Review

Paradoxes in Telemedicine Services: Analysis of Challenges and Opportunities for the Future of Digital Health - A Systematic Literature Review

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Review

Paradoxes in Telemedicine Services: Analysis of Challenges and Opportunities for the Future of Digital Health - A Systematic Literature Review

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Abstract: Telemedicine has become an interesting research topic in recent years, especially since the start of the COVID-19 pandemic. This article conducts research using a systematic literature review to identify paradoxes in telemedicine services. The research method follows the steps in a systematic literature review, by accessing the Scopus journal database to search for relevant articles between 2018 and 2024. The selected articles were selected based on certain inclusion and exclusion criteria, resulting in 28 relevant articles which were then analyzed to understand findings related to paradoxes in telemedicine services. The research results show four main clusters of paradoxes in telemedicine research, namely health services, health quality, the COVID-19 pandemic, and technology. Each cluster shows complex opportunities and challenges in efforts to improve health services through telemedicine. Understanding the clusters for each article can then be mapped to the organizational categories in the Dynamic Equilibrium Model. In conclusion, this study provides a comprehensive insight into the paradoxes in telemedicine services, highlighting the importance of understanding the various aspects involved in the adoption and implementation of this technology. With a better understanding of this paradox, it is hoped that society and health practitioners can overcome the challenges and exploit the opportunities offered by telemedicine to improve the accessibility and quality of health services in the future.

Keywords: paradox; telemedicine; health services; opportunities; challenges; digital health

1. Introduction

In the last few decades, remote health services have emerged as a major focus of researchers in efforts to improve the accessibility and quality of health services [1], especially in remote areas [2,3] or difficult to reach by medical personnel. Telemedicine, as a primary solution for remote healthcare, has become an increasingly popular research subject [4,5]. This technology allows healthcare providers to interact with patients virtually through a variety of platforms, including telephone, video conferencing [6], and mobile applications [7]. The implementation of telemedicine has brought significant benefits [3], such as increasing the accessibility of health services, reducing the cost of care, and expanding the scope of services.

However, despite the great potential that telemedicine has, several challenges need to be overcome [3]. Although this technology provides many benefits, significant barriers are preventing its wider adoption. Some of these challenges include the uneven availability of technological infrastructure [8] in various regions, data privacy and security issues [9], and a lack of trust from patients and health service providers in the quality of services provided virtually [3]. Additionally, concerns remain regarding the effectiveness of remote diagnosis [10] and treatment compared with conventional services.

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This study aims to explore the paradoxes in the use of telemedicine technology in a healthcare context [11]. The paradox includes the challenges and opportunities associated with the application of these technologies in improving the accessibility and quality of health services [12]. On the one hand, telemedicine technology offers a great opportunity to overcome geographic and economic barriers to healthcare accessibility. However, on the other hand, there are complex challenges related to data security, service quality, and acceptance by society. This paradox reflects the paradox in the organizational category, where technological innovation often brings opportunities that are simultaneously accompanied by challenges that must be overcome [13,14].

By understanding this paradox, this study aims to provide deeper insight into the use of telemedicine technology in healthcare. By considering existing challenges and opportunities [3], it is hoped that this research can provide valuable guidance for policy development, implementation strategies, and better technology development in the future [15]. Through a systematic approach to analyzing related literature, this research is expected to present a comprehensive understanding of the dynamics that exist in the implementation of telemedicine in the health service context [16].

The study is structured as follows: Section 2 presents a comprehensive literature review on healthcare, paradoxes, and telemedicine technology. Section 3 discusses the methods used to collect and analyze literature studies. Section 4 discusses the results of the literature collection. Section 5 examines the paradoxical opportunities and challenges contained in the literature used. Section 6 describes the conclusions followed by Section 7 which explains the implications of the research. Finally, limitations and directions for further research are provided.

2. Literature Review

2.1. Health Services

In literature studies on health services, the main focus is on ways to improve the accessibility and quality of services for individuals, especially amidst the challenges faced by the global health system. Accessibility is key in ensuring that individuals can obtain necessary health services without significant barriers [17,18]. Challenges in achieving equitable accessibility include geographic, economic, and cultural disparities. In many countries, there is inequality in the distribution of health facilities [19], with rural or remote areas often having limited access to adequate health services [2]. Cost is also a key factor influencing healthcare accessibility. A health system that is expensive or dependent on health insurance often makes it difficult for individuals with limited financial resources to obtain the services they need. Financial hardship [20] may also encourage some individuals to delay or even avoid health care, which in turn may lead to more serious health problems.

The quality of health services is an important aspect to consider [21]. Quality of service includes not only medical expertise, but also includes patient experience, treatment effectiveness, and patient safety [22–24]. Challenges in maintaining quality healthcare include a lack of resources, limited knowledge, and the complexity of medical conditions. It is also important to pay attention to the security aspects of health services. Patient safety [25,26] is a top priority in any health system, and challenges in maintaining security include the risk of nosocomial infections, errors in medication, and medical data security issues [27].

In facing these challenges, various efforts have been made to improve the accessibility and quality of health services. This includes the development of public health programs, health promotion, medical education, digital health literacy [28], and the development of supportive policies. Despite this, much work still needs to be done to achieve the goal of inclusive and quality health care for all individuals [29].

2.2. The Paradox of Dynamic Equilibrium

The study of paradoxes in the field of management has received much attention [30]. The paradox of dynamic equilibrium is a common phenomenon in various industrial sectors [12], including in the healthcare context. One relevant example is the paradox between established standards and an organization's ability to meet those standards. In various industries, there is often

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a need to comply with certain standards, either those set by regulatory bodies or those that are part of industry best practices. However, in practice, organizations often face difficulties [31] in consistently achieving these standards.

This paradox can occur for several reasons, one of which is the pressure to increase efficiency and productivity, which often conflicts with efforts to comply with certain standards [32]. For example, in the manufacturing industry, there is pressure to reduce production costs and lead times, but this could potentially reduce product quality or work safety. In addition, paradoxes can also arise when there is a difference between customer expectations and the organization's ability to meet these expectations, as well as the role of leadership [33]. In some cases, organizations may set high standards to meet customer expectations, but the gap between expectations and actual performance can create a paradox. For example, the rise and fall of the Indian airline Kingfisher Airlines Ltd (KFA) and its flamboyant promoters [34]. The author draws parallels between Icarus and KFA and presents how both suffered the same fate due to misplaced overconfidence.

When faced with this paradox, organizations often seek to find a dynamic balance between meeting established standards and maintaining operational effectiveness. They may develop strategies to increase efficiency without sacrificing quality or compliance. For example, by adopting new technologies or optimizing work processes, organizations can improve their performance in meeting existing standards [16]. However, achieving dynamic balance is not easy. A deep understanding of the various factors that influence organizational performance is required, as well as the ability to adapt to changes in the environment and market needs. Additionally, building an organizational culture that supports innovation and continuous improvement [16] is also key to effectively dealing with this paradox. Contingency theory offers an alternative approach, which explores how organizations can attend to conflicting paradoxes simultaneously. Smith & Lewis [35] say that tension is inherent and persistent, and describe how deliberate and cyclical responses to paradoxes over time enable the continuation of peak performance in the present which enables future success [30]. Paradox categories include belonging, learning, organizing, and performing [35].

2.3. Telemedicine

The concept of telemedicine refers to the provision of health services remotely through the use of information and communication technology (ICT), which allows interaction between healthcare providers and patients without having to meet face to face. It transforms the traditional way of providing healthcare by leveraging the benefits of technology to improve accessibility, efficiency, and quality of care. One of the main aspects of telemedicine is the availability of remote medical consultations [36]. This could involve live video consultations between a doctor and patient, the exchange of medical information via text message or email, or the use of health apps that allow patients to monitor their health conditions and communicate with health professionals online. This approach has great potential to improve the accessibility of health services, especially for those who live in remote areas or have limited mobility [37].

Telemedicine is also applied in the fields of mental health, emergency services, chronic disease management, and rehabilitation. In this case, technology is used to provide the necessary medical [38] and psychological support without the need for physical presence in a health facility. For example, a person suffering from depression can access counseling online, or a patient experiencing a heart attack can monitor their health condition and receive medical advice remotely [39].

While offering many advantages, telemedicine also faces several challenges that need to be overcome [40]. One of them is the issue of privacy and security of medical data, especially when sensitive information is exchanged via digital platforms. Inadequate data protection can lead to the risk of misuse of patient personal information. Additionally, not everyone has access or the skills [41] to use technology well, which can create access disparities in health care.

3. Methods

This research methodology follows a series of stages in a systematic literature review. First of all, on May 5, 2024, articles were collected using a systematic method by accessing the Scopus journal

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database. The articles collected were articles that had been published between 2018 and 2024. The article search process was carried out using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method [42]. This search aimed to identify articles discussing paradoxes in telemedicine services.

