graphics) between two or more sites [64].

The changes in healthcare services over the past two decades have been implemented, many obstacles have occurred during the process of implementing telehealth in routine care so far. One of the most highlighted obstacles is that healthcare services have not been integrated as a normal part of routine care practices due to the lack of healthcare professionals who understand the technology [65], [66]. In the process of implementing video conferencing telehealth, there are several things that are problematic, such as the security and confidentiality of patient data, internet or electricity that may not be adequate, and also inadequate computer performance that can interfere with the consultation process. These problems can be avoided by periodically copying data to a removable disk to protect information, creating a special power channel and processing unit that can be useful for reducing signal and electrical interference.

In the process of implementing telehealth via video conferencing, there are several important aspects that must be considered to maintain the comfort and effectiveness of communication between healthcare workers and patients. First, adequate lighting is needed so that the faces of healthcare workers are clearly visible to patients during the consultation session. Second, the surrounding environment should be free from noise, and it is advisable to mute the microphone when not speaking to avoid distractions. It is also important to ensure that the surrounding background does not show anything personal and to keep the room neat and professional. Health workers should also wear appropriate attire, as when conducting in-person visits, such as wearing a white coat and ensuring that their identity is clearly visible if possible.

Furthermore, health workers are advised to avoid unnecessary additional movements during the consultation because it can interfere with the patient's concentration. The placement of the head in the center of

the screen is also important so that the face is clearly visible and the focus of communication is maintained. Eye contact should be maintained throughout the session, while remaining focused on the conversation and avoiding other activities that can distract attention. Finally, before the session ends, health workers need to inform the patient about the results of the consultation and schedule the next meeting so that the patient can prepare the time optimally [67], [68].

Videoconferencing can be very helpful in routine patient health care, as well as in physical care and can be easily scaled to serve remote areas and reach across borders. Videoconferencing by health workers and patients can create the most beneficial situation for both. Difficulties in implementing video consultations, related to difficulties that arise from informants related to new technologies that may be unfamiliar or challenging. The need to provide resources for health care professionals so that they can conduct video consultations, and the need to train and shape them for the adequate use of this new modality.

Various benefits of video consultation for health workers and patients, including: both do not need to visit health service centers in person during the pandemic to avoid patients traveling to health service centers. So that health workers can make two-way audio-video calls using telehealth, health workers can see each other or face to face with patients even though it is virtual. The consultation process with patients using telehealth also provides time efficiency for both, flexibility and comfort of the consultation process are still obtained. Because the interaction is real-time, contact with the patient is ensured, allowing verbal and non-verbal communication when communication occurs. Health workers can also see and assess patients by looking at the patient's face and expression. Communication using two-way video-audio can occur well if contact with patients is carried out routinely by maintaining the required time without any interruption [69], [70].

3.2.2. Audio Calls (Mobile Phones)

The use of audio calls during the Covid-19 pandemic in health services is very popular among clinic patients aged 50 and over who have a lower economic level. For patients who do not have access to computers or sophisticated smartphones, telephone calls can be an alternative to using consultations with health workers. The President of the American College of Physicians, said in an interview that the current pandemic disruption creates a "critical time" for elderly patients who live in rural areas and do not have adequate internet access and some of them only have landlines [53]. So the implementation of telehealth using telephones will still be used so that patients can continue to receive health services. Telephone calls also have great benefits for patients who struggle with technology or have work responsibilities or interfere with their ability to make video calls or in-person visits. Voice calls via telephone have become a tool for vulnerable populations so that some physician groups are encouraging a temporary replacement of the health consultation process with audio calls. Conversations using telephones or smartphones are a means of consultation for patient care that has been carried out so far. Conversations using telephones are often feared to cause different understandings between the two parties. Patient data observation is done by reading patient data, then slowly understood by the listener. The listener as the recipient of information must concentrate fully to understand. Therefore, by providing special data access facilities in patient care can help make the work of medical personnel easier and more flexible. The use of audio calls is associated with many patients who do not have the technical knowledge to use the application, so it is not surprising that the inability of patients to access video visits disproportionately affects low-income and medically vulnerable people. The Pew Research Center 2018 reported that nearly a third of households with incomes of $30,000 or less do not have a smartphone and more than 40% do not have a computer for high-speed broadband access. Therefore, telephone calls can bridge the gap that occurs [71]. Various models of care using telehealth can be used as a communication system supported by the internet, wireless networks, computers, mobile phones and satellites. And usually use web-based portals and email with a variety of devices for video conferencing, including mobile phones and tablets with cameras and cloud-based audio-video platforms to provide smooth communication [72].

