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Research Article
Barriers and Challenges to Adopting Telemedicine in Saudi Arabia: A Systematic Review

Authors
Dr Anfal Mohammed Aljohani[1], Dr Amal Elnabasy[2]
[1]Family Medicine consultant
[2]PhD in Public health

Abstract

Background: *Telemedicine involves the use of information technology in the delivery of healthcare services. The implementation of telemedicine has increased recently, especially during the COVID-19 pandemic period. There are many barriers to the adoption of telemedicine. Additionally, these barriers showed little focus, and studies didn't specify a great focus on such barriers in Saudi Arabia.*

Aim: *To assess the barriers and challenges restricting the adoption of telemedicine in Saudi Arabia by reviewing the previous studies conducted on this subject.*

Methods: *The medical literature was explored through PubMed, Elsevier, Research Gate, and Google scholar between the year 2012 and the year 2022. The search keywords included a combination of "Telemedicine, Telehealth, Barriers, Obstacles, Challenges, Adoption, Implementation." The inclusion criteria were original articles conducted in Saudi Arabia that reported barriers and challenges to adopt telemedicine.*

Results: *A total of 820 articles were obtained, and only six articles were eligible for the inclusion criteria. The studies included a total number of 2256 medical staff members. Barriers were divided into two categories; the first category included barriers related to healthcare providers and the second category included other barriers.*

Conclusion: *Barriers and challenges of telemedicine adoption were various and differed between different studies in different regions, even in the same country. The major barriers identified involved a lack of awareness and knowledge about telemedicine, the thought of physicians that the clinic is better, technical issues, lack of experts, andcosts.*

Keywords: *Barriers, Challenges, Telehealth, Telemedicine.*

Chapter one: Introduction
Introduction

Nowadays, technology is redefining all aspects of life, and this has been observed across different fields, including the healthcare field. Electronic health (E-health) refers to the adoption of information and communication technologies for health delivery (Alshammari, 2021). E-health has been implemented in Saudi Arabia in different healthcare facilities to improve the accessibility

and quality of healthcare services (Alshammari, 2021).

Telemedicine is defined as the use of information technology in the provision of healthcare via electronic devices (Altulaihi et al, 2021). According to the World Health Organization, telemedicine is defined as the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities (Chakraborty, 2020).

Telemedicine has different forms; there are three major types of telemedicine based on the timing of the information, and they include store and forward, remote monitoring, and real-time interactive services. Store and forward refers to storing the data such as medical images, whereas remote monitoring, which is also known as self-testing or self-monitoring, refers to the monitoring of health and clinical signs of the patient remotely using different types of technologies. This practice is commonly used in the management of chronic diseases such as diabetes mellitus and cardiovascular disease. Real-time interactive services are the third type of telemedicine and involve face-to-face communication between the healthcare provider and the patient (Abouzid et al, 2022). Telemedicine also can be categorized based on the interacted individuals into two categories, health professionals to health professionals and health professionals to patients (Abouzid et al, 2022).

Telemedicine offers the population a safe and efficient method to consult healthcare professionals about the symptoms of infectious diseases, prevention and management of disease, psychological issues, and other issues (Monaghesh & Hajizadeh, 2020). During the COVID-19 pandemic, there was a need for remote consultation and healthcare due to the consequences of COVID-19, which led to a lockdown and social isolation. Telemedicine has emerged during COVID-19 as it is the key option and the perfect solution to continuously provides essential healthcare services. Also, it enables patients with chronic diseases to obtain consultations without the risk of traveling and visiting hospitals and being exposed to infection (Lukas et al, 2020; Ftouni et al, 2022).

The adoption term refers to the decision of potential users to make full use of an innovation as the best course of action available. Moreover, that innovation is considered to be fully adopted when the majority of users employ it (Zanaboni & Wootton, 2012). The adoption of telemedicine in general by healthcare facilities arises from the desire to improve the service provided to the patients, reduce costs, and access to care, provide improved access to specialists, expand the geographic footprint of the organization, and educate the patients (Alghatani, 2016). The adoption of various technologies in the healthcare field was studied by Russell, who studied the adoption of five types of technologies that spread widely in the hospitals of the United States after 1950 (Zanaboni & Wootton, 2012). Regarding the adoption of telemedicine, there is very little quantitative information about this subject. Telemedicine activities started in North America from 1994 to 1999 (Zanaboni & Wootton, 2012).

The healthcare system in Saudi Arabia faces many challenges, and the Ministry of Health is under tremendous pressure in order to develop a high-quality healthcare system and improve healthcare services to all individuals, especially in remote and rural areas (Alaboudi, et al, 2016). The Ministry of Health, in 2010, stated that telemedicine promises could alleviate many challenges of the healthcare system in Saudi Arabia (Canada Health Infoway, 2013). The first national project of telemedicine was launched in 2011 by the Ministry of Health, and it was referred to as the Saudi Telemedicine Network

(STN) and covered all healthcare facilities (Canada Health Infoway, 2013). Additionally, The Ministry of Health cooperated with Ontario Telemedicine Network and Canada Health Infoway to provide guidance in the development of the Saudi roadmap of telemedicine which was issued in 2013 (Canada Health Infoway, 2013).

