Telemedicine in Middle Eastern countries: Progress, barriers, and policy recommendations

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Abstract

Background: Despite attempts to reform the healthcare delivery system in the Middle East, expectations for its progress have been—and for some still are—somewhat slow. ***Objective:*** This study reviewed progress in the use and adoption of telemedicine in Middle Eastern countries. The key dimensions affecting the progress of telemedicine in these countries were identified. ***Method:*** A systematic review of the literature was conducted on 43 peer reviewed articles from 2010 to 2020. The review followed the scientific process of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines of identification, selection, assessment, synthesis, and interpretation of findings. ***Results:*** The results showed that progress made in the utilization of telemedicine was insufficient and varies across Middle Eastern countries. Certain cultural, financial, organizational, individual, technological, legal, and regulatory challenges were found to prevent telemedicine from being fully used to the point where the full range of medical services can be provided. For example, doctor and patient resistance, poor infrastructure, lack of funding, poor system quality, and lack of information technology training were associated with the low adoption of telemedicine in the region. ***Conclusion:*** This review provides a number of recommendations that will help policymakers to move toward the integration of innovative technologies in order to facilitate access to health information, health services, and training. It also recommends that health initiatives should focus on health education and health promotion in order to increase public awareness of the benefits of telemedicine services in the region.

Keywords: telehealth, telemedicine, e-health, health policy, Middle East

1. Introduction

Over the past decades, rapid advances in information and communication technology (ICT) has had a significant impact on the health sector of developing countries (Sarsam, Al-Samarraie, Ismail, Zaqout, & Wright, 2020; Burney, Mahmood, & Abbas, 2010). Information technologies (IT), such as telemedicine, e-health, telehealth, and mobile health, have been shown to reduce healthcare costs and medical errors (Bervell & Al-Samarraie, 2019; Alotaibi & Federico, 2017). Telemedicine in particular—plays a significant role in healthcare access in developing countries (Luna, Almerares, Mayan, Gonzalez Bernaldo de Quiros, & Otero, 2014). The World Health Organization (WHO) defines telemedicine as "the delivery of healthcare services, where distance is a critical factor, by all the healthcare professionals using ICT for the exchange of valid information for the diagnosis, treatment, and prevention of disease, research and evaluation"(WHO, 2010). According to Sood et al. (2007), it has the potential to play an integral role in providing medical information and services across space and time via telecommunication technologies ranging from the telephone to robotics. In the developed countries, especially in European countries such as Germany, France, United Kingdom, Norway, and Sweden, the effective implementation of telemedicine has enabled broad adoption of best healthcare practices. Developing countries, especially the Middle Eastern countries, are making progress in adopting relevant information technology innovations, policy and guidelines in an effort to advance the use of their telemedicine program. However, the actual implementation of telemedicine in these countries continue to be slow, particularly due to the diverse and complex nature of their cultural and social backgrounds. It is also worth mentioning that past and current conflicts in some Middle Eastern countries–such as Iraq, Yemen, Syria, and Egypt–continue to bring unrest and instability to the region. Based on this, the utilization of telemedicine services in the Middle East has varied considerably over time. In addition, despite the launch of many telemedicine

programs in Middle Eastern countries since the 1990s (Saudi Arabia, United Arab Emirates (UAE), Iran, Turkey, Kuwait, Bahrain, Iraq, Syria, Oman, Qatar, and Jordan), the progress made in the utilization has been insufficient and varied across countries (Bali, Gupta, Khan, & Pakhare, 2016), with most telemedicine initiatives not progressing as expected (Barakat, Woolrych, Sixsmith, Kearns, & Kort, 2013; Jalghoum & Khasawneh, 2016). Poor progress may lead to failure, especially when implemented in low-income countries such as Yemen and Syria (Al-Fadhli, Othman, Rashed, & Ramasamy, 2015; Ruxwana, Herselman, & Pottas, 2014). Zayyad and Toycan (2018) suggested that the poor adoption of telemedicine services in most Middle Eastern countries can be attributed to cultural barriers (Alajlani & Clarke, 2013). According to Abdulellah Alaboudi, Atkins, et al. (2016), about 75% of telemedicine projects are abandoned or fail outright and this percentage is as high as 90% in developing countries.

Given the potential benefits of telemedicine, yet the poor adoption and success rates in developing countries, there is a need to understand the factors influencing the progress of telemedicine in Middle Eastern countries. Consequently, the objective of this review was to describe and evaluate the current progress in using telemedicine within the context of the Middle Eastern culture. This includes identifying the key challenges that have deterred certain healthcare organizations from adopting telemedicine in specific countries and cultural environments. The outcomes of this study can support and improve the decision-making process and planning for the implementation of telemedicine in Middle Eastern countries. The rest of the paper is organized as follows: The methodology used in this review is presented in Section 2. Section 3 identifies the progress and barriers of telemedicine implementation. Section 4 presents recommendations for policy makers. Finally, Section 5 concludes this work.

2. Methodology

This review was guided by two research questions: "What is the current progress in the use and adoption of telemedicine in the Middle Eastern countries?" and "What are the key challenges/barriers of implementing telemedicine in these countries?" To answer these questions, a systematic review was conducted. This review was structured in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Liberati et al., 2009).

2.1 Literature search and inclusion criteria

This systematic review included empirical studies on the use and adoption of telemedicine in Middle East countries. All the papers included in this review were published in peer-reviewed journals, conference proceedings, or university repositories (online theses). We made the decision to include previous systematic reviews related to telemedicine in an attempt to capitalize on the wealth of information acquired previously. This review was guided by certain query filters as an efficient and effective strategy for retrieving relevant articles from different databases. A literature search was performed using MEDLINE (accessed through PubMed), IEEE Xplore Digital Library, Cochrane (Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Cochrane Methodology Register, Database of Abstracts of Reviews of Effects, National Health Service Economic Evaluation Database), ProQuest, Web of Science, Scopus, Global Health, Global Health Library (Regional Indexes and WHOLIS), Emerald, ERIC, Science Direct, Springer, and Google Scholar. It is also worth mentioning that our search of the literature was not restricted by language, data, or publication status. We searched the literature from January 1990 to December 2019 for articles addressing various aspects related to the progress and challenges of telemedicine utilization in Middle Eastern countries. This start date was chosen because it

was the time when policymakers and researchers became interested in barriers associated with extending the telemedicine reach across a country-specific sample.

The following keywords were used in the search: ("challenges" OR "barriers" OR "obstacles" OR "factors") AND ("affect' OR "impact" OR "influence" OR "applied" OR "utilized" OR "adopt" OR "implement") AND ("telemedicine" OR "e-health" OR "telehealth" OR "electronic health" OR "electronic health record") AND ("Middle East" OR "Arab countries" OR "Golf countries" OR "Gulf Cooperation Council" OR "Saudi Arabic" OR "Iraq" Or "Yemen" OR "Iran" Or "Egypt" Or "Jordan" OR "Syria" OR "Palestine" OR "Turkey" OR "Kuwait" OR "United Arab Emirates" OR "Qatar" OR "Bahrain"). Boolean operators and quotation marks were used in the search process to capture variations in the lexicon and to identify the desired intersection.

2.2 Screening and coding procedures

According to Figure 1, the initial search of the literature yielded 648 studies. All titles and abstracts, similar or related to the search keywords, were screened and retained for further review. An article was included if it met the inclusion criteria: publication (the article was published in a scholarly journal); content (the article explored barriers or challenges of telemedicine in the region); and published papers from 2010 to 2020. We decided to include all study design types. Based on these criteria, we found that some of the papers were more useful than others. Our search led to the identification of 240 studies from database searching. After exclusion of duplicates, the 240 articles were screened and 158 were excluded. Our initial screening of titles and abstracts led to the exclusion of studies that did not emphasize particular barriers. The full text of 82 eligible articles was reviewed. Other theoretical and conceptual articles and non-peer-reviewed research reports were also excluded. The remaining 43 studies were then fully reviewed to identify barriers that affecting the progress

of telemedicine in Middle Eastern countries. The 43 studies were carefully read and evaluated by at least two reviewers (authors). A meeting was set up to compare notes and to reach an agreement on barriers/challenges. Six main dimensions were agreed on: organizational, technological, financial, individual, culture, and legal barriers. These challenges were grouped by country of origin.