Patients expressed positive experiences and perceptions when using audio calls using telephones with quality of care, then some patients felt indifferent to the care using audio calls. In addition, patients said that the use of audio calls had worse quality than direct visits, which was related to less effective communication between patients and health workers. Patients said they had difficulty interacting with health workers, so that the information obtained by patients could not be easily understood by patients, thus hampering the consultation process. The process of implementing psychological interventions that have been implemented online via telephone, assistance hotlines, online services and video conferences has had a significant impact on improving psychological conditions. One of the online psychological interventions via telephone media implemented by psychologists at the University Hospital Center (UHC) Milosrdnice Training Center in Zagreb, the intervention was mainly indicated for medical staff who were at the forefront, patients with symptoms of coronavirus infection, close contacts, suspected patients, and patients who had symptoms such as fever, runny nose, and cough. This intervention is effective when the crisis is not too big, so that it can be done with regular telephone consultations and periodic psychiatric examinations to address psychological problems. However, with the sharp increase in the number of people affected by the pandemic. Both infected and suspected cases in isolation, fear and anxiety are growing in the general population, requiring a significant increase in the need for psychiatric

support for patients and medical staff. This condition then makes telephone counseling no longer effective in conditions of an increasingly widespread pandemic.

Various health fields and health organizations have developed various interventions to address psychological impacts. Digital platforms that can be accessed online are widely available to provide psychological interventions to the community. Some examples of online applications that can be used are Wiring Affect with ReAttach (W.A.R.A), Wechat, Questionnaire, Weibo, and Tiktok. Psychological interventions carried out online provide great benefits for healing psychological impacts [73].

Telehealth is a new type of technology, so there are several shortcomings in the implementation process using this telephone audio call, such as patients and health workers can only exchange voices without virtual face-to-face, cannot perform physical examinations or simple interventions on patients, and also both cannot exchange images or graphics that support the consultation process [74].

4. CONCLUSION

Based on the results of the analysis, it can be concluded that Telehealth is a technology that can be used as a mode of communication between health workers and patients to conduct virtual consultations in the health service process during a pandemic. The use of telehealth during a pandemic is in great demand by the public due to time efficiency when making visits, relatively cheap visit costs and also access to consultations that are so easy to reach. Telehealth can access brief updates on laboratory/test results, teleconsultation for subspecialists, patient consultations with nutritionists, pharmacists, children, and other non-physician providers, then continuous video monitoring of patients for parents who are quarantined at home, education training classes, such as asthma and diabetes care, and room consultations with off-site providers. Of the 10 journals that have been reviewed, there are 2 types of platforms that are often used in the implementation of telehealth in health services during a pandemic, namely 8 articles discussing the use of video conferencing (two-way audio video) and 2 articles discussing the use of telephone audio calls.

ACKNOWLEDGEMENTS

Thank you to all parties who have helped, so that this research can be completed.

REFERENCES

[1] D. S. Hui, E. I. Azhar, T. A. Madani, F. Ntoumi, R. Kock, O. Dar, *et al.*, "The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health—The latest 2019 novel coronavirus outbreak in Wuhan, China," *Int. J. Infect. Dis.*, vol. 91, pp. 264–266, 2020, doi: 10.1016/j.ijid.2020.01.009.