Article data was collected by searching the Scopus database. Keywords relevant to the research topic were used to search for articles, with searches carried out on the title, abstract, and keywords. Keywords used include "telemedicine", "telehealth", "telecare", "telemonitoring", "telepractice", "telenursing", along with the keywords "paradox", "opportunity", and "challenge". The search query is set to return articles that have been published from 2018 to the present:

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( TITLE-ABS-KEY ( telemedicine OR telehealth OR telecare OR telemonitoring OR telepractice
OR telenursing ) AND TITLE-ABS-KEY ( paradox OR opportunity OR challenge ) ) AND PUBYEAR >
2017
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This search yielded a database of 11,053 articles. From this data, a selection stage was carried out to filter articles based on predetermined inclusion and exclusion criteria. The selected articles are only articles with the type "article", and source "journal", and have reached the "Final" publication stage. After selection, 6,908 articles met these criteria. The evaluation stage is carried out to evaluate the quality and relevance of the article to the research topic. Selected articles are evaluated based on scientific fields, by considering only articles related to the fields of "Business, Management, and Accounting". After evaluation, there were 97 articles related to this field of science.

Of the 97 articles, further selection was carried out to select articles with relevant topics, available in open access, and in English. A total of 28 articles that met these criteria were selected for further study. Data from selected articles were extracted and synthesized to understand existing findings about paradoxes in telemedicine services. This method allows researchers to present a comprehensive and in-depth analysis of the research topic.

The overall series of stages in the research methodology for conducting a systematic literature review of articles discussing paradoxes in telemedicine services is shown in Figure 1.

The final stage of this research involved the synthesis and interpretation of data from the collected articles. Data from selected articles were extracted and synthesized to understand existing findings. Key information from each article was identified, extracted, and gathered together to form a comprehensive picture of paradoxes in telemedicine services. The results of data synthesis are analyzed and interpreted to conclude important findings in the research context. Analysis and interpretation are carried out in two ways, namely *Quantitative-Bibliometric* [43,44] and *Qualitative-Narrative*.

In *Quantitative-Bibliometric Analysis*, bibliometric data from selected articles is analyzed quantitatively to identify trends, patterns, and relationships between observed variables. We used VOSviewer [43,45] as a tool for this analysis. Meanwhile, *in Qualitative-Narrative Analysis*, qualitative data from these articles is analyzed narratively to describe the findings in depth. This approach involves reading, interpreting, and narrative synthesis of the information found in the selected articles.

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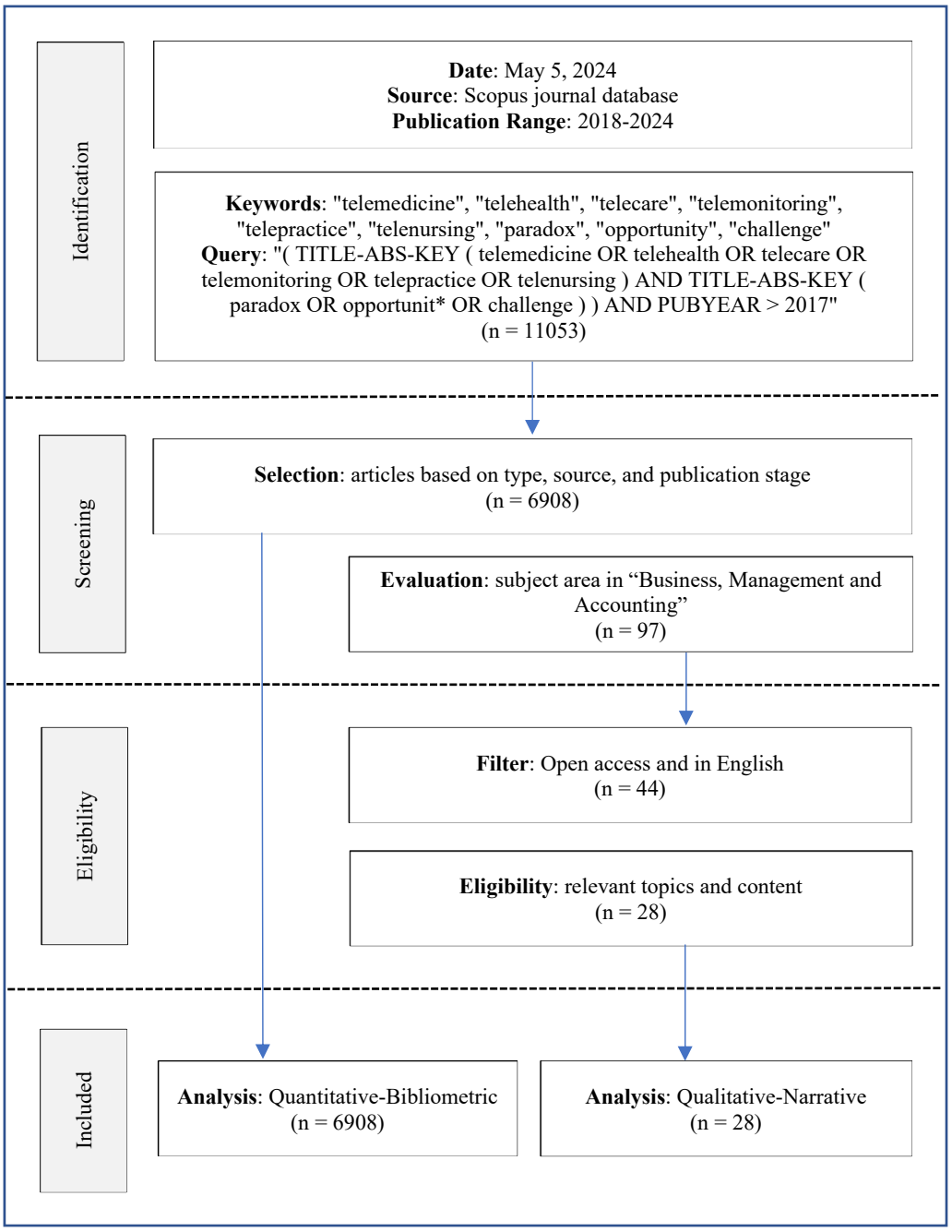

Figure 1. Series of Stages in Research Methodology.

4. Results

4.1. Quantitative Data

Studies related to telemedicine have been in the spotlight of researchers for some time. The data presented in Figure 2 shows an increase in the number of published articles related to telemedicine from 2010 to 2023. At the beginning of this period, the number of articles was relatively stable and continues to increase consistently every year. A particularly significant spike occurred in 2020 and 2021, where the number of articles jumped dramatically to 10,492 and 12,143, respectively. This striking spike is likely related to the COVID-19 pandemic which has driven the accelerated adoption of telemedicine technology as an alternative to conventional healthcare services [46,47]. The pandemic has drastically affected the global health system, sparking increased awareness of the benefits of telemedicine in providing healthcare services remotely. The impact of this pandemic has

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also accelerated the development of telemedicine technology, as well as stimulated related research and publications.

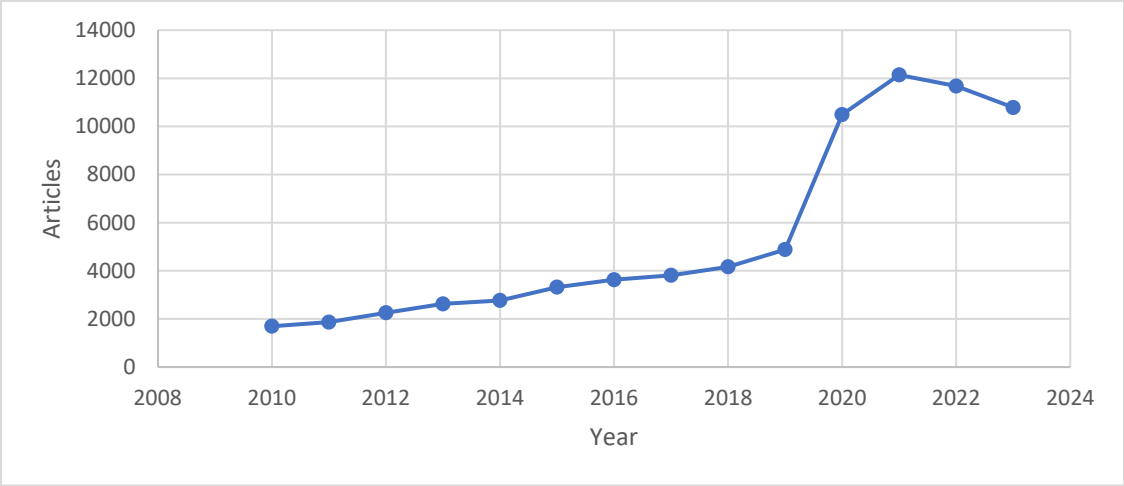

Figure 2. Increase in the publication of telemedicine articles each year.

Even though there will be a slight decrease in 2022 and 2023, the number of articles remains high, reaching 11,677 and 10,786 articles. This suggests that interest and focus on telemedicine remains high among health researchers and practitioners, despite a decline compared to the peak in 2021. Overall, this data reflects a strong upward trend in telemedicine-related research, with a significant spike occurring during the COVID-19 pandemic -19. These increases reflect a significant shift in the way healthcare is delivered and understood and demonstrate the importance of telemedicine in improving the accessibility and quality of healthcare worldwide. It is hoped that this development will make a major contribution to shaping the future of more efficient and inclusive health services.

The importance of telemedicine technology in improving access and quality of health services is also demonstrated based on research in countries around the world. Data analysis as shown in Figure 3 shows that the United States with a total of 30692 articles is the most popular country in the publication of articles related to telemedicine, with a much higher contribution than other countries. This reflects the United States' position as a center for innovation and development in health technology, as well as the existence of an advanced health system. Followed by the United Kingdom, the second largest contributor to the telemedicine literature, showing significant attention to the use of technology in the provision of health services. Furthermore, Australia and Canada also made significant contributions, indicating their focus on developing telemedicine solutions to meet public health needs.