In Saudi Arabia, various forms of telemedicine, such as phone calls and electronic messaging, have been used for years; however, COVID-19 has led to an increase in the implementation and adoption of telemedicine for patients across the country (Idriss et al, 2022).

Although telemedicine has several advantages, its usage is still infrequent and relatively unshaped in daily clinical practice (Berger et al, 2020). There are many barriers and challenges to the adoption of telemedicine (Alaboudi, et al, 2016). The challenges and barriers to adopting telemedicine are often cited as a failed project as 75% of them are abandoned or failed outright, and this proportion has increased to 90% in developing countries (Cresswell Sheikh, 2013; Van Dyk, 2013; Alaboudi, et al, 2016).

The challenges and barriers in the implementation of information communication technology (ICT) in a given organization or country may be different and not similar to neither the same ICT innovation in another organization or country nor for another ICT innovation in the same organization and country (Cresswell & Sheikh, 2013; Alaboudi, et al, 2016). Most organizations and countries are likely to face some challenges and barriers in adopting specific ICT innovations, such as telemedicine, with considerable variation. Moreover, each country or organization has its own unique sets of challenges and barriers related to its environment, contexts, strategy, plan, and innovation needs (Alaboudi, et al, 2016).

In Saudi Arabia, each healthcare facility probably has varied sets of challenges and barriers in implementing and adopting telemedicine as there are different types of healthcare facilities that participate in the Saudi healthcare system, including primary healthcare centers, medical cities, and hospitals. Moreover, these different healthcare facilities belong to varied sectors, such as the military sector, the Ministry of Health sector, and the private sector. Additionally, these facilities are located in different regions, such as urban or rural regions (MOH, 2013; Alaboudi, et al, 2016).

Therefore, the success of adopting telemedicine is dependent on addressing the challenges and barriers of each facility (Alaboudi, et al, 2016). However, there is a lack of focus on such barriers in studies reported from Saudi Arabia. The identification and detection of such barriers are necessary for improving the adoption of telemedicine. So, this systematic review was performed to identify the barriers and challenges to adopting telemedicine in Saudi Arabia by reviewing the previous studies conducted on this subject.

Chapter two: Review of literature
Review of Literature

Telemedicine is restricted by various circumstances, such as the inability to perform comprehensive physical examinations, security breaches, possibilities of technical issues, and regulatory barriers (Balestra, 2018). The critics of the use of telemedicine worry that telemedicine may adversely affect the continuity of care, protesting that online interactions aren't personal and dangerous due to obtaining incomplete history (Yang & Kozhimannil, 2016; Balestra, 2018). Also, there are regulatory and legal obstacles, including regulations, large variations in rules, and guidelines for practicing telemedicine. This variability participates in confusion among providers engaged in telemedicine practice (Balestra, 2018). Regulations and rules of telemedicine differ greatly by state and are constantly emerging and evolving. This creates unclear understanding regarding guidelines and

standards among groups and healthcare organizations (Balestra, 2018).

Several studies have examined the barriers and challenges related to telemedicine, a study by Lintz was conducted on 67 primary healthcare providers at a primary care clinic in north Texas using a self-administrated during the COVID-19 pandemic period; however, the response rate was 70%. The author revealed that the major barriers to the adoption of telemedicine were the cost of equipment and reimbursement. The less common obstacles were inadequate technical infrastructure, confidentiality and security concerns, lack of technical expertise, resistance from administrators, patients, and users, as well as the lack of usefulness of telemedicine. Encouraging the future adoption of telemedicine among providers require decreasing such barriers (Lintz, 2022). Another study from the United States was a qualitative study that assessed the factors affecting the implementation of telehealth in critical access hospitals. There were many factors found to affect the implementation and use of telehealth in critical access hospitals, and they include acceptance of practitioners, availability, and making changes to workflow and infrastructure. On the other hand, supportive factors involved support for implementation and technical assistance (Haque et al, 2021). Therefore, even in the same countries, there are variations in the barriers to adopting telemedicine.

In one study that evaluated issues of telemedicine adoption in the United States and Brazil and conducted on healthcare professionals, it was reported that the adoption of telemedicine was influenced by culture and policies in both countries and was affected by privacy and security in the United States. In the two countries, healthcare professionals disagreed on how the privacy of patients should be preserved (Luciano et al, 2020).

A cross-sectional survey from German included 605 participants; it was demonstrated that the acceptance of telemedicine was rapidly rising compared to previous studies. A few barriers were reported, and barriers such as concerns about data security were seen as less important in case of emergency (Weißenfeld et al, 2021).

A study from North India developed a theoretical framework that highlights facets of perceived risk and their correlation with behavioral intention. The final sample included 215 observations, and it was reported that the behavioral intention of doctors was negatively affected by social risk, technology risk, time risk, and security risk. This behavioral intention can affect the practice of doctors to telemedicine and may act as a barrier to telemedicine practice (Bakshi & Tandon, 2022).