[2] A. Lee, "Wuhan novel coronavirus (COVID-19): why global control is challenging?," *Public Health*, vol. 179, p. A1, 2020, doi: 10.1016/j.puhe.2020.02.001.

[3] A. V. Silven, A. H. J. Petrus, M. Villalobos-Quesada, E. Dirikgil, C. R. Oerlemans, C. P. Landstra, *et al.*, "Telemonitoring for patients with COVID-19: Recommendations for design and implementation," *J. Med. Internet Res.*, vol. 22, no. 9, 2020, doi: 10.2196/20953.

[4] K. Dhama, S. Khan, R. Tiwari, S. Sircar, S. Bhat, Y. S. Malik, K. P. Singh, W. Chaicumpa, D. K. Bonilla-Aldana, and A. J. Rodriguez-Morales, "Coronavirus Disease 2019–COVID-19," *Clin. Microbiol. Rev.*, vol. 33, 2020, doi: 10.1128/cmr.00028-20.

[5] N. Decaro and A. Lorusso, "Novel human coronavirus (SARS-CoV-2): A lesson from animal coronaviruses," *Vet. Microbiol.*, vol. 244, p. 108693, 2020, doi: 10.1016/j.vetmic.2020.108693.

[6] A. El-Sayed and M. Kamel, "Coronaviruses in humans and animals: the role of bats in viral evolution," *Environ. Sci. Pollut. Res.*, vol. 28, no. 16, pp. 19589–19600, 2021, doi: 10.1007/s11356-021-12553-1.

[7] H. K. Mohajan, "Global COVID-19 pandemic: prevention and protection techniques," *J. Econ. Dev. Environ. People*, vol. 10, no. 1, pp. 51–72, 2021.

[8] I. Bergeri, M. G. Whelan, H. Ware, L. Subissi, A. Nardone, H. C. Lewis, *et al.*, "Global SARS-CoV-2 seroprevalence from January 2020 to April 2022: A systematic review and meta-analysis of standardized population-based studies," *PLoS Med.*, vol. 19, no. 11, p. e1004107, 2022, doi: 10.1371/journal.pmed.1004107.

[9] M. Amaku, D. T. Covas, F. A. B. Coutinho, R. S. Azevedo, and E. Massad, "Modelling the impact of delaying vaccination against SARS-CoV-2 assuming unlimited vaccine supply," *Theor. Biol. Med. Model.*, vol. 18, pp. 1–11, 2021, doi: 10.1186/s12976-021-00143-0.

[10] J. Nyasulu and H. Pandya, "The effects of coronavirus disease 2019 pandemic on the South African health system: A call to maintain essential health services," *Afr. J. Prim. Health Care Fam. Med.*, vol. 12, no. 1, pp. 1–5, 2020. https://hdl.handle.net/10520/EJC-1ead3a4d96

[11] W. Enbiale, S. G. Abdela, M. Seyum, D. B. Hundie, K. A. Bogale, K. S. Tamirat, *et al.*, "Effect of the COVID-19 pandemic preparation and response on essential health services in primary and tertiary healthcare settings of Amhara region, Ethiopia," *Am. J. Trop. Med. Hyg.*, vol. 105, no. 5, p. 1240, 2021, doi: 10.4269/ajtmh.21-0354.

[12] E. Webb, C. Hernández-Quevedo, G. Williams, G. Scarpetti, S. Reed, and D. Panteli, "Providing health services effectively during the first wave of COVID-19: A cross-country comparison on planning services, managing cases, and maintaining essential services," *Health Policy*, vol. 126, no. 5, pp. 382–390, 2022, doi: 10.1016/j.healthpol.2021.04.016.