In Europe, other countries such as Italy, Germany, and Spain have also shown significant contributions to telemedicine research. This reflects their efforts to integrate technology into the health system and expand the scope of health services through telemedicine. Additionally, in Asia, India and China dominate in the number of publications, indicating increasing attention to the implementation of technology in providing greater healthcare access in countries with large and widely dispersed populations.

Countries with advanced health systems such as Japan, South Korea, and Singapore also stand out in contributions to the telemedicine literature. This shows that telemedicine technology is not only relevant in the context of developing countries but is also important in improving the efficiency and accessibility of health services in developed countries. However, the role of developing countries such as Brazil, South Africa, and Iran in telemedicine research is also noteworthy. This shows their efforts to overcome public health challenges by utilizing telemedicine technology, although there are still several obstacles that need to be overcome.

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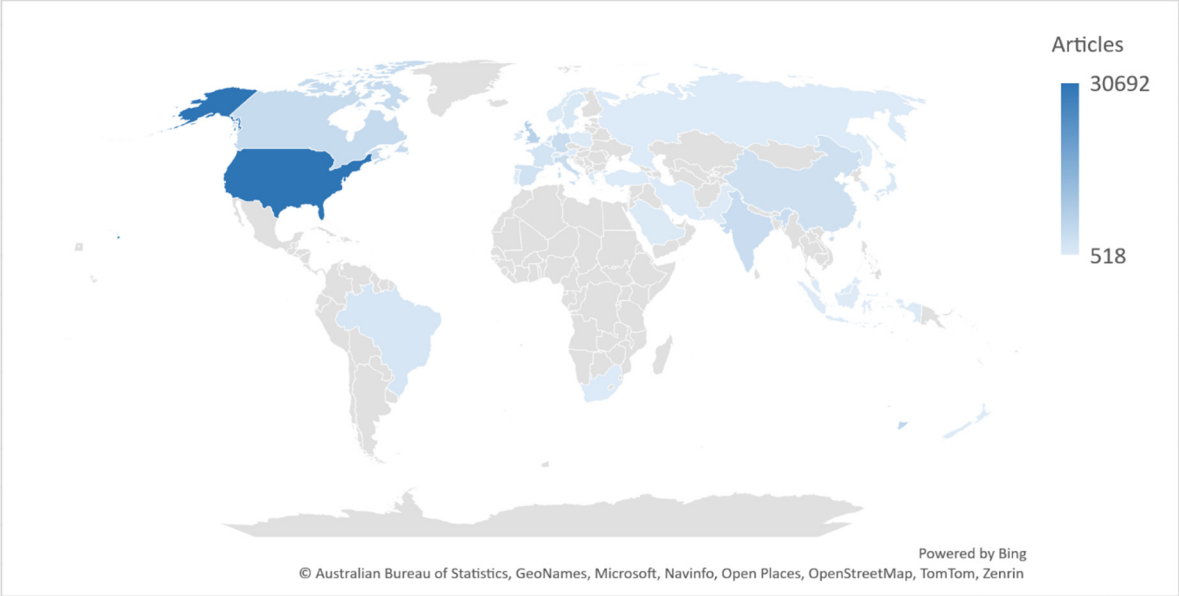

Figure 3. Telemedicine article publications by country.

Next, using Quantitative-Bibliometric data (n = 6908), a graphical representation of the bibliometric results was produced which shows the correlation of keywords in the article database collection. This graphical representation is shown in Figure 4. "Co-occurrence" analysis in the context of Network Visualization VOSviewer shows the co-occurrence of two or more keywords or items in an article. When two items appear together frequently in one article, they are considered to "co-occur" or "together." In this network visualization, items are represented by their labels and by default also by circles. The size of the item's label and circle is determined by the weight of the item. The higher the item weight, the larger the item's label and circle. The distance between the two journals in the visualization shows the relatedness of the journals in terms of co-citation links. In general, the closer two journals are to each other, the stronger their association. The strongest co-citation links between journals are also represented by lines. From the figure, it can be seen that many articles with the keyword item "telemedicine" often appear together with "COVID-19", this shows that the two concepts are interrelated in the context of telemedicine research during the COVID-19 pandemic.

From this VOSviewer visualization, it can be seen that four clusters represent the relationship between various keywords or concepts in telemedicine research. The following is an explanation for each cluster:

- *Cluster 1 (red)*: Health services. This cluster consists of keywords related to aspects of public health and primary health services, such as "health care access", "health care delivery", "primary health care", and "public health". The nodes in this cluster demonstrate the importance of health service accessibility, health service delivery, and the role of primary health care in the context of telemedicine.
- *Cluster 2 (green)*: Health quality. This cluster includes keywords related to mental health and quality of life, such as "mental health", "quality of life", and "patient satisfaction". This shows the focus of research on the psychological aspects and quality of life of patients when using telemedicine.
- *Cluster 3 (blue)*: COVID-19 pandemic. This cluster includes keywords related to the COVID-19 pandemic and viral infections, such as "COVID-19", "coronavirus infection", "pandemic", and "virus pneumonia". This shows that the COVID-19 pandemic has been an important factor driving research on the use of telemedicine in managing the pandemic and treating patients infected with the virus.
- *Cluster 4 (yellow)*: Technology. This cluster consists of keywords related to telemedicine technology and its applications, such as "telemedicine", "eHealth", "mhealth", and "telehealth".

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The nodes in this cluster represent research on various technical aspects of telemedicine, including technology platforms, mobile applications, and remote consultations.

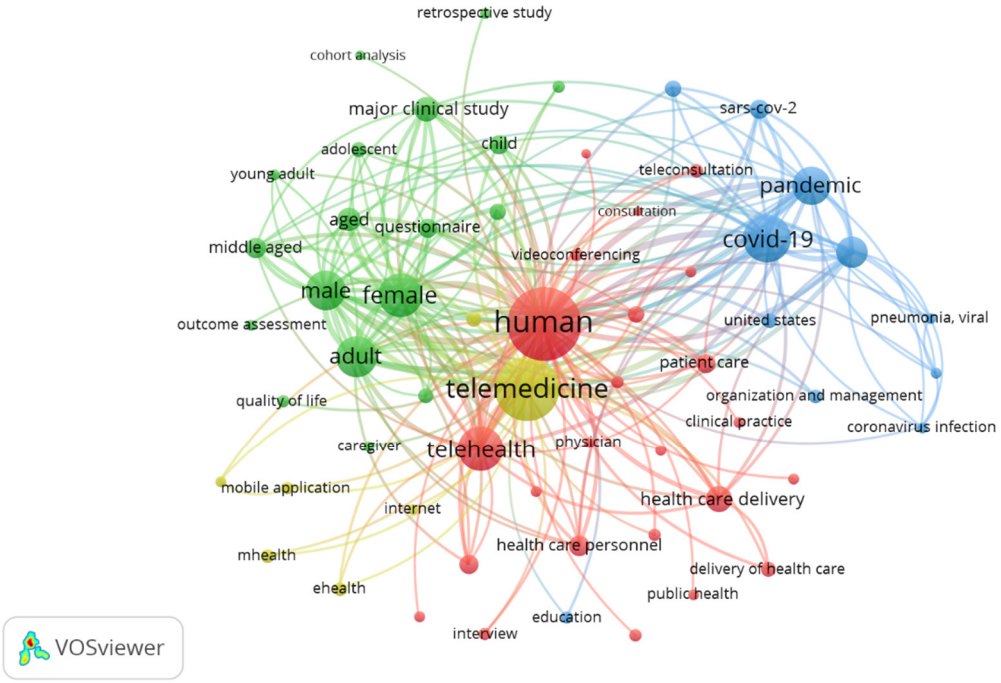

Figure 4. Visualization of article keyword "co-occurrence" in VOSviewer.

4.2. Qualitative Data

We selected a total of 28 relevant article documents for further study to explore paradoxical findings in terms of opportunities and challenges in telemedicine services. From this document, we divided into 2 groups, namely the pre-COVID article group, namely all articles published before the COVID-19 pandemic (2018-2019). Next, is the post-COVID article group, namely all articles published during and after the COVID-19 pandemic (2020-2024). We did this by sorting into 2 groups to find out and understand the characteristics of opportunities and challenges in each era in the context of implementing telemedicine services.

We present article data with information on the name of the writing team, year of publication, purpose, and research findings that focus on opportunities and challenges. In this case, opportunity and challenge are paradoxical elements that are contrasted in each article.

4.2.1. Pre-COVID Telemedicine Services Articles

The pre-COVID articles as presented in Table 1 show several articles from the era before COVID-19 which hit the world in 2018 and 2019. Several studies were conducted to explore paradoxes in telemedicine technology services. The significant growth in telehealth literature suggests opportunities for the development of more advanced telehealth technologies. Telehealth adoption can increase the accessibility of healthcare services, especially in rural areas, and also enable providers to provide healthcare services at lower costs.

Table 1. Pre-COVID telemedicine articles (2018-2019).