We coded the barriers that we identified in previous studies by deciding whether it included items assessing each of the six dimensions. An item-focused coding approach was used due to its heterogeneity across disciplines. The barriers were placed under the organizational dimension if they were related to human resources within an organization. The barriers were placed under the technological dimension if they were related to information system and connectivity software. The barriers that were placed under the financial dimension were those related to financial resource and operational cost of telemedicine. The barriers that were placed under the individual dimension were related to users' experience, knowledge, and awareness of telemedicine systems. The barriers related to certain social constraints and traditional beliefs inside the community were placed under the cultural dimension. Lastly, the barriers that were related to the policies, legislation, standard governing confidentiality and privacy for the use of telemedicine were placed under the legal and regulatory dimension.

2.3 Quality assessment

As illustrated in Figure 1, a total of 43 articles were selected for the review. Four experts (medical health professionals) were independently assigned to evaluate the selected papers. Four criteria were used to assess the quality of publications by the experts:

1- Relevance of the study objectives in addressing the research questions raised in this review.

2- Appropriateness of the research region (Middle East countries).

3- Appropriateness of the study type and relevance to the focus of the review (Empirical [quantitative and qualitative] and review/meta-analysis study focus).

4- Reliability of the results in relation to focus of this review.

A literature matrix was created and used to help experts review all the collected articles that discussed issues related to telemedicine in Middle Eastern countries. The invited experts used a spreadsheet to compile their recommendations on whether the article was relevant to this study, and a consensus meeting was called to exchange their observations. Interrater reliability has been used to assess and obtain the quality of indicators. Based on the recommendation of Cooper et al., the interrater reliability was estimated using an item-by-item method and was calculated by dividing the number of agreements by the total number of agreements plus disagreements divided by 100. The average value for the interrater agreement was 96% among the experts. The total number of articles that met the standard of inclusion and quality check was 43 (see Figure 1).
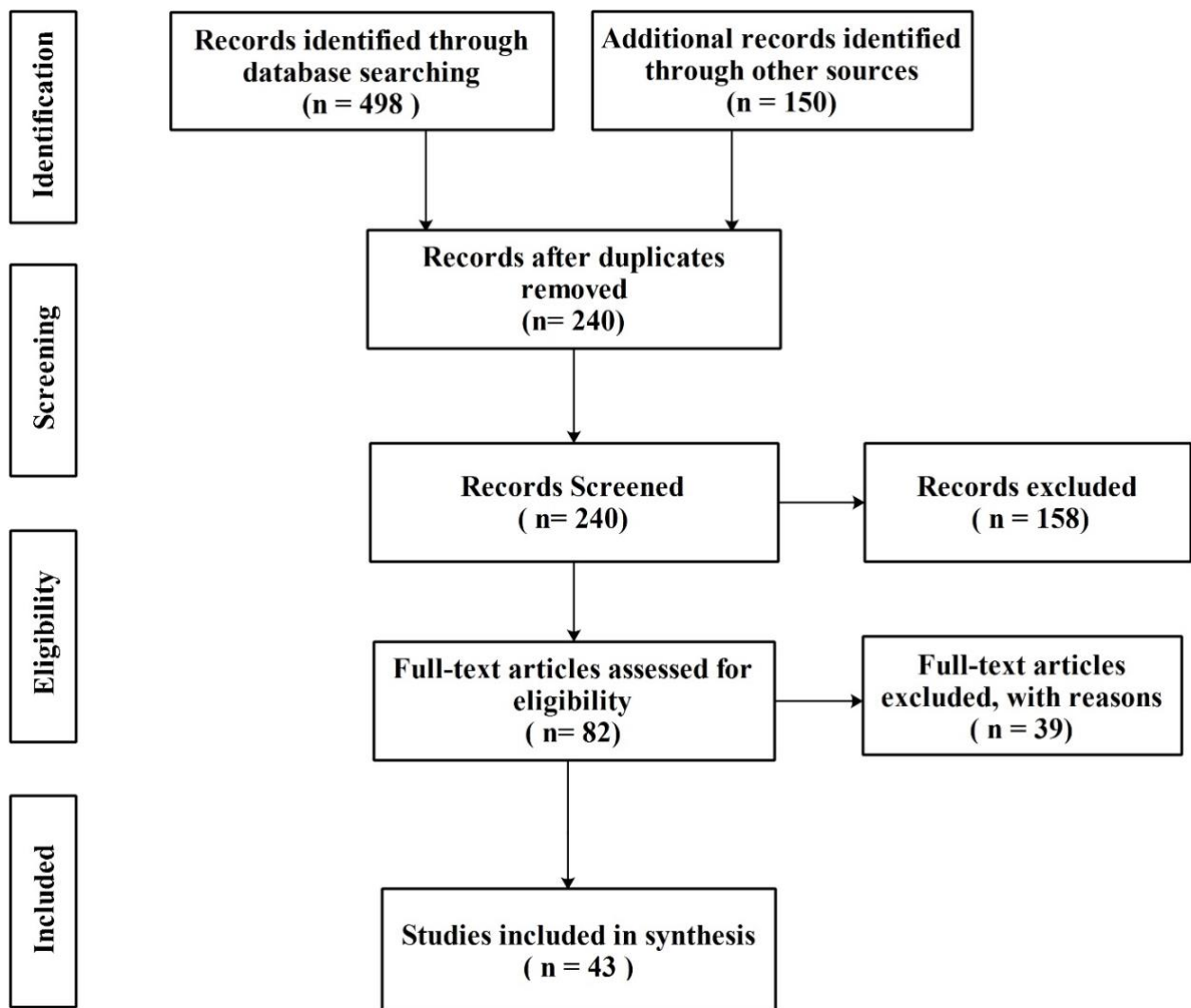
Figure 1: Article searching and selection process

3. Results

3.1 Telemedicine progress in Middle Eastern countries

The progress of telemedicine use in Middle Eastern countries is shown in Figure 2. In 1990, Saudi Arabia and Iran were the first to consider the potential of using telemedicine services in the region. Yale Telemedicine Centre was the main telemedicine source in Saudi Arabia to improve the quality of care, enhance access to healthcare, and offer patient care and management. Yet, the perception of telemedicine adopters in Saudi Arabia was low in terms of ease of use, the use of store-and-forward telemedicine, and the ability to follow up after face-to-face contacts (El-Mahalli, El-Khafif, & Al-Qahtani, 2012). Slow progress has been

observed over the years, including the launch of the first national project for telemedicine in 2011 named the Saudi Telemedicine Network (STN). This project was based on cooperation between the Saudi Ministry of Health, Canada Health Infoway, and the Ontario Telemedicine Network. The aim of the project was to provide the necessary recommendations for developing a telemedicine roadmap (Abdulellah, et al., 2016). This led the STN to issue a set of standards for using telemedicine in the country in 2013, which resulted in wider access to healthcare services for patients in all regions. In 2017, King Fahad Medical City was one of the key players in launching various telemedicine services in accordance with the STN standards. In 2018, the Ministry of Health (MoH) in Saudi Arabia decided to expand its telemedicine services through the delivery of the Seha–a mobile app (Ministry of Health, Kingdom of Saudi Arabia, 2018).