[13] T. Sundararaman, V. R. Muraleedharan, and A. Ranjan, "Pandemic resilience and health systems preparedness: Lessons from COVID-19 for the twenty-first century," *J. Soc. Econ. Dev.*, vol. 23, Suppl. 2, pp. 290–300, 2021, doi: 10.1007/s40847-020-00133-x.
[14] S. Mustafa, Y. Zhang, Z. Zibwowa, R. Seifeldin, L. Ako-Egbe, G. McDarby, *et al.*, "COVID-19 preparedness and response plans from 106 countries: A review from a health systems resilience perspective," *Health Policy Plan.*, vol. 37, no. 2, pp. 255–268, 2022, doi: 10.1093/heapol/czab089.
[15] L. Zhao, Y. Jin, L. Zhou, P. Yang, Y. Qian, X. Huang, and M. Min, "Evaluation of health system resilience in 60 countries based on their responses to COVID-19," *Front. Public Health*, vol. 10, p. 1081068, 2023, doi: 10.3389/fpubh.2022.1081068.
[16] P. Barach, S. D. Fisher, M. J. Adams, G. R. Burstein, P. D. Brophy, D. Z. Kuo, and S. E. Lipshultz, "Disruption of healthcare: Will the COVID pandemic worsen non-COVID outcomes and disease outbreaks?," *Prog. Pediatr. Cardiol.*, vol. 59, p. 101254, 2020, doi: 10.1016/j.ppedcard.2020.101254.
[17] J. G. Adams and R. M. Walls, "Supporting the health care workforce during the COVID-19 global epidemic," *JAMA*, vol. 323, no. 15, pp. 1439–1440, 2020, doi: 10.1001/jama.2020.3972.
[18] Q. Liu, D. Luo, J. E. Haase, Q. Guo, X. Q. Wang, S. Liu, *et al.*, "The experiences of health-care providers during the COVID-19 crisis in China: A qualitative study," *Lancet Glob. Health*, vol. 8, no. 6, pp. e790–e798, 2020, doi: 10.1016/S2214-109X(20)30204-7.
[19] T. Ibn-Mohammed, K. B. Mustapha, J. Godsell, Z. Adamu, K. A. Babatunde, D. D. Akintade, *et al.*, "A critical analysis of the impacts of COVID-19 on the global economy and ecosystems and opportunities for circular economy strategies," *Resour. Conserv. Recycl.*, vol. 164, p. 105169, 2021, doi: 10.1016/j.resconrec.2020.105169.
[20] D. Kringos, F. Carinci, E. Barbazza, V. Bos, K. Gilmore, O. Groene, *et al.*, "Managing COVID-19 within and across health systems: Why we need performance intelligence to coordinate a global response," *Health Res. Policy Syst.*, vol. 18, pp. 1–8, 2020, doi: 10.1186/s12961-020-00593-x.
[21] M. Poongodi, M. Malviya, M. Hamdi, H. T. Rauf, S. Kadry, and O. Thinnukool, "The recent technologies to curb the second-wave of COVID-19 pandemic," *IEEE Access*, vol. 9, pp. 97906–97928, 2021, doi: 10.1109/ACCESS.2021.3094400.
[22] R. Ohannessian, T. A. Duong, and A. Odone, "Global telemedicine implementation and integration within health systems to fight the COVID-19 pandemic: A call to action," *JMIR Public Health Surveill.*, vol. 6, no. 2, p. e18810, 2020, doi: 10.2196/18810.
[23] A. Sharma, M. Pruthi, and G. Sageena, "Adoption of telehealth technologies: An approach to improving healthcare system," *Transl. Med. Commun.*, vol. 7, no. 1, p. 20, 2022, doi: 10.1186/s41231-022-00125-5.
[24] S. Omboni, R. S. Padwal, T. Alessa, B. Benczúr, B. B. Green, I. Hubbard, *et al.*, "The worldwide impact of telemedicine during COVID-19: Current evidence and recommendations for the future," *Connect. Health*, vol. 1, p. 7, 2022, doi: 10.20517/ch.2021.03.