Code	Authors	Year	Purpose	Findings	
				Opportunities	Challenges
B1	Nielsen K.D.; Langstrup H.	2018	Exploring how patients express their participation in various ways through e-health technologies.	• Active involvement of patients in managing their health. • Adoption of e-health technology can improve the quality of health care and enable patients to monitor their conditions.	The implementation to involve is unpredictable.
B2	Standing C.; Standing S.; McDermott M.-L.; Gururajan R.; Kiani Mavi R.	2018	Analyzes telehealth literature from 2000 to 2015 focusing on paradoxes.	Growth in telehealth literature, opportunities for the development of more advanced telehealth technologies.	Disadvantages of telehealth operational models in capturing value.
B3	Samerski S.	2018	Investigate how digital epidemiology and eHealth together become a solid health surveillance system, changing current concepts about the body and health.	• Opportunity to develop a strong health surveillance system by leveraging digital technology and eHealth. • Developments in the fields of Big Data and Quantified Self enable more individualized health monitoring.	Patients are considered a risk profile and are encouraged to perceive and manage themselves as a collection of health and safety risks.
B4	Dash M.; Shadangi PY; Kar S.; Prusty R.	2019	Analyze the factors influencing the adoption of telemedicine services by doctors in India.	• Adoption of telemedicine services can improve the accessibility and quality of health services, especially in rural areas. • Telemedicine is becoming a cheaper channel to provide healthcare services to patients. • Digital OPD services bring about a cultural shift towards providing digital healthcare services.	• Doctors experience barriers in accepting and using telemedicine technology. • Lack of digital infrastructure and limited knowledge of medical technology.

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B5	Samerski S.; Müller H.	2019	To examine the perspectives and status of stakeholders in the German health system and to develop the concept of digital health literacy.	• Digital transformation in Germany is considered the key to "growth and prosperity", a great opportunity for innovation and progress. • The importance of digital health literacy as a prerequisite for patient-oriented digitalization of the health system. • Patients are a central aspect in assessing digital health technology, taking into account patient needs in terms of digital health literacy.	• Lack of attention to digital health literacy. • The experts interviewed did not have a common understanding of digital health literacy, disagreeing on how to promote it. • Disagreement on how to develop effective strategies to improve digital health literacy.
B6	Eklund C.; Elfström ML; Eriksson Y.; Soderlund A.	2019	• Exploration of user experience of web applications to support stress management behavior change. • Identify what needs to be developed or adjusted so that it can be tested.	• Users expressed acceptance of the use of web-based programs for stress-related problems. • The program helps users understand their stress.	• Challenges in creating programs that are effective and efficient for users. • Requires a fair amount of support, and is not too complicated or time-consuming for users. • Further consideration is needed regarding user perceptions of the program.

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Several studies have focused on aspects of patient needs, showing that applications such as e-health provide great opportunities for patients to play an active role in managing their health. The adoption of e-health technology can improve the quality of health care by allowing patients to monitor their conditions. Conceptual research was conducted to explore how digital epidemiology and eHealth can come together to form a solid health surveillance system. It was found that digital technology and eHealth provide opportunities to develop robust health surveillance systems. Developments in the fields of Big Data and Quantified Self enable more individualized health monitoring, which can improve understanding of the health of populations as a whole. Still focused on patients, exploration was carried out on the user experience of web applications that support changes in stress management behavior. This web-based program provides opportunities for users to understand and manage their stress and offers accessible and cost-effective solutions to improve mental health.

Research in this era also focuses on the side of medical personnel, analyzing the factors that influence the adoption of telemedicine services among doctors. This adoption of telemedicine can improve the accessibility and quality of health services, especially in rural areas. Telemedicine can also be a cheaper channel for providing healthcare services to patients. On the other hand, other studies examine the perspectives of stakeholders in the health system. Digital transformation is considered the key to growth and prosperity, offering great opportunities for innovation and progress. The importance of digital health literacy is also recognized as a prerequisite for patient-oriented digitalization of health systems.

Even though there are great opportunities for telemedicine services, research in this era also finds that there are challenges that must be faced. One of them is the use of telemedicine applications for unpredictable patients. The lack of digital infrastructure and medical technology knowledge can be a barrier to the adoption of telemedicine technology. There are also challenges in establishing who is responsible for increasing digital health literacy, as well as disagreement on effective strategies for increasing this literacy. Likewise, providing effective and efficient programs to users is a challenge in itself, given the differences in user perceptions and the technical complexity involved.

4.2.2. Post-COVID Telemedicine Services Article

The post-COVID articles as presented in Table 2 show that in the period 2020 to 2024, there has been a significant increase in research discussing the paradox of telemedicine technology services. Most studies show that telemedicine has great opportunities to improve the accessibility, quality, and efficiency of health services, especially during the COVID-19 pandemic. Telemedicine provides the opportunity to provide healthcare services without physical limitations, reduces pressure on hospitals, and allows patients to stay connected with their healthcare providers.

One of the great potentials of telemedicine during the COVID-19 pandemic is increasing the accessibility of health services, especially in rural and remote areas. With telemedicine, patients in areas that are difficult to reach by traditional health services can obtain medical consultations and treatment without having to travel long distances. This also helps reduce disparities in the health system between urban and rural areas. Several benefits of telemedicine services have been felt, such as treating patients with chronic pain during the pandemic, and telehealth providing easier access for patients. In the context of mobile health (mHealth) application use, data protection, and physician recommendations can increase user interest and participation. The use of 5G and Internet of Things (IoT) technology has also provided innovative solutions in fighting the COVID-19 pandemic, such as telehealth, contact tracing, and distance education.

Table 2. Post-COVID telemedicine articles (2020-2024).

Code	Authors	Year	Purpose	Findings	
				Opportunities	Challenges
P1	Lupiáñez-Villanueva F.; Folkvord F.; Abeele MV	2020	Investigate mobile health (mHealth) application business model factors that influence adoption rates and user willingness to pay revenue models, data protection models, recommendation models, and provider models.	• Data protection increases people downloading health apps. • Doctor recommendations increase people paying for and downloading health apps. • Apps produced by medical organizations are more likely to be downloaded. • People with a health information orientation and health literacy are more likely to be willing to pay for and download apps.	• Data protection does not increase willingness to pay for applications. • The data privacy element cannot be used as a selling point.
P2	Siriwardhana Y.; De Alwis C.; Gur G.; Ylianttila M.; Liyanage M.	2020	To show how 5G and Internet of Things (IoT) technology can be used and developed to fight the COVID-19 pandemic.	• 5G and IoT technology can be used in various sectors, including health, education, retail, government, and manufacturing, to provide innovative solutions in fighting the pandemic. • Solutions such as telehealth, contact tracing, and distance education can enable the continuation of daily activities even amid a pandemic.	• Technical and non-technical challenges that must be overcome, such as infrastructure, data security, and regulations. • Implementation of 5G technology requires major investments in infrastructure and policies.
P3	Rhodes A.; Martin S.; Guarna J.; Vowles K.; Allen T.	2020	Development of a behavioral-contextual perspective on the treatment of patients with chronic pain during the COVID-19 pandemic.	Telehealth can provide easier access for chronic pain patients during periods of mandatory physical distancing.	• Difficulty accessing care and changes in the way mental health services are provided. • Implementation of telehealth with Contextualized Behavioral Therapy (ACT) has technical barriers.
P 4	Zobair KM; Sanzogni L.; Sandhu K.	2020	Investigating barriers to telemedicine adoption in centers hosted by public hospitals in rural Bangladesh.	Telemedicine adoption improves access and quality of health services in rural Bangladesh.	• Lack of organizational effectiveness, health staff motivation, patient satisfaction, and trust.

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					• Lack of information and communication technology infrastructure, resource allocation, and service quality in rural areas.
P5	Müller SD; Wehner DL; Konzag H.; Vesterby M.; Høybye MT	2021	Investigating the paradoxical success of the telehealth platform project "My Pathway" in Denmark to reduce the duration of patient hospitalization while maintaining patient satisfaction.	• Telehealth has succeeded in reducing the duration of patient hospitalization and maintaining patient satisfaction. • Patient satisfaction and reduced length of hospitalization are positive potentials of telehealth to increase healthcare efficiency.	• Lack of use of telehealth platforms. • Barriers to the adoption of telehealth technology influence platform use, so the platform does not have a direct impact on project success.
P6	Shah A.; Guessi M.; Wali S.; Ware P.; McDonald M.; O'Sullivan M.; Posada JD; Ross H.; Seto E.	2021	Understanding the experience of using virtual cardiac care during the COVID-19 pandemic at Toronto General Hospital, Canada.	• Virtual care adoption has increased due to the COVID-19 pandemic. • Improving access and efficiency in cardiac care. • A focus on patient safety is driving the adoption of virtual care. • The gradual approach of virtual care adoption creates adaptive resilience in cardiac care during the pandemic.	• Virtual care solutions are partial and not comprehensive. • Sudden changes in roles and workload for clinic personnel and staff. • Difficulty building long-distance relationships. • Inequality of access to health services.
P7	Guarcello C.; Raupp E.	2021	Analyzing the impact of the pandemic on innovation in the health sector and proposing an end-to-end innovation adoption model.	• The pandemic pushed health systems to innovate, focusing on efficient and effective solutions such as telemedicine. • Telemedicine innovation reduces pressure on hospitals and the spread of COVID-19 while still providing care. • The innovation process is accelerated and creates new interactions between health stakeholders.	• It is necessary to identify key innovation determinants and relevant contextual conditions, including economic, social, and political impacts, as well as regulations and market timing. • Challenges overcome social acceptance, regulation, and market timing.
P8	Chowdhury A.; Hafeez-Baig A.; Gururajan R.; McCubbin A.; Sharif MA; Miah SJ	2021	Investigates the challenges of the telehealth environment in India and Pakistan that hinder the transmission of high-quality images between patients and healthcare professionals.	• Telehealth has the potential to provide better access to healthcare in urban, rural, and remote areas. • Training patients to use handheld devices to capture high-quality images can improve the quality of images delivered.	• ICT infrastructure and connectivity are inconsistent between urban, rural, and remote areas.