Iran was also one of the major players in healthcare IT development with the first attempt by Hashemi Nejad Hospital to build a health information system. Then, after many attempts, the fourth telemedicine program was approved by the Ministry of Health in 2004, followed by the introduction of the national integrated care electronic health record in 2008. The utilization of telemedicine by most hospitals in Iran have been accepted as a viable alternative to addressing the inequality of access to health services, especially in rural areas (Latifi & Alizadeh, 2016). In 2017, a telemedicine system was installed on offshore oil and gas platform in Iran's southern Assaluyeh port in an attempt to provide online health-oriented services without any time-related restrictions.

Turkey followed with its initiative of a telemedicine development process in 1997 under the national medical communication network project. This initiative aimed to provide a communication channel between health personnel and access to various health-related information (Aydoğdu & Aydoğdu, 2013). This project underwent progressed to the Ministry

of Health launching the first telemedicine project in 2007. This project was extended to another 15 city hospitals by 2013 and over 900 hospitals by 2016.

The development of telemedicine in Kuwait was noted back in 1998 when the US military tested a store and forward ophthalmic telemedicine system. Another attempt was made in 1999 when a group of medical professionals at Kuwait University exchanged medical images of pathological tissues. Later in 2004, the US army provided support to key hospitals in the country by introducing an online electronic email referral system to facilitate access and sharing of medical records.

Jordan initiated the first step toward using electronic health record services in the Madaba area in 1998. At that time, poor technological infrastructure and policy standards were the main challenges facing hospitals in Jordan. In 2008 and 2009, full utilization of telemedicine services was achieved within a limited area to provide continuing follow-up care (Dua'A, Othman, & Yahya, 2013).

The healthcare sector in Egypt witnessed a major development in 2002 when two Italian Hospitals (Umberto and ARNAS-Civic hospitals) established the inter-hospital teleconsulting project in order to provide a general roadmap for the implementation of telemedicine in the country. This was mainly managed by the IT unit at the Ministry of Communications and Information Technology in an attempt to lead the Arab-African Telemedicine Network initiative. Throughout the years (2006-2010), Egypt has undertaken extensions to develop its national telemedicine network, known as the Egyptian Telemedicine Network (ETN), mainly through the integration of two mobile units and the launch of the women's healthcare outreach program. This was followed by the launch of the National Picture Archiving and Communication System along with the Radiology Information System.

In Bahrain, the first attempt to utilize telemedicine services in the country was in 2003, with the establishment of telemedicine for diabetic retinopathy in order to improve the

detection and treatment of disease. In 2018, the first national project for telemedicine in Bahrain was launched.

In 2004, Iraq made its first attempt to implement telemedicine services in cooperation with the Swinfen Charitable trust group and Italian military cooperation. The Iraqi Telemedicine Center was the first telemedicine initiative funded by Mercy Hands for Humanitarian Aid. It was established in 2014 to provide support to healthcare professionals and patients across the country. However, further developments have not yet been reported.

Interestingly, the UAE joined the telemedicine race in 2013 when the health authority of Abu Dhabi implemented a sophisticated regulatory regime for telemedicine across the country. In 2017, Hatta Hospital launched telemedicine services mainly to speed up the disbursement of medicines for patients. Furthermore, in 2017, the Dubai Health Authority (DHA) introduced telemedicine at its facilities through the "Dubai RoboDoc" initiative. Later in 2018, the Mubadala Healthcare project was established to form a joint venture between Abu Dubai and Switzerland's leading telemedicine provider "Medgate." The service was launched through a live consultation between a patient at the Arab Health conference licensed doctors in the free zone. In 2019, DHA launched the "Doctor for Every Citizen Initiative" to enable healthcare providers in Dubai to use the latest digital technology in order to enhance efficiencies in care delivery.

In 2011, Oman developed its first national e-health strategy that led to further development of the telemedicine project. Another example of telemedicine implementation in Oman was by Al Shifa Hospital, where the national electronic health record system was fully installed and utilized to serve patients from different regions.

There was limited evidence available about the use of telemedicine services in Qatar. One evidence found was dated 2015 when the National Health Information Exchange System was established to aid the healthcare community. In 2019, the Qatar Foundation partner

university launched a comprehensive mobile telemedicine platform to provide swift medical services to residents and visitors to the 2022 FIFA World Cup.

From this timeline of telemedicine progress, it can be seen that telemedicine has undergone dramatic changes in the last 10 years in response to the technological development in the region. Yet, a number of challenges have also been reported with regard to the utilization of telemedicine services in this region. This is discussed in detail in the next section.
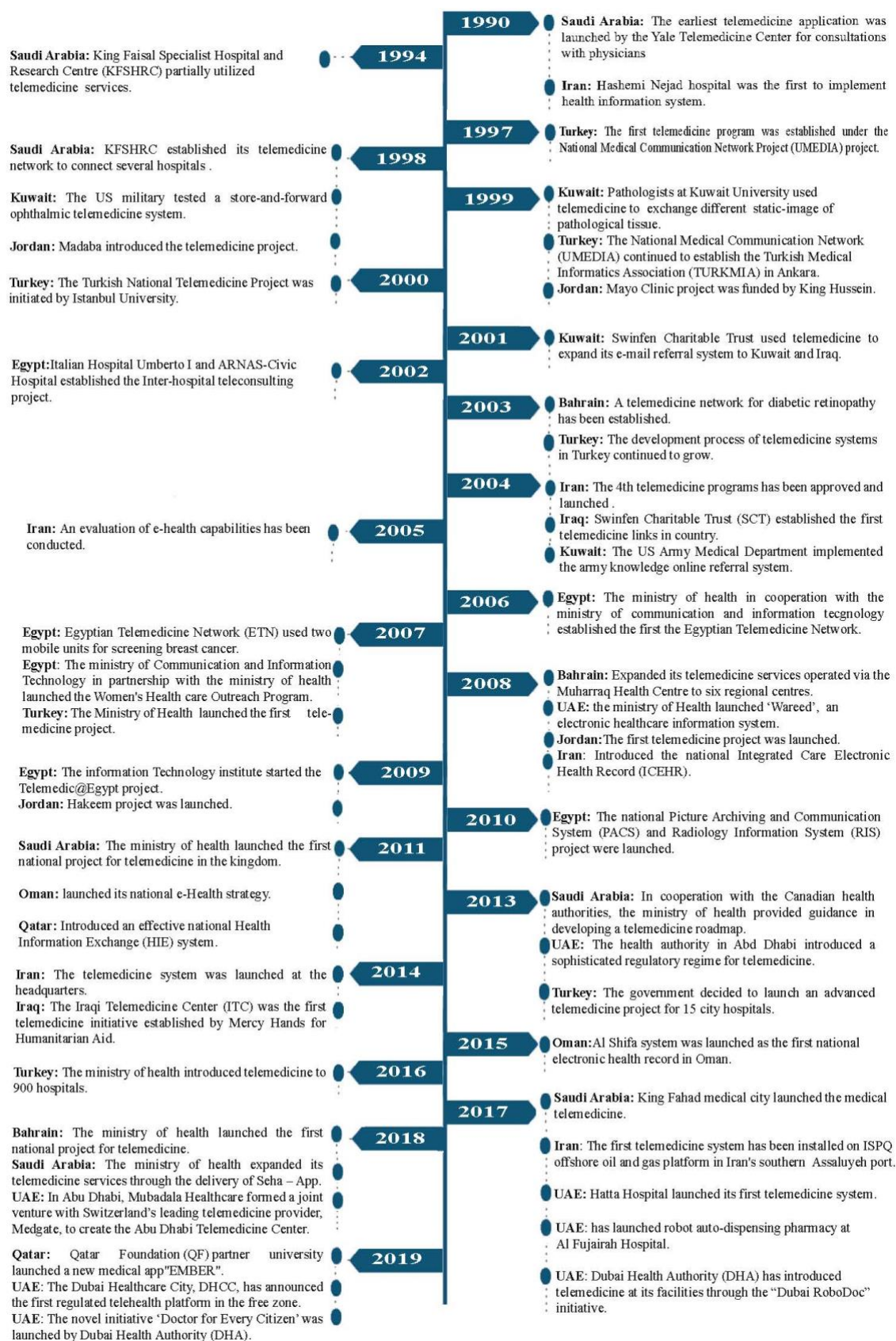
Saudi Arabia: King Faisal Specialist Hospital and Research Centre (KFSHRC) partially utilized telemedicine services.