[25] J. Fang, Y. T. Liu, E. Y. Lee, and K. Yadav, "Telehealth solutions for in-hospital communication with patients under isolation during COVID-19," *West. J. Emerg. Med.*, vol. 21, no. 4, p. 801, 2020, doi: 10.5811/westjem.2020.5.48165.
[26] V. A. Wade, J. Karnon, A. G. Elshaug, and J. E. Hiller, "A systematic review of economic analyses of telehealth services using real time video communication," *BMC Health Serv. Res.*, vol. 10, p. 233, 2010, doi: 10.1186/1472-6963-10-233.
[27] X. Ren, Y. Zhai, X. Song, Z. Wang, D. Dou, and Y. Li, "The application of mobile telehealth system to facilitate patient information presentation and case discussion," *Telemed. e-Health*, vol. 26, no. 6, pp. 725–733, 2020, doi: 10.1089/tmj.2020.0084.
[28] R. Khandelwal, A. Kolte, and M. Rossi, "A study on entrepreneurial opportunities in digital health-care post-COVID-19 from the perspective of developing countries," *Foresight*, vol. 24, no. 3/4, pp. 527–544, 2022, doi: 10.1108/FS-02-2021-0043.
[29] N. Viswanadham, "Ecosystem model for healthcare platform," *Sādhanā*, vol. 46, no. 4, p. 188, 2021, doi: 10.1007/s12046-021-01708-y.
[30] D. Sharma and S. Gupta, "The role of E-Government in modern public health systems," in *Startup-Driven E-Government: Digital Innovation for Sustainable Ecosystems*, IGI Global Scientific Publishing, 2025, pp. 239–272, doi: 10.4018/979-8-3373-0817-3.ch010.
[31] R. Bhatia, "Telehealth and COVID-19: Using technology to accelerate the curve on access and quality healthcare for citizens in India," *Technol. Soc.*, vol. 64, p. 101465, 2021, doi: 10.1016/j.techsoc.2020.101465.
[32] S. H. Tan, Y. Y. Yap, S. K. Tan, and C. K. Wong, "Determinants of telehealth adoption among older adults: Cross-sectional survey study," *JMIR Aging*, vol. 8, no. 1, p. e60936, 2025, doi: 10.2196/60936.
[33] B. E. Bunnell, J. F. Barrera, S. R. Paige, D. Turner, and B. M. Welch, "Acceptability of telemedicine features to promote its uptake in practice: A survey of community telemental health providers," *Int. J. Environ. Res. Public Health*, vol. 17, no. 22, p. 8525, 2020, doi: 10.3390/ijerph17228525.
[34] J. Ye, L. He, and M. Beestrum, "Implications for implementation and adoption of telehealth in developing countries: A systematic review of China's practices and experiences," *NPJ Digit. Med.*, vol. 6, no. 1, p. 174, 2023, doi: 10.1038/s41746-023-00908-6.
[35] M. A. Hincapié, J. C. Gallego, A. Gempeler, J. A. Piñeros, D. Nasner, and M. F. Escobar, "Implementation and usefulness of telemedicine during the COVID-19 pandemic: A scoping review," *J. Prim. Care Community Health*, vol. 11, p. 2150132720980612, 2020, doi: 10.1177/2150132720980612.
[36] K. R. Palmer, M. Tanner, M. Davies-Tuck, A. Rindt, K. Papacostas, M. L. Giles, *et al.*, "Widespread implementation of a low-cost telehealth service in the delivery of antenatal care during the COVID-19 pandemic: An interrupted time-series analysis," *Lancet*, vol. 398, no. 10294, pp. 41–52, 2021, doi: 10.1016/S0140-6736(21)00668-1.