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					• Lack of imaging expertise and multiple transmissions worsen the quality of images received by health professionals.
P 9	Sadrul SSM; Noushin N.	2021	Explores the role of telemedicine in providing adequate health services, especially during the COVID-19 pandemic, to reach communities in rural areas of Bangladesh.	• Telemedicine has the potential to reach people in rural areas that are difficult to access by traditional health services. • Providing adequate health services through telemedicine can reduce disparities in the health system between urban and rural areas.	Inequality in the health system between urban and rural areas, with most highly qualified doctors providing services only in urban areas.
P10	Koinig I.; Diehl S.	2022	• Investigating the willingness of young people to provide access to their data to commercial parties to use health applications. • Understand the importance of privacy in a health context.	• The development of the Internet of Medical Things (IoMT) brings advances in health monitoring. • Health apps provide great benefits for individual health monitoring and management, especially in pandemic situations like COVID-19.	• Although individuals claim a high level of privacy concern, their behavior suggests otherwise. • Young people's willingness to share their health information with commercial parties is only moderate.
P11	Frenert S.; Petersson L.; Muhic M.; Rydelfält C.; Nymberg VM; Ekman B.; Erlingsdottir G.	2022	Explores how eHealth mediates the experiences of health professionals, with a focus on the influence of solution materiality.	• eHealth increases the sense of closeness with patients and colleagues without the limitations of space and time. • Increase understanding of patients through data generated by patients themselves. • Increases autonomy, as asynchronous communication makes it possible to decide when and which patients to deal with.	• Strengthening and changing boundaries between patients and professional groups. • Need to restructure professional control over work.
P12	van Kessel R.; Hrzic R.; O'Nuallain E.; Weir E.; Wong BLH; Anderson M.; Baron-Cohen S.; Mossialos E.	2022	Exploring the benefits of digital health technologies for the global population, particularly those with disabilities,	• The COVID-19 pandemic is accelerating the adoption of digital health technologies worldwide, opening up opportunities to improve health access and services. • Digital health technology improves the quality of life for people with disabilities, and the autistic community.	• Inequalities in access to digital health technology, especially for people with disabilities. • Lack of digital health literacy. • People with disabilities are often not accommodated in the design and

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				• Policies in several countries have recognized the importance of inclusion in digital health systems.	implementation of digital health technologies.
P13	Ghasemzadeh K.; Escobar O.; Yordanova Z.; Villasalero M.	2022	Application of user innovation (UI) in the e-health sector, as a step to discuss potential, trends, managerial gaps, and future research opportunities.	• Users have an important role in innovation in the e-health sector. • There is great potential for developing innovations that involve users more holistically.	• Managerial gaps in including users in all stages of the innovation process. • Some current practices in the e-health sector do not engage users with user innovation best practices.
P 14	Kark SM; Worthington MA; Christie RH; Masino AJ	2023	To identify the challenges psychiatrists face in treating patients with major depressive disorder (MDD), with a focus on the problem of misdiagnosis of bipolar disorder (BD).	• Digital health technology (DHT) has great potential to improve the diagnosis and management of bipolar disorder and depression. • Developing predictive models using machine learning methods can increase diagnostic accuracy.	• Psychiatrists have difficulty accurately diagnosing bipolar disorder. • Important information for evaluating BD is often not apparent from clinical observation. • Misdiagnosis of BD has an impact on treatment.
P15	Dreisoerner A.; Ferrandina C.; Schulz P.; Nater UM; Junker NM	2023	Explore the possibility of improving self-compassion through a novel, intense, and accessible intervention using online group-based interactive video teleconferencing.	• Group-based interactive video teleconference interactions allow for more interaction between participants, which can reduce feelings of isolation. • Intense and accessible interventions can increase self-compassion.	There remains great unexplored potential to improve other resources that improve mental health
P16	Alviani R.; Purwandari B.; Eitiveni I.; Purwaningsih M.	2023	Research and enrich knowledge about telemedicine adoption in Indonesia.	• Telemedicine has the potential for long-term adoption in Indonesia. • Factors such as performance expectations, effort expectations, social influence, eHealth literacy, and trust influence adults' behavioral intentions to use telemedicine.	• Factors such as facility condition, price value, and privacy concerns did not show a significant influence on adults' behavioral intentions to use telemedicine. • Adoption in Indonesia is still faced with several challenges, including the insignificance of several factors that influence usage intentions.

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P17	Khafizova AA; Galimov AM; Kharisova SR; Grebenshchikova LY; Yagudina RI; Smirnova LM	2023	Analyze how medical education programs are evolving to address the digital transformation in health care.	• Adding technology to the curriculum can improve students' digital skills. • There is potential for developing personalized and in-depth learning innovations thanks to technology. • Digital transformation can bring significant advances in the understanding and use of medical technology.	• Imbalance in curriculum emphasis between the use of electronic medical records and telemedicine. • Technical difficulties, costs, and over-reliance on technology. • Concerns that over-reliance on technology may hinder the development of clinical skills and humanism.
P18	Patnaik A.; Prasad KK	2023	Protect sensitive medical data in the cloud by leveraging cloud computing facilities.	• Cloud computing technology for storing electronic medical records (EMR) can improve accessibility and scalability for healthcare workers and consumers. • AES encryption technology, ECC, and hybrid optimization approaches can improve the security of medical data in the cloud.	• Medical data stored in the cloud is vulnerable to data theft attacks, which is one of the most critical security vulnerabilities. • Security risks associated with storing and transmitting sensitive medical data online.
P19	Wang Y.; Yi N.; Ericksen HM; Zhang W.	2023	Exploration of the possibility of self-administered orthopedic examination in telehealth treatment of a young athlete	• Telehealth provides accessibility and cost efficiency in the treatment of young athlete patients with rotator cuff injuries. • Patients can perform orthopedic examinations themselves with virtual assistance, enabling effective remote treatment.	• The validity of tests and measurements carried out remotely is a problem, due to the limited ability to carry out direct evaluations. • Limited communication and difficulty in evaluating the patient's physical condition directly.
P20	Kuen L.; Schürmann F.; Westmattelmann D.; Hartwig S.; Tzafrir S.; Schewe G.	2023	Exploration of the interaction of various trust references (physician, technology, medication) and risk dimensions (performance, privacy, time, psychological) in patient adoption of telemedicine, taking physical and mental considerations into account.	• Telemedicine has great potential to address major challenges in healthcare delivery. • The importance of trust in technology and medicine in influencing intentions to use telemedicine.	• Trust in doctors is not as strong as trust in technology and medicine in influencing intentions to use telemedicine. • There is a gap between usage intentions and actual behavior in telemedicine adoption.

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P21	Sheng X.; Martirosyan Y.; Hossain KS; Felix R.; Singh A.	2024	Exploration of challenges and motivations for telehealth use among older consumers, an under-researched population in the telehealth literature.	• Telehealth provides the benefits of convenience, ease of use, and efficiency for older consumers. • Telehealth is a solution when other options are not available, such as during the COVID-19 pandemic.	• Telehealth limitations, privacy concerns, lack of trust, access, and technology skills. • Telehealth use among older consumers is influenced by attitudes toward technology, gender, and health conditions. • Not all older consumers adopt telehealth easily.
P22	Aji PT; Ramadani L.	2024	Assessing the influence of user dimensions, technological aspects, and socio-cultural elements on intention to adopt telemedicine services.	• Significant increase in the role of startups in healthcare delivery, especially in telemedicine. • Great opportunity for innovation and service development. • Factors such as self-efficacy, perceived usefulness, facilitating conditions, and cultural factors have a significant influence on the intention to adopt telemedicine services.	• Challenges in dealing with cultural factors, lack of digital literacy, and uneven internet network infrastructure. • The absence of a significant influence from the factors of trust, perceived ease of use, and social influence indicates that there is still uncertainty in understanding user behavior and socio-cultural dimensions that influence telemedicine adoption.

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Although there are great opportunities, the challenges faced in the adoption of telemedicine are not simple, there are several challenges that need to be overcome. One of the main challenges is the lack of information and communications technology infrastructure, especially in rural areas. Lack of consistent internet connectivity between urban, rural, and remote areas is a major barrier to telemedicine adoption. Challenges also arise regarding data privacy, it cannot be used as a selling point and data protection does not increase willingness to pay for the app. Additionally, data privacy and security issues are a major concern, especially in storing sensitive medical data in the cloud.

Lack of digital health literacy is also a barrier to telemedicine adoption, especially among less educated or elderly populations. It is also linked to privacy concerns, lack of trust, access, and technology skills, especially among older consumers.