A study from Bangladesh based on quantitative analysis of a data set of 500 telemedicine patients from rural areas identified the significant barriers to telemedicine adoption, and they include health staff motivation, lack of organizational effectiveness, and patient satisfaction. The previous obstacles offered considerable resistance to the maintenance and adoption of telemedicine projects in rural Bangladesh. Moreover, the success of the implementation of telemedicine was indirectly affected by various factors such as lack of information and communication technology infrastructure, quality of care, and allocation of resources (Zobair et al, 2020). It was reported by Hassibian and Hassibian that the main barriers to telemedicine being applied in developing countries were high cost and cultural resistance (Hassibian & Hassibian, 2016). In Indonesia, of a total of 100 clinicians, there were 78% satisfied with telemedicine; however, the main barrier reported of telemedicine was poor internet connection which hindered the use of the system. There were 40% of participants suggested improvement of the infrastructure, including internet connection and electricity, to facilitate using telemedicine (Indria et al, 2020).

In a narrative review conducted during the COVID-19 pandemic, the barriers to telehealth in this period included limited access to the internet and devices, which is a technical problem, and

lack of awareness about the technology, and this indicates the requirement of training and education. Also, the implementation of telehealth required high costs. Other challenges were the legal framework related to confidentiality and privacy (Kalal et al, 2022).

Hast et al. included 118 studies for analysis to identify barriers to telemedicine. It was found that the most important barriers to telemedicine-supported integrated care were the characteristics of individuals and the surrounding social and healthcare system. Additionally, the successful implementation of telemedicine was hampered by missing data, evidence for the effectiveness of telemedicine, and information system development and application (Harst et al, 2020).

A systematic review included 27 studies and included studies conducted during the COVID-19 pandemic; it was reported that despite the widespread of telemedicine usage during the COVID-19 pandemic, using telemedicine is still hampered by various challenges and barriers. The barriers and challenges were categorized into seven categories; data confidentiality and reimbursement, technical aspects, special population, physical examination and diagnostics, training of healthcare providers and patients, accessibility, and the correlation between doctors and patients. The major technical barriers reported included a lack of universal access to technology and poor internet connection. Also, physical examination and performing certain procedures were impossible to be done through telemedicine. Concerns about the privacy of patients were also an obstacle to telemedicine. Additionally, healthcare providers and patients were deficiently trained and required more training on such technology (Ftouni et al, 2022).

A previous systematic review conducted before the COVID-19 pandemic reported a total of 33 barriers to adopting telemedicine reported through 30 articles. The major identified barriers were technical issues challenged by the staff, followed by resistance to change and cost, then

reimbursement, age of patients, and level of education. The other remaining barriers represented almost 4% or less than 4% (Scott Kruse et al, 2018).

In Saudi Arabia, there is a lack of studies reporting barriers to telemedicine. However, the investigation of telemedicine in Saudi Arabia involved other subjects that can influence the implementation of telemedicine. One cross-sectional study was conducted in four hospitals; King Faisal Specialist Hospital and Research Center, King Abdul-Aziz Medical City, King Saud University Medical City, and King Saud Medical City. The study included 391 physicians, and it was found that the majority of clinicians have two or more smart devices and connect with patients by social media or email; however, the majority of medical practitioners showed little understanding of telemedicine technologies. This lack of knowledge about technology may act as a barrier to implementing telemedicine. However, most of the participants showed a willingness to incorporate telemedicine in clinical practice. The main obstacles to implementing telemedicine included concerns related to anonymity, costs, lack of preparation, and information and communication issues of technology (Albarrak et al, 2019).

Another study by Aboalfotouh et al. included 351 healthcare workers at King Abdul-Aziz Medical city to assess the recognition of the usage and practicality of smartphones in clinical settings. The rate of usage was 42.3%; however, a few proportions (6.1%) of all healthcare providers reported that they always use applications in their practice (Abolfotouh et al, 2019).

A larger sample size of 781 participants from rural and urban areas of Saudi Arabia was included in a cross-sectional study using an online survey questionnaire that was distributed through various social media platforms. Most of the participants (70%) recognized the possible advantages of telemedicine; however, they demonstrated concerns regarding using this technology for

healthcare purposes. The authors recommended the importance of general public confidence in telemedicine in Saudi Arabia. These concerns and unconfident also can act as barriers to adopting telemedicine (Alshahrani et al, 2019).

When the capacity and practice of telemedicine were investigated in Saudi Arabia in one study, it was found that 84% of practitioners have willing to adopt telemedicine, and the major barriers were the lack of expertise (90%), followed by preparation (71%) and then consuming time (Amin et al, 2020).

Patients can act as barriers to the implementation of telemedicine. One study evaluated the use of four-G smartphones for mobile dermatology by taking a photo of the skin with the mobile phone and then making a face-to-face diagnosis. The images were transmitted to a second dermatologist to make an independent diagnosis for comparison. However, 14% of the patients opposed skin lesion photography. Refusal of patients to be photographed can be considered an obstacle to applying telemedicine (Kaliyadan et al, 2013).

In the dentistry field, the major problems facing Saudi dental informatics were lack of IT support, financial costs, and social acceptability; again, the population shows a significant influence on the application of informatics (Al-Nasser L et al, 2014).

Barriers to adopt telemedicine remain in both developed and developing countries and unnecessarily slow its diffusion. Developing countries may also struggle with the implementation of technology, such as high-speed Internet (Alshammari, 2021). The global diffusion of telemedicine can provide many advantages to both providers and patients, but barriers exist.