1994

1990

Saudi Arabia: The earliest telemedicine application was launched by the Yale Telemedicine Center for consultations with physicians

Iran: Hashemi Nejad hospital was the first to implement health information system.

Saudi Arabia: KFSHRC established its telemedicine network to connect several hospitals .

1998

1997

Turkey: The first telemedicine program was established under the National Medical Communication Network Project (UMEDIA) project.

Kuwait: The US military tested a store-and-forward ophthalmic telemedicine system.

1999

Kuwait: Pathologists at Kuwait University used telemedicine to exchange different static-image of pathological tissue.

Jordan: Madaba introduced the telemedicine project.

Turkey: The National Medical Communication Network (UMEDIA) continued to establish the Turkish Medical Informatics Association (TURKMIA) in Ankara.

Turkey: The Turkish National Telemedicine Project was initiated by Istanbul University.

2000

Jordan: Mayo Clinic project was funded by King Hussein.

2001

Kuwait: Swinfen Charitable Trust used telemedicine to expand its e-mail referral system to Kuwait and Iraq.

Egypt: Italian Hospital Umberto I and ARNAS-Civic Hospital established the Inter-hospital teleconsulting project.

2002

2003

Bahrain: A telemedicine network for diabetic retinopathy has been established.

Turkey: The development process of telemedicine systems in Turkey continued to grow.

2004

Iran: The 4th telemedicine programs has been approved and launched .

Iraq: Swinfen Charitable Trust (SCT) established the first telemedicine links in country.

Iran: An evaluation of e-health capabilities has been conducted.

2005

Kuwait: The US Army Medical Department implemented the army knowledge online referral system.

2006

Egypt: The ministry of health in cooperation with the ministry of communication and information tecgnology established the first the Egyptian Telemedicine Network.

Egypt: Egyptian Telemedicine Network (ETN) used two mobile units for screening breast cancer.

2007

Egypt: The ministry of Communication and Information Technology in partnership with the ministry of health launched the Women's Health care Outreach Program.

Turkey: The Ministry of Health launched the first tele-medicine project.

2008

Bahrain: Expanded its telemedicine services operated via the Muharraq Health Centre to six regional centres.

UAE: the ministry of Health launched 'Wareed', an electronic healthcare information system.

Jordan: The first telemedicine project was launched.

Iran: Introduced the national Integrated Care Electronic Health Record (ICEHR).

Egypt: The information Technology institute started the Telemedic@Egypt project.

Jordan: Hakeem project was launched.

2009

2010

Egypt: The national Picture Archiving and Communication System (PACS) and Radiology Information System (RIS) project were launched.

Saudi Arabia: The ministry of health launched the first national project for telemedicine in the kingdom.

2011

Oman: launched its national e-Health strategy.

2013

Saudi Arabia: In cooperation with the Canadian health authorities, the ministry of health provided guidance in developing a telemedicine roadmap.

Qatar: Introduced an effective national Health Information Exchange (HIE) system.

UAE: The health authority in Abd Dhabi introduced a sophisticated regulatory regime for telemedicine.

Turkey: The government decided to launch an advanced telemedicine project for 15 city hospitals.

Iran: The telemedicine system was launched at the headquarters.

2014

Iraq: The Iraqi Telemedicine Center (ITC) was the first telemedicine initiative established by Mercy Hands for Humanitarian Aid.

2015

Oman: Al Shifa system was launched as the first national electronic health record in Oman.

Turkey: The ministry of health introduced telemedicine to 900 hospitals.

2016

2017

Saudi Arabia: King Fahad medical city launched the medical telemedicine.

Bahrain: The ministry of health launched the first national project for telemedicine.

2018

Saudi Arabia: The ministry of health expanded its telemedicine services through the delivery of Seha – App.

Iran: The first telemedicine system has been installed on ISPQ offshore oil and gas platform in Iran's southern Assaluyeh port.

UAE: In Abu Dhabi, Mubadala Healthcare formed a joint venture with Switzerland's leading telemedicine provider, Medgate, to create the Abu Dhabi Telemedicine Center.

UAE: Hatta Hospital launched its first telemedicine system.

UAE: has launched robot auto-dispensing pharmacy at Al Fujairah Hospital.

Qatar: Qatar Foundation (QF) partner university launched a new medical app"EMBER".

2019

UAE: The Dubai Healthcare City, DHCC, has announced the first regulated telehealth platform in the free zone.

UAE: Dubai Health Authority (DHA) has introduced telemedicine at its facilities through the "Dubai RoboDoc" initiative.

UAE: The novel initiative 'Doctor for Every Citizen' was launched by Dubai Health Authority (DHA).

Figure 2: Telemedicine progress in Middle Eastern countries

Table 1: Barriers affecting telemedicine adoption in Middle Eastern countries (N=43)