5. Discussion

5.1. Pre- and Post-COVID Telemedicine

The paradoxical differences between the pre-COVID (2018-2019) and post-COVID (2020-2024) eras in telemedicine technology services can be seen from the accessibility aspect, data protection aspect, infrastructure aspect, and technology acceptance aspect. Before the COVID-19 pandemic, paradoxes associated with the adoption of digital health technologies, such as telemedicine, highlighted the potential for increased accessibility of healthcare services, especially in rural or remote areas. Pre-COVID articles emphasized the need for better digital infrastructure to support the implementation of these technologies [48]. However, the main challenge is predicting uncertain implementation and the lack of consistent digital infrastructure in some regions. Data protection and privacy are also concerns but are difficult to use as selling points due to existing data security challenges. Additionally, digital health literacy is also a focus [41], where cultural change is required to accept new medical technologies, however, there is still uncertainty in such acceptance due to a lack of knowledge and understanding of medical technologies.

Meanwhile, post-COVID-19, the paradox related to telemedicine adoption has undergone significant changes. Telemedicine adoption [47] is increasing dramatically in response to physical restrictions and the continued need for healthcare services. Post-COVID articles highlight increased awareness of the usefulness of telemedicine during the pandemic, but challenges remain regarding unequal access to healthcare and uncertainty in accepting this technology, especially among older populations who may be unfamiliar with the technology [49]. Data protection and privacy remain an important focus, especially due to the increasing use of telemedicine, but the challenges are more severe, with the need to ensure the security of sensitive medical data in the cloud and address increasing user privacy concerns [50,51]. Additionally, technological infrastructure and connectivity are becoming more important [38], with the need to address internet network infrastructure inequalities and ensure the availability of reliable connectivity in all regions [52]. Technology acceptance has also increased significantly, but the challenge is ensuring continued acceptance and addressing gaps in digital health literacy in society.

These paradoxical differences between the pre-COVID and post-COVID eras reflect different responses to situational changes and societal needs in terms of health services. Post-COVID, telemedicine has become more integrated and widely accepted as an integral part of the health system, while challenges associated with adoption and implementation remain relevant. By illustrating these conditions, it can be seen how the focus of research has changed from the pre-COVID to the post-COVID era, especially in terms of accessibility and adoption, as well as cultural changes and acceptance of technology. Meanwhile, aspects of data protection and privacy as well as technological infrastructure tend to receive less attention in these two eras.

5.2. Telemedicine Paradox Cluster

The results of the bibliometric data that were collected showed that there were 4 paradoxical cluster findings of telemedicine articles, namely the health service cluster, the health quality cluster,

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the COVID-19 pandemic cluster, and the technology cluster. The paradoxical elements of opportunity and challenge for each cluster are explained in each of these subsections.

5.2.1. Health Services

In the context of the Health Services aspect, the focus on public health and primary health care faces several paradoxes that illustrate the challenges and opportunities in efforts to improve public health [53]. In the context of primary health care, paradox creates complex opportunities and challenges. One of the main challenges is the tension between preventing and treating disease. Practitioners must allocate resources between disease prevention efforts and care for patients who are already sick. However, this paradox also creates an opportunity to develop holistic strategies, where prevention and treatment efforts can be undertaken together. By integrating a comprehensive approach, primary health care can be more effective in improving overall community health.

Furthermore, the tension between individual and population needs also creates a paradox in which practitioners must find a balance between individual care and interventions that impact the health of entire communities. While the challenge is the appropriate allocation of resources, it also creates opportunities to develop more integrated health programs [54]. By combining individualized care with broader prevention strategies, primary health care can increase its impact in improving the health of the population as a whole. Thus, this paradox inspires innovation [36] in the provision of more efficient and sustainable health services.

5.2.2. Health Quality

To maintain mental health and improve quality of life, the primary focus on mental health can often neglect physical health, and vice versa. For example, someone who is overly focused on career success may sacrifice rest and exercise, which in turn can affect their physical health [55]. Conversely, people who care too much about physical appearance may forget the importance of mental health, such as emotional self-care or managing stress effectively. This shows the paradox that requires a balance between attention to mental and physical health to achieve optimal quality of life.

Mental health often requires a balance between having control over your life and receiving support from others. Individuals may feel the need to maintain autonomy and feel they have control over their life decisions. However, social support from family, friends, and society is also very important for mental well-being. Paradoxes arise when individuals feel caught between maintaining autonomy and accepting help from others. Resolving this paradox is a challenge, but it also provides an opportunity to strengthen self-management skills and build a healthy support network, ultimately contributing to improved quality of life.

5.2.3. COVID-19 Pandemic

The COVID-19 pandemic has brought paradoxes that illustrate the challenges and opportunities society faces in navigating this complex situation. One is the tension between the health response and the economic response. Restrictive measures such as lockdowns and travel restrictions are critical to controlling the spread of the virus, but can also have a serious impact on the economy, causing job and business losses and creating great financial uncertainty. Finding a balance between public health efforts and economic sustainability is a real challenge in responding to the pandemic.

Individuals may wish to continue their social and economic activities to meet personal needs and maintain mental well-being, but these actions may increase the risk of virus transmission for society at large. Finding a balance between individual needs for personal freedom and comfort with the public interest in protecting the health of society as a whole is a complex challenge, requiring collective awareness and adherence to public health guidelines. Additionally, the pandemic has highlighted the tension between physical health and mental health. Restrictive measures necessary to protect physical health, such as social isolation and quarantine, can also hurt mental health, increasing the risk of anxiety, depression, and loneliness. This highlights the importance of providing adequate resources and support to maintain mental health during the pandemic. In facing these

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challenges, society has the opportunity to increase resilience, solidarity, and innovation [36] in responding to the ongoing health crisis.

5.2.4. Technology

Telemedicine technology brings various opportunities and challenges that need to be considered in its implementation [56]. One of the main paradoxes is the tension between accessibility and service quality. Although these technologies can expand the accessibility of healthcare services, especially for those living in remote or hard-to-reach areas, concerns remain regarding the quality of services [57]. In virtual environments, there is a risk that accurate diagnosis and effective treatment may be compromised. However, on the other hand, this technology allows more people to receive care without having to travel long distances to health facilities, which in turn increases accessibility for those who are difficult to reach.

Although telemedicine technology promises major advances in healthcare provision [38], there is resistance to its adoption, especially from medical authorities accustomed to traditional practices. The main challenge is to convince and train medical staff and patients about the benefits and safety of using this technology. While telemedicine technology can improve efficiency in healthcare, paradoxes arise when faced with closer patient-physician relationships. While telemedicine allows for efficient remote consultations, there are concerns that it may reduce face-to-face interactions between patients and physicians, which could impact the quality of the relationship and the level of trust in care. Therefore, while telemedicine technology offers great opportunities [15] to improve the accessibility and efficiency of healthcare services, the challenges of overcoming uncertainty, resistance, and risk must be addressed judiciously to achieve maximum benefits for society.

5.3. Telemedicine Research Perspective in the Dynamic Equilibrium Model

Based on the organizational paradox categories described by Smith and Lewis [35], each Pre-COVID telemedicine article (Table 1) can be mapped as shown in Table 3.

Table 3. Mapping Pre-COVID telemedicine articles against organizational paradox categories.

Code	Year	Opportunities	Challenges
B1	2018	Performing	Organizing
B2	2018	Performing	Organizing
B3	2018	Learning	Belonging
B4	2019	Performing	Learning
B5	2019	Belonging	Learning
B6	2019	Performing	Organizing

Pre-COVID telemedicine articles (Table 2) can be mapped as shown in Table 4. In the post-COVID period, the articles show slightly different trends than pre-COVID. Post-COVID articles tend to be more spread across categories of organizational paradoxes, with Performing and Organizing remaining the main focus. However, there was a significant increase in the Belonging and Learning categories. This shows that after the COVID-19 pandemic, there is increased awareness about the importance of membership (Belonging) in the adoption of telemedicine and the need for learning in implementing this technology.

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Table 4. Mapping Post-COVID telemedicine articles against organizational paradox categories.

Code	Year	Opportunities	Challenges
P1	2020	Belonging	Performing
P2	2020	Learning	Organizing
P3	2020	Performing	Organizing
P4	2020	Performing	Organizing
P5	2021	Performing	Organizing
P6	2021	Performing	Organizing
P7	2021	Learning	Organizing
P8	2021	Performing	Organizing
P9	2021	Performing	Belonging
P10	2022	Performing	Belonging
P11	2022	Belonging	Organizing
P12	2022	Performing	Belonging
P13	2022	Learning	Organizing
P14	2023	Performing	Learning
P15	2023	Belonging	Learning
P16	2023	Performing	Belonging
P17	2023	Learning	Belonging
P18	2023	Performing	Organizing
P19	2023	Performing	Organizing
P20	2023	Performing	Belonging
P21	2024	Performing	Belonging
P22	2024	Learning	Performing

The compilation results of the mapping of these articles on the organizational categories of Smith and Lewis [35] are shown in Figure 5. Pre-COVID articles show that the majority are identified as Performing, which focuses on performing or carrying out, and Organizing, which highlights organizing. This shows that in the pre-COVID period, the main focus was on how to organize and run telemedicine in the healthcare context.