[37] R. E. Scott and M. Mars, "Telehealth in the developing world: Current status and future prospects," *Smart Homecare Technol. TeleHealth*, pp. 25–37, 2015, doi: 10.2147/SHTT.S75184.
[38] D. A. Hoffman, "Increasing access to care: Telehealth during COVID-19," *J. Law Biosci.*, vol. 7, no. 1, p. lsaa043, 2020, doi: 10.1093/jlb/lsaa043.
[39] E. Monaghesh and A. Hajizadeh, "The role of telehealth during COVID-19 outbreak: A systematic review based on current evidence," *BMC Public Health*, vol. 20, pp. 1–9, 2020, doi: 10.1186/s12889-020-09301-4.
[40] F. Khoshrounejad, M. Hamednia, A. Mehrjerd, S. Pichaghsaz, H. Jamalirad, M. Sargolzaei, *et al.*, "Telehealth-based services during the COVID-19 pandemic: A systematic review of features and challenges," *Front. Public Health*, vol. 9, p. 711762, 2021, doi: 10.3389/fpubh.2021.711762.
[41] S. De Simone, M. Franco, G. Servillo, and M. Vargas, "Implementations and strategies of telehealth during COVID-19 outbreak: A systematic review," *BMC Health Serv. Res.*, vol. 22, no. 1, p. 833, 2022, doi: 10.1186/s12913-022-08235-4.
[42] W. M. Bramer, G. B. De Jonge, M. L. Rethlefsen, F. Mast, and J. Kleijnen, "A systematic approach to searching: An efficient and complete method to develop literature searches," *J. Med. Libr. Assoc.*, vol. 106, no. 4, p. 531, 2018, doi: 10.5195/jmla.2018.283.
[43] E. Aromataris and D. Riitano, "Constructing a search strategy and searching for evidence," *Am. J. Nurs.*, vol. 114, no. 5, pp. 49–56, 2014, doi: 10.1097/01.NAJ.0000446779.99522.f6.
[44] M. Sampson, J. McGowan, E. Cogo, J. Grimshaw, D. Moher, and C. Lefebvre, "An evidence-based practice guideline for the peer review of electronic search strategies," *J. Clin. Epidemiol.*, vol. 62, no. 9, pp. 944–952, 2009, doi: 10.1016/j.jclinepi.2008.10.012.
[45] A. Goenka, D. Ma, S. Teckie, C. Alfano, B. Bloom, J. Hwang, and L. Potters, "Implementation of telehealth in radiation oncology: Rapid integration during COVID-19 and its future role in our practice," *Adv. Radiat. Oncol.*, vol. 6, no. 1, p. 100575, 2021, doi: 10.1016/j.adro.2020.09.015
[46] G. De Biase, W. D. Freeman, M. Bydon, N. Smith, D. Jerreld, J. Pascual, *et al.*, "Telemedicine utilization in neurosurgery during the COVID-19 pandemic: A glimpse into the future?," *Mayo Clin. Proc. Innov. Qual. Outcomes*, vol. 4, no. 6, pp. 736–744, 2020, doi: 10.1016/j.mayocpiqo.2020.07.013.
[47] A. W. Gilbert, J. C. Billany, R. Adam, L. Martin, R. Tobin, S. Bagdai, *et al.*, "Rapid implementation of virtual clinics due to COVID-19: Report and early evaluation of a quality improvement initiative," *BMJ Open Qual.*, vol. 9, no. 2, p. e000985, 2020, doi: 10.1136/bmjoq-2020-000985.
[48] D. Jiménez-Rodríguez, A. Santillán García, J. Montoro Robles, M. D. M. Rodríguez Salvador, F. J. Muñoz Ronda, and O. Arrogante, "Increase in video consultations during the COVID-19 pandemic: Healthcare professionals' perceptions about their implementation and adequate management," *Int. J. Environ. Res. Public Health*, vol. 17, no. 14, p. 5112, 2020, doi: 10.3390/ijerph17145112.