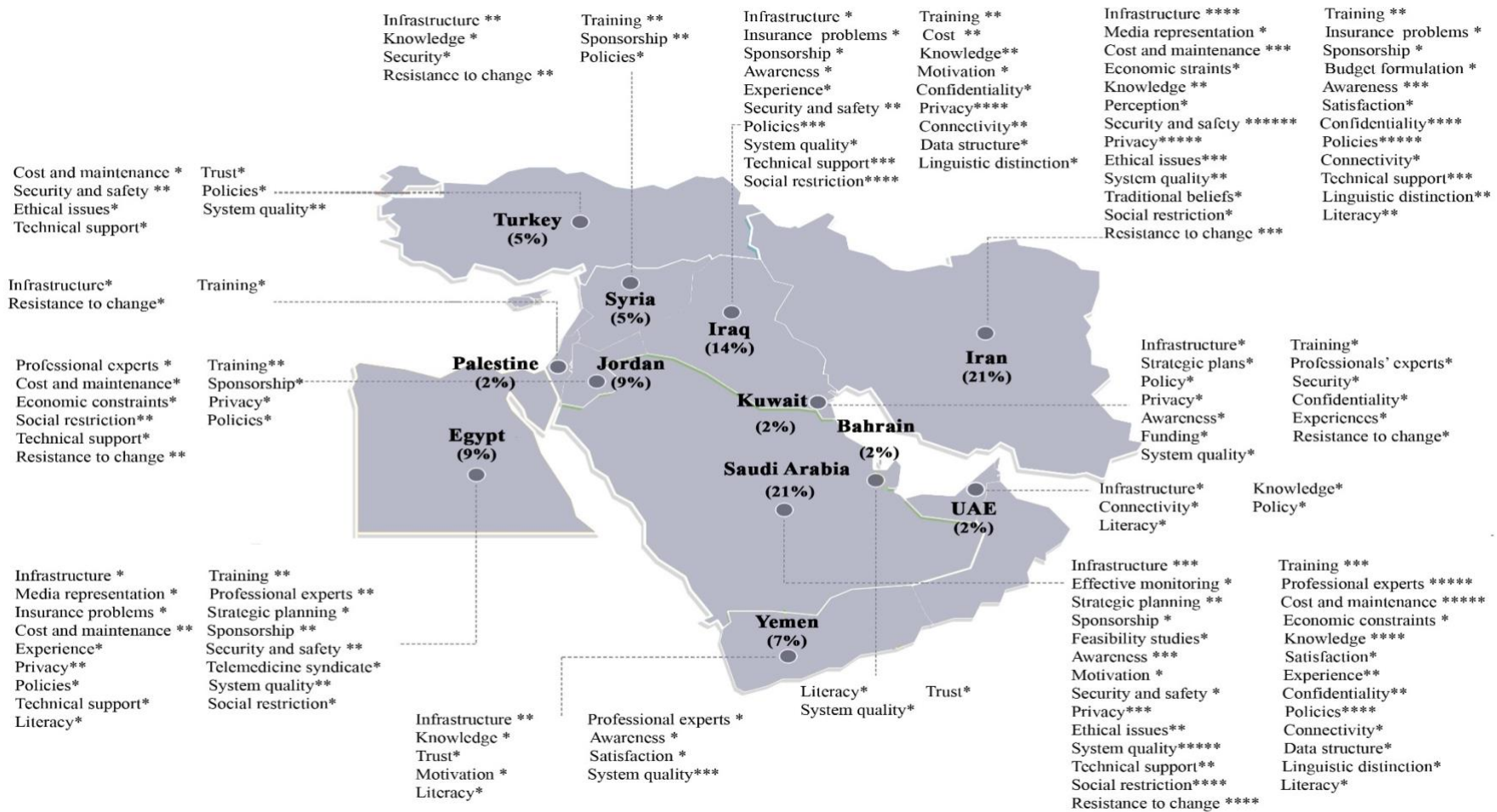| N	Author/year published	Country	Purpose	Category	Barriers/Challenges
1	Salehahmadi and Hajialiasghari (2013)		Identify the strengths and weaknesses of telemedicine in Iran	Technological	Tactile feedback
				Legal and regulatory	Security, policies, privacy, and confidentiality
				Cultural	ICT literacy and linguistic distinctions
				Organizational	Infrastructure
2	Sheikhtaheri, Sarbaz, Kimiafar, Ghayour, and Rahmani (2016)		Examine the readiness of clinical workers and their attitudes toward the use of telemedicine	Individual	Awareness
3	Ajami, Ketabi, Isfahani, and Heidari (2011)		Assess the readiness of Iran to implement the Electronic Health Record (EHR)	Individual	Awareness
4	Keshvari, Haddadpoor, Taheri, and Nasri (2015)		Determine the awareness and attitudes of employees toward the utilization of telemedicine	Individual	Awareness
5	Nikabadi and Jahromi (2015)		Identify and analyze barriers of telemedicine implementation	Legal and regulatory	Legal and ethical barriers
				Organizational	Infrastructure
				Technological	Technical support
				Financial	Financial
		Iran		Cultural	Cultural
6	Saghaeiannejad-Isfahany, Jahanbakhsh, and Shayan (2015)		Investigate the feasibility of using telemedicine in selected hospitals in Iran	Organizational	Initial costs, insurance and reimbursement, and infrastructure
				Legal and regulatory	Legal issues and confidentiality
				Technological	Technical staff and internet problems
				Cultural	Resistance to change
				Individual	Knowledge
7	Maher, Malmir, and Alimohamadzadeh (2016)		Investigate barriers affecting the success of telemedicine implementation	Organizational	Infrastructure, management, budget formulation, tools and equipment, training, and media representation
				Legal and regulatory	Rules and regulations
8	Ayatollahi, Sarabi, and Langarizadeh (2015)		Explore clinicians' perceptions of telemedicine technology	Individual	Knowledge, perception, and satisfaction
				Legal and regulatory	Medical malpractice, and security
9	Sharifi et al. (2013)		Identify the challenges associated with the implementation of e-health in medical care	Organizational	Standardized applications and training
				Financial	Initial costs
				Legal and regulatory	Privacy and security
				Cultural	Resistance to change
				Technological	Technical difficulties
10	Abdulellah Alaboudi, Alzahrani, et al. (2016)		Investigate the perceptions and attitudes of clinical staff toward telemedicine acceptance	Individual	Awareness and knowledge
				Cultural	Resistance to change and social and religious restrictions
				Legal and regulatory	Ethical issues
				Financial	Cost
11	Abdulellah Alaboudi, Atkins, et al. (2016)		Identify the predictive barriers in adopting and implementing telemedicine	Organizational	Professional expertise, strategic plans, and infrastructure
				Technological	System quality and information quality
		Saudi Arabia		Cultural	Culture and society
				Financial	Economic constraints and recession
12	El-Mahalli et al. (2012)		Examine perceptions of health professionals to use telemedicine	Individual	Knowledge
				Organizational	Infrastructure
				Cultural	Resistance to change
13	A Alaboudi, Atkins, and Sharp (2015)		Develop a framework to support the adoption and development of telemedicine	Individual	Satisfaction
				Cultural	Resistance to change
				Legal and regulatory	Privacy and security
				Organizational	Infrastructure
				Financial	Cost

14	Khalifa (2013)	Identify the important barriers and constraints that hinder the successful implementation of health information systems and electronic medical records	Individual	Awareness, knowledge, experience, and motivation
			Organizational	Professional expertise, strategic planning, effective monitoring, and training
			Legal and regulatory	Laws and policies
			Financial	Cost and maintenance, feasibility studies, and sponsorship
			Technological	Technical support, connectivity, data structure, and system quality
15	Hasanain (2010)	Examine the barriers of e-health implementation	Individual	Knowledge and experience
			Cultural	Social and linguistic distinctions
			Technological	Technical support and system quality
16	Dawoud, Althbiti, Al Khatib, and AL-Ghalayini (2017)	Assess the limitations of the healthcare system in the country	Individual	Awareness
			Cultural	Resistance to change
			Organizational	Experts and training
			Financial	Cost
17	Albarrak et al. (2019)	Evaluate the readiness of clinicians to adopt telemedicine	Legal and regulatory	Privacy and confidentiality
			Financial	Cost of equipment
			Technological	System quality
			Organizational	Training and experts
18	Ghani and Jaber (2015)	Investigate the effect of patients' privacy on their intention to adopt telemedicine	Legal and regulatory	Confidentiality and privacy
19	Ghani and Jaber (2015a)	Examine the factors influencing healthcare workers to adopt telemedicine	Legal and regulatory	Privacy and policy
			Technological	Connectivity, data structure, and technical support
			Cultural	Social
			Financial	Cost
20	Jaber, Ghani, Burhanuddin, Abdulameer, and Mohammed (2015)	Examine the feasibility and acceptance level of the telemedicine framework in Iraq	Legal and regulatory	Privacy and policy
			Cultural	Culture
			Financial	Cost
			Technological	Technical support, connectivity
21	AL-Hadban and Kamarul Faizal Hashim (2017)	Explore the important factors and issues influencing the use and adoption of new technologies in the healthcare sector	Cultural	Social and linguistic distinction
			Individual	Experience and motivation
			Technological	System quality
			Legal and regulatory	Security
			Organizational	Training, infrastructure, and insurance
			Financial	Sponsorship support
22	Neamah and Abd Ghan (2018)	Investigate the factors affecting the adoption of electronic health records	Individual	Knowledge and attitude
			Organizational	Training
			Legal and regulatory	Privacy security and policy
			Cultural	Culture
			Technological	Support and complexity
23	Al-Moosawi and Nayyef (2017)	Assess the readiness to adopt telemedicine	Individual	Knowledge and awareness
			Financial	Funding
			Cultural	Social and cultural
24	Fouad and Abdullah (2013)	Propose a new ICT-based telemedicine system for Egyptian society	Individual	Experience
			Organizational	Professional expertise
25	Hussein and Khalifa (2012)	Provide a comprehensive view regarding the major strengths, weaknesses, opportunities, and threats (SWOT) of the current telemedicine applications	Technological	System quality
			Organizational	Experts, insurance and reimbursement, infrastructure, and media representation
			Legal and regulatory	Medical practice law, security, and privacy
			Financial	Cost, maintenance, and sponsorship
			Cultural	Social
26	Stadelmann (2012)		Organizational	Training

Note: the "Iraq" label spans rows 18–23 and the "Egypt" label spans rows 24–26 in the country column.