Telemedicine is a component of E-health, and the factors affecting the adoption of E-health in Saudi Arabia have been investigated. It was reported similar barriers to that of telemedicine, such as the correlation between the healthcare professional and the patient. The lack of such correlation, fear about the possibility of violating data privacy, and the lack of governmental regulations were challenged to implement E-health. Additionally, some demographic factors such as gender, residence, age, income, culture, and education also acted as barriers to the adoption of the E-health system in Saudi Arabia (Alanezi, 2021).

Chapter three: Research Objectives

Research Questions

- What are the barriers of the adoption of telemedicine in Saudi Arabia?
- What are the challenges facing healthcare providers to adopt telemedicine in Saudi Arabia?
- What are the possible solutions to conquer the barriers of telemedicine in Saudi Arabia?

Research Objectives

- To assess the barriers restricting the adoption of telemedicine in Saudi Arabia by reviewing the previous studies conducted on this subject.
- To assess the challenges facing healthcare provider to adopt telemedicine in Saudi Arabia.
- To identify the possible solutions to overcome the barriers of telemedicine and implement telemedicine in Saudi Arabia.

Chapter four: Methodology

Methodology:

Data sources and Search strategy: The PRISMA guidance for systematic review and meta-analysis (Liberati et al, 2009) was adopted while writing this systematic review. Electronic databases and scientific websites were explored to obtain studies related to our subject. The search process was performed throughPubMed, Elsevier, Research Gate, and Google scholar between the year 2012 and the year 2022. A variety of keywords were used for searching purposes, including "Telemedicine, Telehealth, Barriers, Obstacles, Challenges, Adoption, Implementation." These terms were used in

different combinations to obtain all possible articles.

Eligibility criteria:

All the titles obtained from this primary exploration were revised thoroughly, and any title not related to our subject was excluded. Then duplicate findings were excluded as well as articles not conducted in Saudi Arabia. The remaining findings were reviewed for abstracts to precisely include articles that reported barriers and focused on telemedicine and excluded other articles. Any article that studies telemedicine and reports the barriers or challenges to adopting or implementing such technology was eligible for our analysis. Original articles were the articles eligible for our inclusion, whereas review articles, systematic reviews, brief reports, and letters to the editors were excluded. The second step involved checking the language of the full-text article and excluding articles written in non-English language and articles not available for full text. The final stage involved a precise review of the abstract and the exclusion of articles that included incomplete or overlapped data. The full description of the search strategy is shown in figure 1.

All the obtained records were 820, then duplicated titles, and ineligible articles not focusing and related to the current subject were removed. The remained records after removal was 200, of them 88 records were excluded as they didn't report clear data on barriers or challenges. However, of those 88 articles there were 8 sought for retrieval, but only one article retrieved and seven articles weren't retrieved. The final records were 113; of them 77 didn't report barriers or challenges by deep reviewing, 10 articles weren't original articles, 10 articles weren't written in English language, 7 articles weren't available for full-text and 3 articles reported overlapped and incomplete data. Therefore, the remaining articles eligible for our systematic review was only six articles.
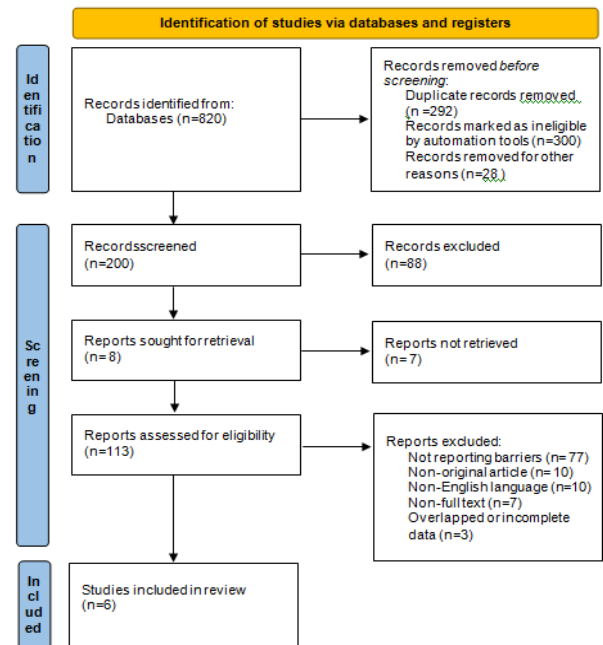

Fig 1: Planning of Eligible criteria

Data review and analysis

A specially designed excel sheet was used for data extraction; the data of interest included author and publication year, study design, population and sample size, results, and main findings. The extracted data was revised and then transferred to a pre-designed table to summarize the collected data.

Chapter five: Results

Results

This systematic review included six articles that met the eligible criteria, (table1).The studies were recently published between 2020 and 2022, except for one study, which was published in 2012 (El-Mahalli et al 2012).There were four cross-sectional studies (Alghamdi et al 2022, Altulaihi et al 2021, Kaliyadan et al 2020, Althbiti et al 2017), and of the remaining two studies, one was observational cross-sectional (El Kheir et al 2022), and the other was cross-sectional descriptive (El-Mahalli et al 2012).