[49] J. Nicholas, I. H. Bell, A. Thompson, L. Valentine, P. Simsir, H. Sheppard, and S. Adams, "Implementation lessons from the transition to telehealth during COVID-19: A survey of clinicians and young people from youth mental health services," *Psychiatry Res.*, vol. 299, p. 113848, 2021, doi: 10.1016/j.psychres.2021.113848.
[50] P. A. Newman-Casey, L. De Lott, J. Cho, D. Ballouz, L. Azzouz, S. Saleh, and M. A. Woodward, "Telehealth-based eye care during the COVID-19 pandemic: Utilization, safety, and the patient experience," *Am. J. Ophthalmol.*, vol. 230, pp. 234–242, 2021, doi: 10.1016/j.ajo.2021.04.014.
[51] K. L. Bennell, B. J. Lawford, B. Metcalf, D. Mackenzie, T. Russell, M. van den Berg, *et al.*, "Physiotherapists and patients report positive experiences overall with telehealth during the COVID-19 pandemic: A mixed-methods study," *J. Physiother.*, vol. 67, no. 3, pp. 201–209, 2021, doi: 10.1016/j.jphys.2021.06.009.
[52] J. D. Hron, C. R. Parsons, L. A. Williams, M. B. Harper, and F. C. Bourgeois, "Rapid implementation of an inpatient telehealth program during the COVID-19 pandemic," *Appl. Clin. Inform.*, vol. 11, no. 3, pp. 452–459, 2020, doi: 10.1055/s-0040-1713635.
[53] T. K. Manyati and M. Mutsau, "Exploring the effectiveness of telehealth interventions for diagnosis, contact tracing and care of Corona Virus Disease of 2019 (COVID-19) patients in sub Saharan Africa: A rapid review," *Health Technol.*, vol. 11, no. 2, pp. 341–348, 2021, doi: 10.1007/s12553-020-00485-8.
[54] K. Shafi, F. Lovecchio, K. Forston, J. Wyss, E. Casey, J. Press, *et al.*, "The efficacy of telehealth for the treatment of spinal disorders: Patient-reported experiences during the COVID-19 pandemic," *HSS J.*, vol. 16, no. 1_suppl, pp. 17–23, 2020, doi: 10.1007/s11420-020-09808-x.
[55] K. Bouabida, B. Lebouché, and M. P. Pomey, "Telehealth and COVID-19 pandemic: An overview of the telehealth use, advantages, challenges, and opportunities during COVID-19 pandemic," in *Healthcare*, vol. 10, no. 11, p. 2293, Nov. 2022, doi: 10.3390/healthcare10112293.
[56] S. Doraiswamy, A. Abraham, R. Mamtani, and S. Cheema, "Use of telehealth during the COVID-19 pandemic: Scoping review," *J. Med. Internet Res.*, vol. 22, no. 12, p. e24087, 2020, doi: 10.2196/24087.
[57] R. L. Parisien, M. Shin, M. Constant, B. M. Saltzman, X. Li, W. N. Levine, and D. P. Trofa, "Telehealth utilization in response to the novel coronavirus (COVID-19) pandemic in orthopaedic surgery," *JAAOS-J. Am. Acad. Orthop. Surg.*, vol. 28, no. 11, pp. e487–e492, 2020, doi: 10.5435/JAAOS-D-20-00339.
[58] P. W. Tuerk, S. M. Keller, and R. Acierno, "Treatment for anxiety and depression via clinical videoconferencing: Evidence base and barriers to expanded access in practice," *Focus*, vol. 16, pp. 363–369, 2019, doi: 10.1176/appi.focus.20180027.
[59] K. Bouabida, K. Malas, A. Talbot, M. È. Desrosiers, F. Lavoie, B. Lebouché, *et al.*, "Healthcare professional perspectives on the use of remote patient-monitoring platforms during the COVID-19 pandemic: A cross-sectional study," *J. Pers. Med.*, vol. 12, no. 4, p. 529, 2022, doi: 10.3390/jpm12040529.
[60] L. Van Dyk, "A review of telehealth service implementation frameworks," *Int. J. Environ. Res. Public Health*, vol. 11, no. 2, pp. 1279–1298, 2014, doi: 10.3390/ijerph110201279.