			Evaluate and analyze the challenges and weaknesses in the implementation of e-health	Financial	Sponsorship
				Technological	System quality
27	Eldin, Saad, and Samie (2013)		Evaluate clinicians' adoption of EHRs in Egypt	Technological	Technical support
				Cultural	Literacy
				Legal and regulatory	Privacy and security
				Financial	Start-up costs
				Organizational	Training
28	Alajlani (2010)		Identify the factors affecting the application of telemedicine in Jordan	Financial	Funding
				Organizational	Training
				Cultural	Resistance to change
29	Jalghoum and Khasawneh (2016)		Explore the challenges that hinder the development of e-health	Cultural	Social and resistance to change
30	Al-Rawajfah and Tubaishat (2017)	Jordan	Explore views on the barriers or facilitators for implementing EHRs in the country	Financial	Economic burden
				Organizational	Professional expertise and training
				Legal and regulatory	Privacy
31	Shafiei and Safavi (2015)		Examine the problems facing healthcare organizations in Jordan	Legal and regulatory	Policy
				Technological	Technical support
				Financial	Cost
				Cultural	Social
32	Al-Fadhli et al. (2015)		Identify the challenges and readiness of ICT infrastructure to implement telemedicine in Yemen	Organizational	Infrastructure
				Technological	Service quality
				Individual	Experiences
				Cultural	Literacy
33	Al-Fadhli, Othman, and Al-Jamrh (2017a)	Yemen	Investigate the adoption of telehealth	Organizational	Professionals, experts, and infrastructure
				Individual	Trust, awareness, and knowledge
				Technological	Information quality and service quality
34	Al-Fadhli, Othman, and Al-Jamrh (2017b)		Determine the intention of health professionals to use telehealth	Technological	System quality, information quality, and service quality
				Individual	Satisfaction
35	Ataç, Kurt, and Yurdakul (2013)		Identify the ethical problems in telemedicine	Legal and regulatory	Ethical problems and security
				Technological	Information quality
				Individual	Trust
36	Aydoğdu and Aydoğdu (2013)	Turkey	Study the main obstacles and recommendations of telemedicine implementation	Legal and regulatory	Medical law and security
				Financial	Cost
				Technological	Technical support and service quality
37	Alajlani (2010)		Assess the readiness of healthcare professionals to use telemedicine	Organizational	Infrastructure and training
				Financial	Funding
				Cultural	Resistance to change
38	Alajlani and Clarke (2013)	Syria	Investigate issues that affect the use and adoption of telemedicine in the Syrian Arab Republic	Organizational	Infrastructure and training
				Individual	Knowledge
				Financial	Funding
				Cultural	Resistance to change
				Legal and regulatory	Security and policy
39	Alaslawi, Berrou, Alhuwail, and Aslanpour (2019)	Kuwait	Examine the factors affecting e-health adoption and implementation in Kuwait	Organizational	Infrastructure, training, strategic plans, and professional expertise
				Legal and regulatory	Policy, security, privacy, and confidentiality
				Individual	Awareness and experiences
				Cultural	Resistance to change
				Financial	Funding
				Technological	System quality
40	Jaber et al. (2015)	Palestine	Examine the problems facing many healthcare organizations in Palestine	Organizational	Infrastructure and training
				Cultural	Resistance to change
41	Zolait, Radhi, Alhowaishi, Sundram, and Aldoseri (2019)	Bahrain	Examine the factors affecting e-health adoption	Cultural	Literacy
				Technological	System quality
				Individual	Trust

42	Alrawi and Hussain (2011)	United Arab Emirates	Analyze the factors influencing the transformation from a real community to a virtual community by the adoption of e-health	Cultural	Literacy
				Individual	Knowledge
				Organizational	Infrastructure
				Technological	Connectivity
				Legal and regulatory	Policy
43	Alkraiji, Osama, and Fawzi (2014)	Gulf Cooperation Council (GCC)	Identify the challenges in the development of health informatics	Legal and regulatory	Ethical, privacy, confidentiality, and policies
				Organizational	Professional expertise

3.2 Barriers affecting telemedicine adoption in Middle Eastern countries

In this study, we reviewed previous studies in an attempt to identify the barriers in adopting telemedicine in the Middle Eastern countries (see Table 1). A number of barriers were found across the Middle East. Precisely, thirty-seven barriers stemming from studies in twelve countries in the Middle East were identified. Figure 3 provides an overview of the barriers in each country. In order to facilitate the discussion and analysis process, we grouped Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE together into the Gulf Cooperation Council (GCC). Figure 3 organizes the countries of origin by frequency of occurrence in the literature. The highest percentage of studies on telemedicine in the Middle East was mainly found in the GCC (28%), followed by Iran (21%), Iraq (14%), Egypt and Jordan (9% each), Yemen (7%), Turkey and Syria (5% each), and Palestine (2%).

Infrastructure **
Knowledge *
Security*
Resistance to change **

Training **
Sponsorship **
Policies*

Infrastructure *
Insurance problems *
Sponsorship *
Awareness *
Experience*
Security and safety **
Policies***
System quality*
Technical support***
Social restriction****

Training **
Cost **
Knowledge**
Motivation *
Confidentiality*
Privacy****
Connectivity**
Data structure*
Linguistic distinction*

Infrastructure ****
Media representation *
Cost and maintenance ***
Economic straints*
Knowledge **
Perception*
Security and safety ******
Privacy*****
Ethical issues***
System quality**
Traditional beliefs*
Social restriction*
Resistance to change ***

Training **
Insurance problems *
Sponsorship *
Budget formulation *
Awareness ***
Satisfaction*
Confidentiality****
Policies*****
Connectivity*
Technical support***
Linguistic distinction**
Literacy**

Cost and maintenance *
Security and safety **
Ethical issues*
Technical support*

Trust*
Policies*
System quality**

Infrastructure*
Resistance to change*

Training*

Professional experts *
Cost and maintenance*
Economic constraints*
Social restriction**
Technical support*
Resistance to change **

Training**
Sponsorship*
Privacy*
Policies*

**Turkey
(5%)**

**Syria
(5%)**

**Iraq
(14%)**

**Palestine
(2%)**

**Jordan
(9%)**

**Iran
(21%)**

**Kuwait
(2%)**

**Bahrain
(2%)**

**Egypt
(9%)**

**Saudi Arabia
(21%)**

**UAE
(2%)**

Infrastructure*
Strategic plans*
Policy*
Privacy*
Awareness*
Funding*
System quality*

Training*
Professionals' experts*
Security*
Confidentiality*
Experiences*
Resistance to change*

Infrastructure*
Connectivity*
Literacy*

Knowledge*
Policy*

Infrastructure *
Media representation *
Insurance problems *
Cost and maintenance **
Experience*
Privacy**
Policies*
Technical support*
Literacy*

Training **
Professional experts **
Strategic planning *
Sponsorship **
Security and safety **
Telemedicine syndicate*
System quality**
Social restriction*

**Yemen
(7%)**

Infrastructure **
Knowledge *
Trust*
Motivation *
Literacy*

Professional experts *
Awareness *
Satisfaction *
System quality***

Literacy*
System quality*

Trust*

Infrastructure ***
Effective monitoring *
Strategic planning **
Sponsorship *
Feasibility studies*
Awareness ***
Motivation *
Security and safety *
Privacy***
Ethical issues**
System quality*****
Technical support**
Social restriction****
Resistance to change ****