The total number of participants was 2256, and the populations involved in the studies were healthcare providers 11Althbiti et al 2017(50.9%) (Alghamdi et al 2022, Althbiti et al 2017), physicians 712 (31.6%) (El Kheir et al 2022, Altulaihi et al 2021, Kaliyadan et al 2020), and

healthcare professionals 396 (17.5%) (El-Mahalli et al 2012). Only one study recruited participants from two different settings and included health professionals settings that adopted telemedicine 252 (63.6%) and those from settings where telemedicine wasn't adopted 114(36.4%) (El-Mahalli et al 2012).

There were two studies didn't report the number and rates of males and females (Kaliyadan et al 2020, Althbiti et al 2017), whereas the remaining four studies reported a total number of males of 1090 (62.3%) and females of 660(37.7%), with a dominancy of males in the four studies.

The results showed that the use rate of telemedicine was reported in three studies (Alghamdi et al 2022, El Kheir et al 2022, Kaliyadan et al 2020); the rate ranged between Kaliyadan et al 2020% (Alghamdi et al 2022) and 58.1% (Kaliyadan et al 2020). In one study, one-third of participants preferred telemedicine over office visits (Altulaihi et al 2021). In another study, the majority (84%) of medical providers were interested in the implementation of advanced telehealth technology (Althbiti et al 2017). Satisfaction with telemedicine and being comfortable with this technology was reported in three studies (Alghamdi et al 2022, El Kheir et al 2022, Altulaihi et al 2021); the rates ranged between 43% (Alghamdi et al 2022) and 64.3% (Altulaihi et al 2021). Only one study reported the platforms used for telemedicine, and they included Whatsapp (53.8%), zoom (33.4%), Microsoft teams (6.2%), Sehha app (16.5%), and email (21.4%) (Kaliyadan et al 2020).

The barriers to telemedicine were various and varied greatly between the studies. However, the barriers can be categorized into two groups; one group includes barriers due to the attitude, preference, and knowledge of health care providers, and the second group includes the barriers in general. Regarding the barriers related to health care providers, the barriers reported in the studies were lack of knowledge about telehealth (36%) (Alghamdi et al 2022), lack of

awareness (90%) (Althbiti et al 2017), lack of knowledge about telemedicine (71%) (El-Mahalli et al 2012), lack of trained staff (31%) (Alghamdi et al 2022), the thought that face to face clinic is the best when delivering healthcare (84.2%) (El Kheir et al 2022), and telemedicine isn't important or different from face to face visits (40%) (Althbiti et al 2017), (21%) (El-Mahalli et al 2012). Physicians chose office visits during the COVID-19 pandemic due to the ease of discussion and the ability to make a comprehensive physical examination (52%), office visits five enough time to diagnose the complaint, being more comfortable, office visits reduce stress, office visits don't require technology and uses time more efficiently compared to telemedicine consultation (Altulaihi et al 2021). Other barriers related to healthcare providers include concerns of diagnostic reliability (66.1%), physician resistance (36.5%) (Kaliyadan et al 2020), but the resistance of health professionals was the least barrier in another study (1.6%) (El-Mahalli et al 2012), and resistance in medical and social members represented (71%) in one study (Althbiti et al 2017).

The general barriers included lack of time and a busy schedule (38%) (Alghamdi et al 2022), lack of time to adopt telemedicine(39.7%) (El-Mahalli et al 2012), poor internet connection (36%), lack of expert support (29%) (Alghamdi et al 2022), it is hard to get some qualified to transmit the needed information thoroughly (63%) (Althbiti et al 2017), the readiness of patients for virtual care (51.5%) (El Kheir et al 2022), requiring new healthcare system that may consume time, money and training (71%) (Althbiti et al 2017), lack of human resources (61%) (Althbiti et al 2017), the expected misuse (52%)(Althbiti et al 2017), financial barriers and lack of instruction (13.9%) (El-Mahalli et al 2012), and technological limitations (66.6%) (Kaliyadan et al 2020). Technological issues were the least reported barrier in one study (Altulaihi et al 2021).