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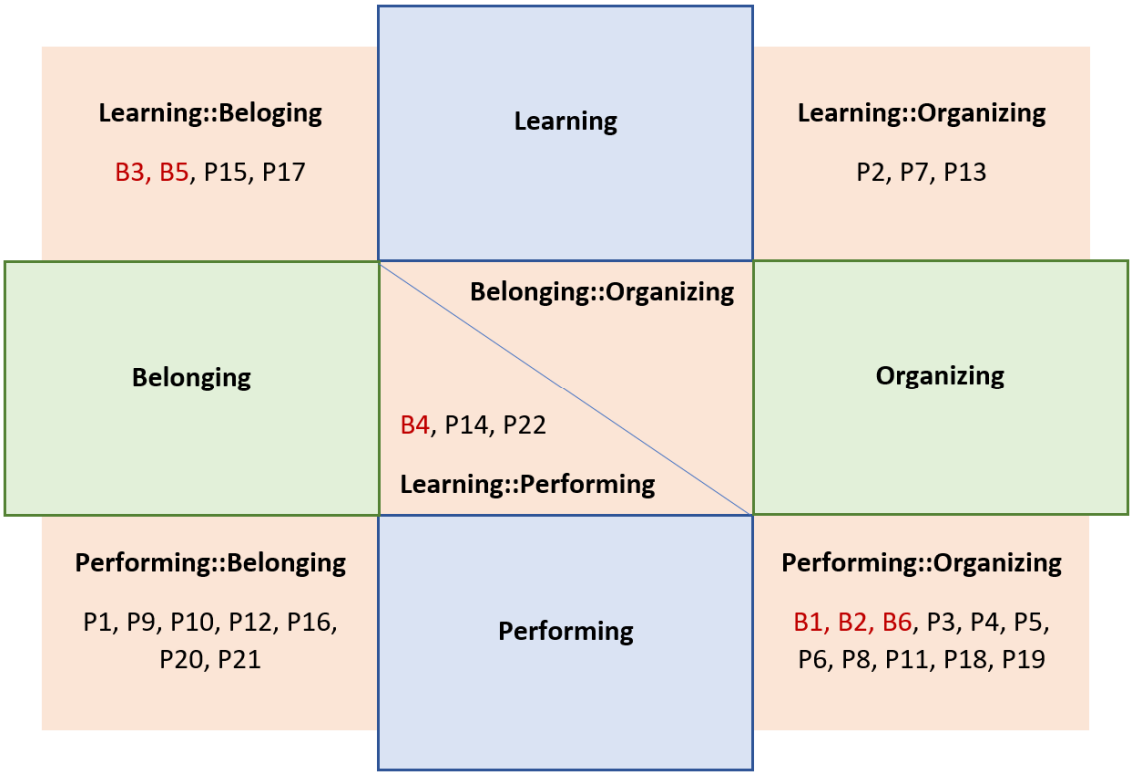

Figure 5. Telemedicine paradox article in Smith and Lewis' organizational categories [35].

6. Conclusion

This research has provided a comprehensive insight into the paradoxes in telemedicine services. Through systematic literature review analysis, we identified four main paradox clusters, namely health services, health quality, the COVID-19 pandemic, and technology. Each cluster shows complex opportunities and challenges in developing health services via telemedicine. Understanding these clusters can be mapped to the organizational categories in the Dynamic Equilibrium Model, providing a deeper view of the complexity of telemedicine use in a health context. It is hoped that a better understanding of this paradox will assist the public and healthcare practitioners in overcoming the challenges and exploiting the opportunities offered by telemedicine to improve the accessibility and quality of healthcare services in the future [15].

By anticipating the challenges and opportunities health care organizations should formulate and implement a paradoxical strategy for the use of telemedicine services. The regular assessment and monitoring of newly introduced digital technologies should be conducted, including feedback from consumers. The conditions for telemedicine implementation are multiple perspectives and should be carefully considered to achieve success in telemedicine programs.

7. Implications

This article not only identifies paradoxes in telemedicine services but also offers deep insights into the associated challenges and opportunities. By clarifying paradoxes such as healthcare, healthcare quality, the COVID-19 pandemic, and technology, a better understanding of the complex dynamics behind the use of telemedicine in a healthcare context is provided. In the process, this article provides a solid foundation for developing effective strategies for improving healthcare through telemedicine.

One of the main contributions of this article is the use of the Dynamic Equilibrium Model to map these paradox clusters into organizational categories. This model allows for identifying the position and direction of change needed in healthcare organizations to overcome the challenges faced in implementing telemedicine. By understanding the necessary changes in organizational structure, healthcare stakeholders can plan more effective steps to integrate telemedicine technology into daily practice. [38] . By capturing paradoxes such as increasing accessibility but also concerns about quality of care, healthcare

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practitioners and policymakers can adapt their approaches to maximize the benefits of telemedicine while minimizing the associated risks. This includes improvements in technological infrastructure, the development of appropriate clinical practice guidelines, and increasing the digital literacy of society.

The practical implications of this article are highly relevant to global efforts to improve the accessibility and quality of health services. By understanding emerging paradoxes, health practitioners can design more adaptive and effective solutions, while policymakers can direct investment and support to areas where it is most needed.

Developing a telemedicine program takes time and does not happen instantly. It is hoped that this review can be used to support the adoption and implementation of telemedicine services around the world as well as to enrich the theoretical aspects of telemedicine service paradoxes.

8. Limitations and Further Research

Although this research provides valuable insight into the challenges and opportunities in implementing telemedicine technology in healthcare, several limitations need to be noted. This research was limited to an analysis of the literature available at the time of writing, meaning it is possible that some recent studies or relevant articles have not been included. As telemedicine continues to develop rapidly, new information that might influence our understanding of the existing paradox may be missed. This research also does not explore in depth the perspectives of direct users of telemedicine services, namely patients and health service providers. Understanding their perceptions and experiences of the use of these technologies can provide richer insight into the challenges and opportunities faced in daily practice. Qualitative studies involving interviews or surveys could be the next step to fill this gap in the literature.

Furthermore, further research could examine in detail the factors that influence the adoption and acceptance of telemedicine technology in various contexts, including social, cultural, economic, and policy factors. Understanding these factors will help in designing more effective and relevant implementation strategies to ensure that telemedicine is widely accepted and used in society. Future research could also focus on developing better evaluation methods to measure the effectiveness, safety, and quality of telemedicine services. A comprehensive evaluation will help in assessing the true impact of this technology on health care and patient outcomes.

With these limitations in mind, there are several interesting and worthwhile research directions to explore further. It is hoped that future research will continue to deepen our understanding of telemedicine and identify more effective strategies for overcoming challenges and exploiting existing opportunities.

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References

1. LR Koenig, A. Becker, J. Ko, and UD Upadhyay, "The Role of Telehealth in Promoting Equitable Abortion Access in the United States: Spatial Analysis.," *JMIR Public Heal. Surveillance.* , vol. 9, p. e45671, Nov. 2023.
2. S. Kolluri, TS Stead, RK Mangal, RLJ Coffee, J. Littell, and L. Ganti, "Telehealth in Response to the Rural Health Disparity.," *Heal. Psychol. Res.* , vol. 10, no. 3, p. 37445, 2022.
3. SN Gajarawala and JN Pelkowski, "Telehealth Benefits and Barriers.," *J. Nurse Pract.* , vol. 17, no. 2, pp. 218–221, Feb. 2021.
4. DD Payán, JL Frehn, L. Garcia, AA Tierney, and HP Rodriguez, "Telemedicine implementation and use in community health centers during COVID-19: Clinic personnel and patient perspectives," *SSM - Qual. Res. Heal.* , vol. 2, p. 100054, 2022.
5. JR Abbatemarco *et al.*, "Providing Person-Centered Care via Telemedicine in the Era of COVID-19 in Multiple Sclerosis," *J. Patient Exp.* , vol. 8, p. 2374373520981474, Jan. 2021.