Training ***
Professional experts *****
Cost and maintenance *****
Economic constraints *
Knowledge ****
Satisfaction*
Experience**
Confidentiality**
Policies****
Connectivity*
Data structure*
Linguistic distinction*
Literacy*

* Number of barriers identified by the reviewers for
the countries in the literature

Figure 3. An illustration of barriers affecting the utilization of telemedicine in Middle Eastern countries

As shown in Figure 4, the barriers of telemedicine implementation described in the previous section were reorganized into six dimensions: Cultural, legal and regulatory, financial, individual, organizational, and technological.
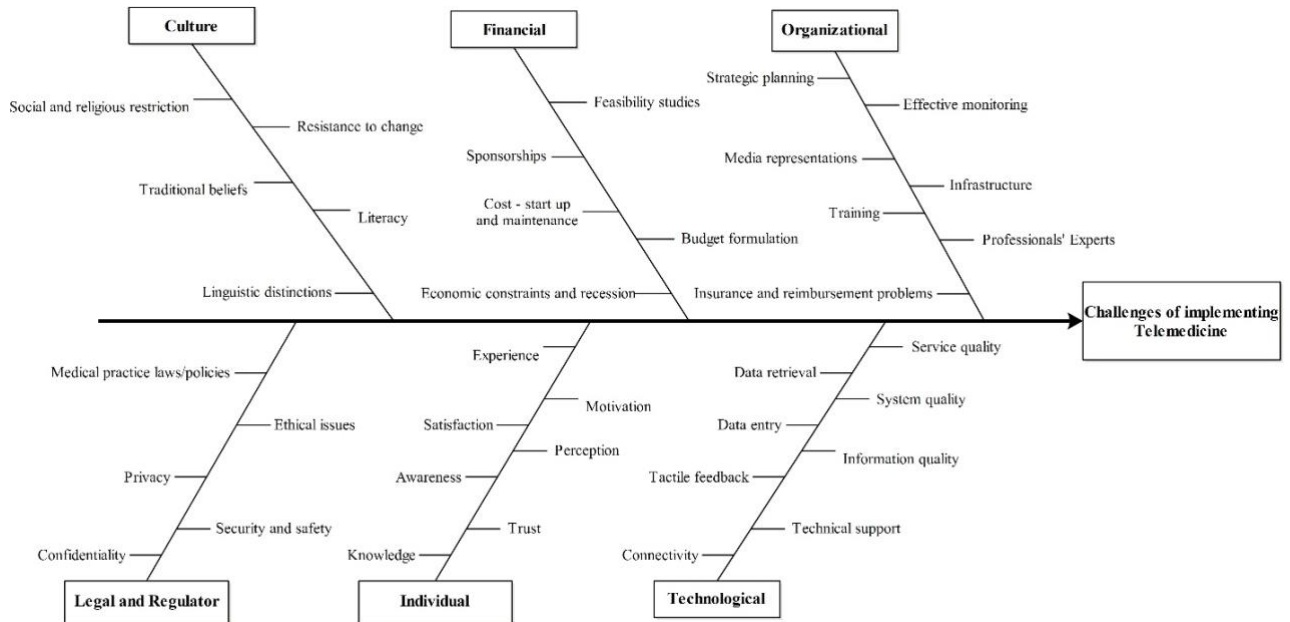
Figure 4: Fishbone diagram of telemedicine challenges in the Middle East

3.2.1 Culture barriers

In general, cultural, social, and religious restrictions are not always inconsistent with the procedure of providing healthcare services. However, in most Middle Eastern countries, such as Saudi Arabia, Iran, Egypt, Syria, Kuwait, Iraq, and Yemen, users' perceptions and attitudes toward adopting and accepting a new system were found to be strongly influenced by cultural, social, and religious barriers (AL-Hadban & Kamarul Faizal Hashim, 2017; Abdulellah Alaboudi, Alzahrani, et al., 2016; Jalghoum & Khasawneh, 2016; Nikabadi & Jahromi, 2015; Shafiei & Safavi, 2015). This study identified five cultural and social barriers that may potentially influence the use of telemedicine in the region (see Figure 4). These were religious and social restrictions, resistance to change, traditional beliefs, literacy level, and linguistic distinction. Our review showed that social and religious restrictions were the most common challenges in adopting telemedicine in several countries such as Iran, Saudi

Arabia, Iraq, and Palestine (Abdulellah Alaboudi, Alzahrani, et al., 2016; Nikabadi &

Jahromi, 2015; Shafiei & Safavi, 2015). It may be that clinical staff, especially in the case of

women, are often averse to being recorded/filmed. There may be a fear of sharing media with

other clinical staff or fear of data being lost, stolen, leaked, or seen by unauthorized people.

Resistance to change by doctors and patients was also identified as a cultural barrier.

Jalghoum and Khasawneh (2016) found that several health workers were overwhelmed when

telehealth projects were introduced in their hospitals. In addition, the lack of laws and

regulations that support the transformation process were also addressed in the literature as to

why healthcare workers resist change. It is anticipated that the greater the resistance of

physicians and other healthcare professionals to accept and use health information systems,

the less likely they will accept telemedicine, thus delaying its adoption and success in the

region. In Iran, it is believed that adopting telemedicine requires standardized patient training

on how to use the technology by users (Salehahmadi & Hajialiasghari, 2013). The level of

literacy and other linguistic distinctions were also found to contribute to individual use of

telemedicine. Some Middle Eastern countries, such as Iran and Turkey, have diversity in

languages and cultural aspects, which makes it difficult to build an acceptable verbal

communication between the physician and the patient (Darvish & Far, 2017; Hassibian &

Hassibian, 2016).

Alkabba, Hussein, Albar, Bahnassy, and Qadi (2012) argue that, in Saudi Arabia,

clinical consultations between different sexes are one of the top ten challenges in the

healthcare system. Whilst clinical consultations between members of the opposite sex are

permitted in Islamic ethics and rules under specific circumstances, the cultural and traditional

beliefs of some patients prohibit this practice, even via ICT. It is a sensitive cultural issue and

can potentially influence users' perceptions and attitudes toward accepting and using

telemedicine. Figure 5 shows the frequency of occurrence of cultural, legal and regulatory,