Table 1: The studies included in the analysis

Author and Publication year	Study design	Population and Sample size	Results and main findings
Alghamdi et al 2022	Cross-sectional	-Healthcare providers -N=1034 -Gender: *Males=677(65%) *Females=357(35%)	*Only El-Mahalli et al 20121 HCPs (Kaliyadan et al 2020%) have used telehealth applications *Alghamdi et al 2022% of HCPs perceived telehealth as being useful in quality and care delivery. *43% of HCPs felt comfortable using telehealth. *El Kheir et al 2022.El Kheir et al 2022% perceived telehealth as being useful for patients with transportation difficulties *38% believed that telehealth provides a confidential way of protecting patients' information *Speech-language therapists and public health professionals were the highestHCP users (98% and 95%, respectively), while general physicians and dentists were the lowest users(Alghamdi et al 2022% and 55%, respectively). *The barriers for not using telehealth were lack of time/busy schedule (38%) was the most frequently reported barrier, poor internet connection (36%), lack of knowledge about telehealth (36%), and lack of trained staff (31%), and a lack of expert support (29%).
El Kheir et al 2022	Observational cross-sectional	-Physicians -N=101 -Gender: *Males=62(61.4%) *Females=39(38.6%)	*There were 58 (57.4%) physicians use smart devices in healthcare delivery *There were 51 (50.5%) satisfied with this use *Barriers: There were 52 (51.5%) physicians doubtful about patients' readiness for virtual care, and there were 84.2% of the sample believed that face-to-face clinic encounters with patients were the best when delivering healthcare.
Altulaihi et al 2020	Cross-sectional	-Physicians -N=219 -Gender: *Males=111(50.6%) *Females=108(El-Mahalli et al 2012.4%)	*There were 64.3% satisfied with telemedicine *Only one-third preferred telemedicine over office visits *The barriers while using telemedicine during the COVID-19 pandemic among physicians included 52% the ease of discussion and the ability to make a comprehensive physical examination as the most important reasons for choosing office visits over telemedicine; technological issues were the least important factor for choosing either clinic. *Other barriers included office visits giving enough time to diagnose the complaint of the patient, office visits being more comfortable than telemedicine consultation, office visits reducing stress, office visits don't require any form of technology, and office visits using time more efficiently than telemedicine consultation.
Kaliyadan et al 2020	Cross-sectional	-Licensed physicians -N=392 -Gender:-------	*There 228 (58.1%) had used some form of telemedicine (other than standard phone calls) during the COVID-19 pandemic *The most common platforms used for telemedicine include WhatsApp® (211, 53.8%), Zoom® (131, 33.4%), Microsoft Teams® (27, 6.2%), Sehha App (65, 16.5%), Email (84, 21.4%). *There was a strong agreement that Telemedicine can reduce unnecessary outpatient visits (87.5%), *The barriers to telemedicine included technological limitations (66.6%) and concerns about diagnostic reliability (66.1%). Only 36.5% agreed or strongly agreed that physician resistance was a barrier to the practice of telemedicine. *The majority of the respondents agreed or strongly agreed that the use of telemedicine will decrease after the pandemic ends (52.8%).
Althbiti et al. 2017	Cross-sectional	-Medical providers -N=114 -Gender:-----	*Participants actually interested in implementing advanced Telehealth Technologies by percent of 84%, *The barriers to implementing telemedicine included lack of awareness (90%), it requires a new healthcare system that may consume time, money, and training (71%), the resistance to change in both social and medical members (71%), it is hard to get someone qualified to transmit the needed information thoroughly (63%), lack of human resources (61%), there will be misuse (52%), no strong need for this technique and it is not important or different from face to face visit (40%).
El-Mahalli et al 2012	Cross-sectional descriptive	-Health professionals from one hospital not adopting telemedicine and three hospitals adopting telemedicine -N=396 *Adopting tele=252 (63.6%) *Not adopting tele=1Alghamdi et al 2022 (36.4%) -Gender (total) *Males=240 (60.6%) *Females=156 (39.4%)	*The perceived barriers and challenges at the hospital not adopting telemedicine were: *lack of knowledge about the meaning of telemedicine and its applications, types, and benefits (71%) *Lack of time to adopt telemedicine (39.7%) *Telemedicine isn't important (21%) *Financial barrier and lack of infrastructure (13.9%) *Health professionals' resistance (1.6%)

Chapter six: Discussion

Discussion:

Telemedicine is one type of information and communication technology-supported care delivery (Harst et al, 2020). Telemedicine technology has been proven to be beneficial and is considered to be a viable option, allowing healthcare facilities to provide care in a comprehensive and more economical way (El-Mahalli et al, 2012). Telemedicine has been adopted in many countries in order to provide better healthcare for individuals, especially those living in remote areas and far away healthcare services (Hassibian & Hassibian, 2016). Healthcare facilities are working to implement telemedicine for various reasons, including improving the services delivered to the patients, reducing costs and access to care, educating the patients, and expanding the geographic footprint of the facility (Alghatani, 2016). However, telemedicine has recorded poor implementation and a very patchy history of adoption (El-Mahalli et al, 2012).

The implementation of telemedicine in Saudi Arabia has encountered various challenges and barriers, as reported in a previous scoping review (El Kheir et al, 2021). The term "barrier" is defined, according to Oxford Dictionary, as a circumstance or obstacle that keeps individuals or things apart or prevents progress or communication (Harst et al, 2020).

The barriers to telemedicine adoption can be categorized as technical barriers, economic barriers, organizational barriers, and barriers to end-user acceptance (Harst et al, 2020). However, there is no definite classification or categorization of the barriers; A systematic review from Ethiopia published in 2020, categorized barriers as staff and programmer barriers, user barriers, and organizational barriers (Sagaro et al, 2020). In the current analysis, we divided barriers into two main categories; general barriers and barriers related to healthcare providers. The general barriers included basic schedule, lack of time, poor internet connection, lack of expert support, whereas the barriers related to healthcare providers include lack of knowledge and awareness about telehealth, lack of training, and the thought that face to face clinic is the best for delivering healthcare.