6. DI Atefeh Farzindar, *Natural Language Processing for Social Media*, 1st ed. Switzerland: Springer Cham, 2015.
7. F. Binsar and N. Legowo, "Design of Cloud Computing Outpatient Registration Model Through SMS Messages at Hospitals using TOGAF ADM," *Int. J. Recent Technol. Eng.* , vol. 8, no. 5, pp. 3857–3865, 2020.
8. I. Chakraborty, S. Edirippulige, and P. Vigneswara Ilavarasan, "The role of telehealth startups in healthcare service delivery: A systematic review," *Int. J. Med. Inform.* , vol. 174, p. 105048, 2023.
9. RMA van der Boon *et al.*, "Risks and benefits of sharing patient information on social media: a digital dilemma," *Eur. Listen. J. - Digits. Heal.* , p. ztae009, Feb. 2024.
10. R.-A. Hardie *et al.*, "Telehealth-based diagnostic testing in general practice during the COVID-19 pandemic: an observational study.," *BJGP open*, vol. 6, no. 1, March. 2022.
11. B. Hofmann, "The paradox of health care," *Heal. Anal Care.* , vol. 9, no. 4, pp. 369–386, 2001.
12. D. Kabel, J. Martin, and M. Elg, "Paradoxical tensions during industry 4.0 integration within health care: managing tensions for quality improvement," *Int. J. Lean Six Sigma*, 2024.
13. N. Singh, M. Jain, MM Kamal, R. Bodhi, and B. Gupta, "Technological paradoxes and artificial intelligence implementation in healthcare. An application of paradox theory," *Technol. Forecast. Soc. Change*, vol. 198, no. November 2023, p. 122967, 2024.
14. O. Kokshagina and S. Schneider, "The Digital Workplace: Navigating in a Jungle of Paradoxical Tensions," *Calif. Manage. Rev.*, vol. 65, no. 2, pp. 129–155, 2023.
15. M. Abdel-Wahab, E. Rosenblatt, B. Prajogi, E. Zubizarretta, and M. Mikhail, "Opportunities in Telemedicine, Lessons Learned After COVID-19 and the Way Into the Future," *Int. J. Radiat. Oncol. Biol. Phys.* , vol. 108, no. 2, pp. 438–443, 2020.
16. E. Tenggono, BW Soetjipto, and L. Sudhartio, "Navigating institutional pressure: Role of dynamic managerial capabilities and strategic agility in healthcare organizations' renewal," *Int. J. Health c. Manag.* , 2024.
17. Y. Mahendradhata *et al.*, *The Republic of Indonesia Health System Review*, vol. 7, no. 1. Asia Pacific Observatory on Health Systems and Policies, 2017.
18. KR Gallardo, D. Santa Maria, S. Narendorf, CM Markham, MD Swartz, and CM Batiste, "Access to healthcare among youth experiencing homelessness: Perspectives from healthcare and social service providers," *Child. Youth Serv. Rev.*, vol. 115, p. 105094, 2020.
19. J. Choi and J. Xavier, *Digitalization of Public Service Delivery in Asia*, First edit. Tokyo: Asian Productivity Organization, 2021.
20. JH Vojtěch Máca, Milan Ščasný, Iva Zvěřinová, Michal Jakob, "Incentivizing Commuter Cycling by Financial and Non-Financial Rewards," *Int. J. Environment Res. public Heal.* , vol. 17, no. 17, p. 6033, 20AD.
21. L. Emanuel *et al.*, "What Exactly Is Patient Safety?," *J. Med. Regular.* , vol. 95, no. 1, pp. 13–24, 2009.
22. A. Kuek and S. Hakkennes, "Healthcare staff digital literacy levels and their attitudes towards information systems," *Health Informatics J.*, vol. 26, no. 1, pp. 592–612, Apr. 2019.
23. J.L. Sánchez, S. Savin, and V. Vasileva, "Key Success Factors in Implementing Electronic Medical Records in University Hospital of Rennes," *L'Ecole Natl. la Santé Publique Natl. Sch. Public Heal. Rennes Rennes Fr.* , no. January 2005, pp. 1–59, 2005.
24. B.M. Esch, F. Marian, A. Busato, and P. Heusser, "Patient satisfaction with primary care: an observational study comparing anthroposophic and conventional care," *Heal. Qual. Life Outcomes*, vol. 6, no. 74, pp. 1–15, 2008.
25. G. of Ireland, *Building a Culture of Patient Safety*. Dublin, Ireland: Brunswick Press Ltd, 2008.
26. C. Vincent, *Patient Safety*, 2nd Editio. London, UK: Wiley-Blackwell, 2010.
27. MU Chelladurai, DS Pandian, and DK Ramasamy, "A blockchain-based patient-centric electronic health record storage and integrity management for e-Health systems," *Heal. Policy Technol.* , vol. 10, no. 4, 2021.
28. D. Diaz, "Digital literacy in healthcare," *University of Sunderland*, 2021. [Online]. Available: https://online.sunderland.ac.uk/digital-literacy-in-healthcare/. [Accessed: 10-Sep-2023].
29. O. WHO, World, *Delivering quality health services: a global imperative for universal health coverage*, no. July. Geneva, 2018.
30. J. Schad, M.W. Lewis, S. Raisch, and W.K. Smith, "Paradox Research in Management Science: Looking Back to Move Forward," *Acad. Manag. Ann.* , vol. 10, no. 1, pp. 5–64, 2016.
31. D. Miller, "Icarus paradox: How exceptional companies bring about their downfall," *IEEE Eng. Manag. Rev.*, vol. 21, no. 2, pp. 80–88, 1992.
32. MP e Cunha and LL Putnam, "Paradox theory and the paradox of success," *Strateg. Organ.* , vol. 17, no. 1, pp. 95–106, Oct. 2017.
33. Ella Miron-Spektor, "Embracing the Paradoxes of Leadership," *INSEAD Knowl.* , pp. 1–3, 2019.

34. MM Sulphey, "How the Icarus Paradox Doomed Kingfisher Airlines," *Vision*, vol. 24, no. 1, pp. 118–124, 2020.
35. W. Smith and M. Lewis, "Toward a theory of paradox: A dynamic equilibrium model of organizing," *Acad. Manag. Rev.*, vol. 36, no. 2, pp. 381–403, 2011.
36. J. Grady, "Telehealth: A case study in disruptive innovation," *Am. J. Nurs.* , vol. 114, no. 4, pp. 38–45, 2014.
37. M. Chen, S. Xu, L. Husain, and G. Galea, "Digital health interventions for COVID-19 in China: a retrospective analysis," *Intell. Med.*, no. April, 2021.
38. R. Wasim, K. Salah, R. Jayaraman, I. Yaqoob, S. Ellahham, and M. Omar, "The role of blockchain technology in telehealth and telemedicine," *Int. J. Med. Inform.* , vol. 148, no. 2021, pp. 1–10, 2021.
39. J. Gaughan, L. Siciliani, H. Gravelle, and G. Moscelli, "Do small hospitals have lower quality? Evidence from the English NHS," *Soc. Sci. Med.*, vol. 265, p. 113500, 2020.
40. RS Weinstein *et al.*, "Telemedicine, Telehealth, and Mobile Health Applications That Work: Opportunities and Barriers," *Am. J. Med.* , vol. 127, no. 3, pp. 183–187, 2014.
41. D. Greene *et al.*, "Creating training opportunities for public health practitioners," *Am. J. Prev. Med.*, vol. 16, no. 3 SUPPL., pp. 80–85, 1999.
42. RA Scheepers, H. Emke, RM Epstein, and KMJMH Lombarts, "The impact of mindfulness-based interventions on doctors' well-being and performance: A systematic review," *Med. Educ.* , vol. 54, no. 2, pp. 138–149, 2020.
43. A. Kirby, "Exploratory Bibliometrics: Using VOSviewer as a Preliminary Research Tool," *Publications*, vol. 11, no. 1. 2023.
44. N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, and WM Lim, "How to conduct a bibliometric analysis: An overview and guidelines," *J. Bus. Res.* , vol. 133, pp. 285–296, 2021.
45. Y. Qiang, X. Tao, X. Gou, Z. Lang, and H. Liu, "Towards a Bibliometric Mapping of Network Public Opinion Studies," *Information*, vol. 13, no. 1. 2022.
46. H. Tiirinki *et al.*, "COVID-19 pandemic in Finland – Preliminary analysis on health system response and economic consequences," *Heal. Policy Technol.* , vol. 9, no. 4, pp. 649–662, 2020.
47. M. Hamsal and M. Ichsan, "The COVID-19 Pandemic and Telemedicine Adoption: Challenges and Opportunities," *Proc. First Int. Conf. Econ. Bus. Entrep. ICEBE 2020* , p. 324, 2020.
48. C. Standing, S. Standing, M. L. McDermott, R. Gururajan, and R. Kiani Mavi, "The Paradoxes of Telehealth: a Review of the Literature 2000–2015," *Syst. Res. Behav. Sci.* , vol. 35, no. 1, pp. 90–101, 2018.
49. X. Sheng, Y. Martirosyan, KS Hossain, R. Felix, and A. Singh, "Unpacking the influencing factors of telehealth usage among older consumers," *Health Mark. Q.* , vol. 41, no. 1, pp. 95–111, 2024.
50. A. Patnaik and KK Prasad, "Secure Authentication and Data Transmission for Patients Healthcare Data in the Internet of Medical Things," *Int. J. Math. Eng. Manag. Sci.* , vol. 8, no. 5, pp. 1006–1023, 2023.
51. R. Pitchai, S. Anjanayya, and M. Maravarman, "Cloud computing based generic medicine recommendation system for advanced E-Healthcare," *Mater. Today Proc.* , 2021.
52. KM Zobair, L. Sanzogni, and K. Sandhu, "Telemedicine healthcare service adoption barriers in rural Bangladesh," *Australas. J. Inf. Syst.* , vol. 24, pp. 1–24, 2020.
53. AA Khafizova, AM Galimov, SR Kharisova, LY Grebenshchikova, RI Yagudina, and LM Smirnova, "The impact of healthcare digitalization on the medical education curricula and programs: Points of convergence and divergence," *Contemp. Educ. Technol.* , vol. 15, no. 4, 2023.
54. SSM Sadrul and N. Noushin, "Alternative Modes of Health Service Delivery," *Sustain. Future.* , vol. 3, p. 100055, 2021.
55. Y. Wang, N. Yi, H.M. Ericksen, and W. Zhang, "Case report: Self-performed orthopedic examinations in telehealth treatment of a youth athlete with acute rotator cuff strain," *Front. Sport. Act. Living*, vol. 5, no. May, pp. 1–6, 2023.
56. Y. Siriwardhana, C. De Alwis, G. Gur, M. Ylianttila, and M. Liyanage, "The Fight against the COVID-19 Pandemic with 5G Technologies," *IEEE Eng. Manag. Rev.*, vol. 48, no. 3, pp. 72–84, 2020.
57. A. Chowdhury, A. Hafeez-Baig, R. Gururajan, A. McCubbin, M.A. Sharif, and S.J. Miah, "The Role of Image Quality in Telehealth: Adoption Challenges in the Subcontinent," *Pacific Asia J. Assoc. Inf. Syst.* , vol. 13, no. 3, pp. 131–145, 2021.