[61] A. C. Smith, E. Thomas, C. L. Snoswell, H. Haydon, A. Mehrotra, J. Clemensen, and L. J. Caffery, "Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19)," *J. Telemed. Telecare*, vol. 26, no. 5, pp. 309–313, 2020, doi: 10.1177/1357633X20916567.
[62] M. S. Neubauer *et al.*, "Learning from the pandemic: The future of meetings in HEP and beyond," *arXiv preprint*, arXiv:2106.15783, 2021, doi: 10.48550/arXiv.2106.15783.
[63] D. J. Carlberg *et al.*, "Preliminary assessment of a telehealth approach to evaluating, treating, and discharging low-acuity patients with suspected COVID-19," *J. Emerg. Med.*, vol. 59, no. 6, pp. 957–963, 2020, doi: 10.1016/j.jemermed.2020.08.007.
[64] World Health Organization, "Videoconferencing system, Telemedicine Core medical equipment – Information," *WHO Medical Devices*, 2017.
[65] Q. Wang, M. Su, M. Zhang, and R. Li, "Integrating digital technologies and public health to fight Covid-19 pandemic: Key technologies, applications, challenges and outlook of digital healthcare," *Int. J. Environ. Res. Public Health*, vol. 18, no. 11, p. 6053, 2021, doi: 10.3390/ijerph18116053.
[66] R. Filip, R. G. Puscaselu, L. Anchidin-Norocel, M. Dimian, and W. K. Savage, "Global challenges to public health care systems during the COVID-19 pandemic: A review of pandemic measures and problems," *J. Pers. Med.*, vol. 12, no. 8, p. 1295, 2022, doi: 10.3390/jpm12081295.
[67] J. A. Bielicki, X. Duval, N. Gobat, H. Goossens, M. Koopmans, E. Tacconelli, and S. van der Werf, "Monitoring approaches for health-care workers during the COVID-19 pandemic," *Lancet Infect. Dis.*, vol. 20, no. 10, pp. e261–e267, 2020, doi: 10.1016/S1473-3099(20)30458-8.
[68] P. Cinar *et al.*, "Safety at the time of the COVID-19 pandemic: How to keep our oncology patients and healthcare workers safe," *J. Natl. Compr. Cancer Netw.*, vol. 18, no. 5, pp. 504–509, 2020, doi: 10.6004/jnccn.2020.7572.
[69] V. Ardhyantama and D. Idayani, "Two-way communication in distance learning," in *Proc. Int. Conf. Future Educ. (IConFEd)*, 2020, pp. 404–410.
[70] M. Y. L. Yeung, H. H. M. Cheng, P. T. W. Chan, and D. W. Y. Kwok, "Communication technology and teacher–student relationship in the tertiary ESL classroom during the pandemic: A case study," *SN Comput. Sci.*, vol. 4, no. 2, p. 202, 2023, doi: 10.1007/s42979-023-01667-7.
[71] M. C. Jaklevic, "Telephone visits surge during the pandemic, but will they last?," *JAMA*, vol. 324, no. 16, pp. 1593–1595, 2020, doi: 10.1001/jama.2020.17201.
[72] R. Latifi, C. R. Doarn, and R. C. Merrell, *Telehealth and Telepresence*, 2021.
[73] S. M. Adams, M. J. Rice, S. L. Jones, E. Herzog, L. J. Mackenzie, and L. G. Oleck, "TeleMental Health: Standards, reimbursement, and interstate practice," *J. Am. Psychiatr. Nurses Assoc.*, vol. 24, no. 4, pp. 295–305, 2018, doi: 10.1177/1078390318763963.
[74] D. Efendi and D. Sari, "Aplikasi mobile–health sebagai upaya peningkatan kualitas pelayanan keperawatan anak dengan penyakit kronis pada setting home hospital," *J. Keperawatan Indones.*, vol. 20, no. 1, pp. 1–8, 2017, doi: 10.7454/jki.v20i1.447.