User barriers are barriers related to the patients who use telemedicine and were reported in one analysis to include seven barriers by reviewing different literature during the study period. These barriers included limited literacy regarding computer or e-health, access to the mobile phone, education level, socioeconomic factors, unawareness of telehealth products' existence and services, the bandwidth of dwelling, and cultural factors. This category of barriers represented 28% of barriers and was in the second rank of barriers (Sagaro et al, 2020). In our analysis, no study was conducted on patients or users, all the included studies were conducted on the medical staff.

The second category reported in the previous analysis from Ethiopia was organizational barriers which represented Althbiti et al 2017% as the major barrier category reported. There were 12 types of organizational barriers identified, and they included cost as the major barrier (20.5%), ICT infrastructure (18.2%), internet connection (13.6%), technical support system (13.6%), health system (6.8%), and electricity (6.8%), whereas the remaining barriers represented less than 5% for each and they included human resources, staff turnover, reimbursement regulations, implementation model and guidelines, service integration and e-health policy (Sagaro et al, 2020). Similarly, in our analysis, we found poor internet connection, lack of expert support, lack of human resources, financial barriers, and lack of instruction, as well as technological limitations, were barriers to adopting telemedicine; however, there were variations in studies included in our analysis between barriers reported. Therefore, we couldn't report the major reported barriers in the studies.

The third category reported in the previous systematic review conducted in Ethiopia was staff and programmer barriers. There were six main barriers reported in this category; these barriers included resistance to change as the major barrier (33.3%), followed by language (25%) and readiness (16.7%), whereas design/system, anxiety, and technically challenged staff represented less than 10%. Resistance to telemedicine adoption by healthcare professionals was the major barrier in Ethiopia (Sagaro et al, 2020). In our analysis, the resistance of medical and social members represented 71% in one study (Althbiti et al 2017), physicians were reported by 36.5% in another study (Kaliyadan et al 2020), whereas in another study, it was reported as the least barrier (El-Mahalli et al 2012). Language wasn't found as a barrier in our analysis, but readiness was reported; there were 51.5% of physicians in one study reported that the readiness of patients is a barrier to adopting telemedicine (El Kheir et al 2022). In our analysis, also a requirement for a new healthcare system and technological issues were reported as barriers to adopting telemedicine. However, the new system represented one of the major barriers (71%) (Althbiti et al 2017), whereas technical issues were the least reported barriers (Altulaihi et al 2021). Again, these barriers were reported individually in different studies as each study included in our analysis reported different and various barriers.

In a previous scoping review from Saudi Arabia, the reported barriers included inadequate information technology (IT) infrastructure, lack of expertise, bureaucracy, insufficient institutional support, and absence of guidelines (El Kheir et al, 2021). In our analysis, we found that there is a lack of expert support, a lack of qualified ones to transmit the needed information, a lack of instructions, and technological limitations.

It was reported that the major barrier to the implementation of telemedicine is the perception that the costs of telemedicine are very high (Alghatani et al, 2016). Cost doesn't involve the initial cost of applying telemedicine only, but it is also associated with the development of telemedicine applications. The main cost of telemedicine also involves the training of medical professionals and patients, telecommunication expenses, and the need for new advanced technologies. However, the cost of telemedicine varies with the application intended for it (Hassibian & Hassibian, 2016). In our analysis, financial barriers were reported. Also, consuming money was reported when stating that implementation of telemedicine requires a new healthcare system that may consume money. However, no more information or data were reported regarding the cost as a barrier for telemedicine.

Healthcare institutions are likely to face new ethical barriers due to the implementation of telemedicine, such as the protection of patients' private information against potential cyberattacks (Florea et al, 2021). Legal issues regarding the privacy of the patients and confidentiality play a crucial role in competing for health system priorities and a perceived lack of demand to be barriers to telemedicine adoption. Legal issues are one of the major hindrances to the adoption of telemedicine (Alghatani et al, 2016). In our analysis, the expected misuse was reported as an obstacle to adopting telemedicine and was reported by more than one-half of the medical staff (Althbiti et al 2017). There were no other barriers reported regarding legal issues or patient privacy in our analysis.

Technological challenges are related to legal considerations (Alghatani et al, 2016). Technological challenges include low wideband internet and other network communication systems. The application of telemedicine requires high speed and reliable communication to motivate users (Hassibian & Hassibian, 2016). Also, the need for an expert technician is another technical challenge, as it is an accepted fact that the general population and many physicians aren't

aware of technical issues and aren't able to fix such problems arising in their computer systems and networks. Therefore, there is a need for trained expert manpower to fix such issues and establish stable and continuous communication between healthcare professionals and patients (Hassibian & Hassibian, 2016). Other issues related to infrastructure include power supplies. These technical issues can be of great concern in developing countries (Alghatani et al, 2016).

In our analysis, we could identify some barriers related to technology, including lack of expert support, poor internet connection, technological limitations, and technological issues.

It was stated that organizational culture is the third-most common barrier globally. This is due to being unusual in sharing and exchanging skills and knowledge with professionals and patients located in remote areas via telecommunication. This challenge involves both cultural and human factors. Some healthcare providers and patients resist adopting service models that vary from the traditional approaches or indigenous practice (Alghatani et al, 2016). There is a lack of confidence in patients regarding the outcomes of practicing telemedicine. It is hard for them to believe that they can receive healthcare services without visiting the physicians (Jang-Jaccard et al, 2014). In our analysis, as the studies were conducted on the medical staff, we couldn't report the barriers related to the patients. In our analysis, the rate of physicians who thought that face-to-face clinics were the best for delivering healthcare was high and significant proportions of physicians also thought that telemedicine isn't important, and others thought it isn't different from face-to-face visits. A considerable proportion of physicians preferred office visits compared to telemedicine, even during the COVID-19 pandemic. However, this preference was due to various factors, including concerns of diagnostic reliability, as patients may require physical examination that can't be performed through telemedicine. Also, office visits offer enough time for the diagnosis of

patients to ensure the correct diagnosis. In terms of the confidence of patients about the efficacy of telemedicine (Alghatani et al, 2016), in our analysis, physicians thought that the readiness of patients for virtual care is a barrier to telemedicine.

Additionally, the lack of ICT literacy to use telemedicine effectively among healthcare providers and patients is another barrier to the adoption of telemedicine (Alghatani et al, 2016). In our analysis, the lack of trained staff, lack of awareness, and knowledge about telemedicine were potential barriers identified to the adoption of telemedicine. The adoption of telemedicine requires the acceptance and satisfaction of users incorporated in the process (Alghatani et al, 2016). In our analysis, the acceptance of physicians was reported in three studies (Alghamdi et al 2022, El Kheir et al 2022, Kaliyadan et al 2020); however, the acceptance rate didn't even reach 60%, and satisfaction ranged between 43% (Alghamdi et al 2022) to 64.3% (Altulaihi et al 2021). Physicians aren't well convinced about the efficacy of telemedicine in delivering healthcare services. Being unfamiliar with telemedicine and its efficiency the delivering healthcare service is a big challenge for the acceptance of telemedicine, especially in developing countries. Successful acceptance of telemedicine can be obtained if both patients and physicians have sufficient confidence in the effectiveness of telemedicine (Saghaeiannejad-Isfahany et al, 2015). It was reported in one study that almost 77% of professionals believe that continued training is necessary for healthcare providers to stay up-to-date with advances in telemedicine (Florea et al, 2021).

The lack of appropriate guidelines is a barrier to telemedicine and may lead to the malpractice of telemedicine (Florea et al, 2021). In our analysis, the lack of instruction was a barrier to telemedicine.

Summary

Electronic health (E-health) has been implemented in Saudi Arabia in different healthcare facilities. Telemedicine is a part of E-health and it has various forms. One form is self-testing or self-monitoring which focus on monitoring of health and clinical signs of the patient remotely using different types of technology. The adoption of telemedicine in Saudi Arabia has been increased since the COVID-19 announced to be a global pandemic. Telemedicine has many advantages; however, it is still infrequently used in the daily clinical practice. Therefore, the identification of the barriers for the implementation of telemedicine can help to put solutions and increase the implementation of telemedicine. This systematic review showed that there are various barriers for the implementation of telemedicine in Saudi Arabia and these barriers were categorized into two main groups; barriers related to the healthcare providers and general barriers. The barriers associated with the healthcare providers, included lack of knowledge and awareness about telemedicine, lack of trained staff, the thought that face to face clinic is the best when delivering healthcare, concerns of diagnostic reliability, physician resistance. The general barriers included lack of time and a busy schedule, poor internet connection, lack of expert support, the readiness of patients for virtual care, the requirement of new healthcare system, and the lack of human resources. These barriers varied between different studies, although they were from Saudi Arabia and this indicates that the determination of the barriers for implementing telemedicine should be individually and related to each facility. Also, the solutions should be suggested based on the barriers reported in each healthcare facility.

Conclusion

There is no focus on the barriers and challenges of adopting telemedicine and the great focus is awareness, knowledge, perception, and attitude toward telemedicine. The studies reported barriers and challenges as additional findings without reporting barriers in the title or the aim of the study. Barriers and challenges of telemedicine adoption were various and varied between studies in different regions, although the studies were from the same countries. The major barriers identified involved a lack of awareness and knowledge about telemedicine, the thought of physicians that the clinic is better, technical issues, lack of experts, and costs. Acceptance of physicians and patients of telemedicine, training, and increasing knowledge and awareness about telemedicine and its effectiveness is necessary for the successful adoption of telemedicine.

Limitations, and strengths

The limitations of this systematic review are the inclusion of a few studies for analysis and the probability of missing studies that reported barriers and challenges of telemedicine as the studies didn't report them either in the title or in the aim of the studies. The strength of the study is that this is the first systematic review report on the challenges and barriers of telemedicine adoption in Saudi Arabia with a great focus on barriers and challenges; the previous studies reported barriers and challenges as besides finding and didn't even focus on it. This systematic review showed that the barriers could be varied between different facilities, even in the same countries, and this ensures the evaluation of barriers in each facility individually.

Recommendations

We recommend further studies conducted and focus on barriers and challenges facing telemedicine adoption in order to identify the general barriers to be solved in the whole country and the individual barriers specific to each facility to individually conquer them in order to enhance the adoption and implementation of telemedicine.

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