financial, individual, organizational, and technological barriers in the literature for each country. The percentage shown in Figure 5 was calculated by dividing the total number of each barrier in previous studies for each country by the total number of the same barrier reviewed in all Middle Eastern countries.
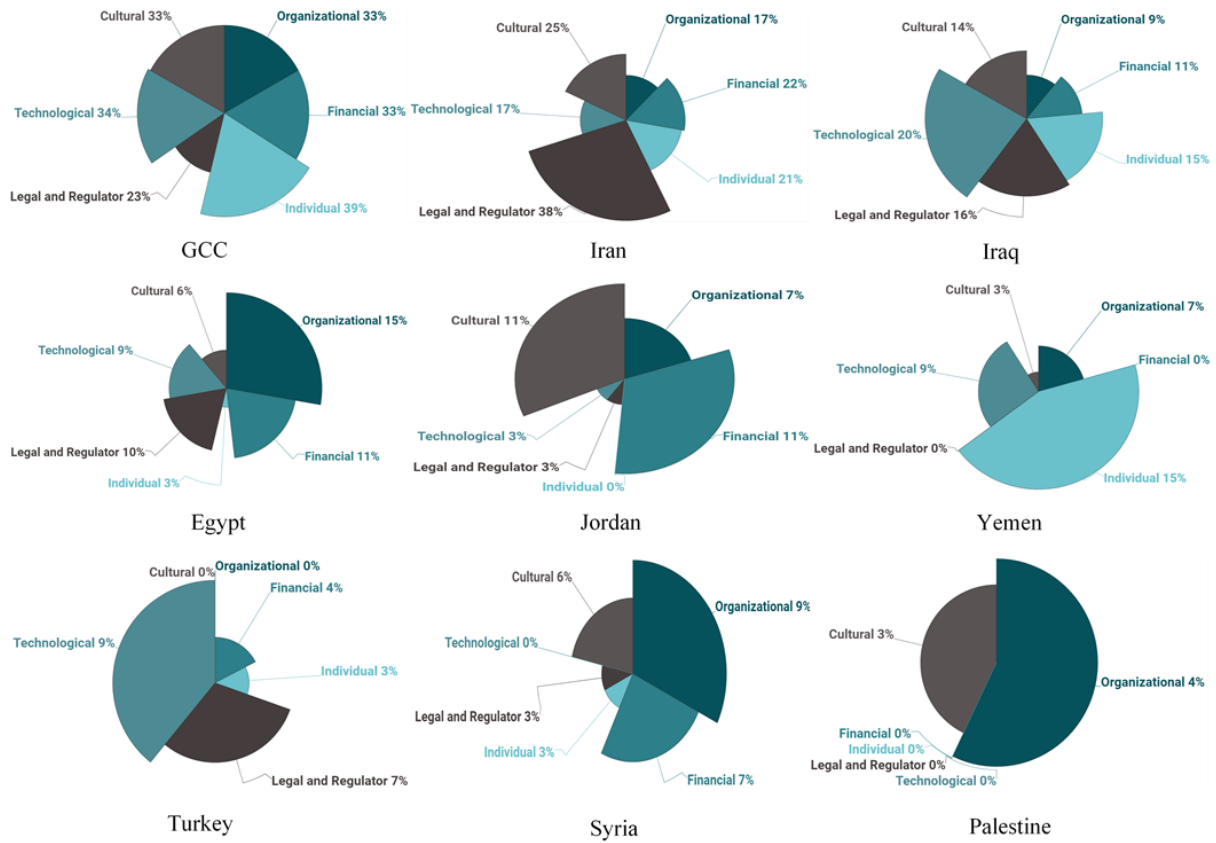
Figure 5: Barriers affecting the adoption of Telemedicine in the Middle East

3.2.2 Legal and regulatory barriers

Various legal and regulatory issues have been noted as concerns in the development of telemedicine in the Middle East (Al-Rawajfah & Tubaishat, 2017; Ataç et al., 2013; Ghani & Jaber, 2015; Hussein & Khalifa, 2012; Khalifa, 2013; Salehahmadi & Hajialiasghari, 2013). This is because the healthcare system in the region is often driven by different legal and regulatory frameworks designed to guide care delivery in several countries such as the GCC, Iran, Syria, Yemen, Iraq, and Turkey. Boonstra and Broekhuis (2010) found that the

use of telemedicine may have a negative effect on patient privacy. It seems that physicians are still in doubt as to whether telemedicine is a secure place to share personal patients' information and records, and fear that the data may be accessible to people who are not authorized to obtain it. In addition, physicians may also fear that inappropriate disclosure of patient information could lead to legal problems (Darvish & Far, 2017). Furthermore, the barriers of security, safety, confidentiality for data protection, and other ethical issues were also found to influence the use of telemedicine in the Middle East. The governmental structure in some countries in the Middle East may also delay the use of telemedicine (Jefee-Bahloul, 2014; Jefee-Bahloul, Moustafa, Shebl, & Barkil-Oteo, 2014) and influence patients' intention to use the technology. Thus, there is a need to implement the relevant policies and regulatory frameworks to protect information transmitted electronically and provide reassurance to patients and clinicians.

3.2.3 Organizational barriers

The implementation of telemedicine does not only require an understanding of the system but also knowledge of the healthcare organization itself. The healthcare organization plays an important role in ensuring that medical systems are successfully implemented and fit with the organizational goals. From the review of previous studies, we found that there are often significant barriers imposed by the structure of the organization, such as available infrastructure, professional expertise, strategic planning, training, effective monitoring, media representation, insurance, and reimbursement problems, which affect implementing telemedicine in Middle Eastern hospitals.

While some countries in the region have the required infrastructure for implementing telemedicine (e.g., Turkey, Jordan, and UAE), others do not (e.g., Saudi Arabia, Syria, Iraq, Yemen, and Iran). Lack of infrastructure was the most commonly highlighted barrier to

adopting telemedicine in several Middles Eastern countries (Al-Fadhli et al., 2015; AL-Hadban & Kamarul Faizal Hashim, 2017; Abdulellah Alaboudi, Alzahrani, et al., 2016; Alajlani, 2010; Hussein & Khalifa, 2012; Maher et al., 2016; Salehahmadi & Hajialiasghari, 2013). Some obvious examples of infrastructure-related barriers include lack of electricity and computer hardware. Moreover, most Middle Eastern countries have a large number of their citizens living in rural areas that lack the basic infrastructure, ICT, and broadband internet connectivity.

The lack of training programs provided to healthcare professionals was identified as another organizational barrier in most Middle Eastern countries (Dawoud et al., 2017; Maher et al., 2016). This may be due to the lack of widespread dissemination of information about telemedicine through workshops, seminars, symposia, conferences, and other platforms. In general, the healthcare sector in the Middle East lacks the knowledge and expertise to participate in standards development (Albarrak et al., 2019; Alshammari, 2019), thus affecting the ability to effectively implement standards locally. Furthermore, inadequate professional expertise could lead to the absence of or ineffective government policies regarding the adoption of telemedicine standards.

Other insurance and reimbursement problems were identified in the literature. For example, Naditz (2008) states that payment or reimbursement to the care providers for their services is made by private insurance companies or through government programs. Currently, reimbursements are not consistent across various types of telemedicine services. Reimbursement policies have also not been standardized amongst various private payers (Dantu & Mahapatra, 2013). In addition, Salehahmadi and Hajialiasghari (2013) found that the level of poverty amongst the rural population in the Middle East can have a negative impact on the sustainability of telemedicine services. This is simply because there are user charges associated with the use of healthcare services and most of the patients end up paying

these charges by themselves unless they are covered by health insurance. In addition, lack of strategic planning and media representation was also found to act as a barrier to telemedicine implementation in Middle Eastern countries (Abdulellah Alaboudi, Atkins, et al., 2016; Hussein & Khalifa, 2012; Khalifa, 2013). For example, providing a managed care strategic plan can contribute to the ability of health organizations to make structural and technological changes.

3.2.4 Individual barriers

For the successful adoption of any technology within an organization, it is very important that the individuals who use the system accept it. There are several studies on individual resistance to telemedicine implementation in Middle East countries (Ajami et al., 2011; Al-Fadhli et al., 2017b; AL-Hadban & Kamarul Faizal Hashim, 2017; Hasanain, 2010; Khalifa, 2013). These studies report various individual barriers such as lack of experience, awareness, knowledge, trust, motivation, and satisfaction in the usage of technology. The review showed that some service providers in Middle Eastern countries have good knowledge of telemedicine applications in comparison with service recipients. The lack of knowledge, skill, and experience in using technology can influence users' perceptions, trust, and motivation to use health systems. In addition, the lack of trust and motivation between a patient and the doctor is attributed as a reason for low use in the region. If end-users (e.g., patients and healthcare providers) cannot see the potential benefits of telemedicine, their adoption of the technology will be limited.

3.2.5 Financial barriers

In the healthcare context, finance-related factors are often found to play a key role in the success of technology utilization (Jefee-Bahloul, 2014). The implementation and

maintenance of telemedicine itself is costly. Our review showed that financial barriers have remained a major barrier to the success of telemedicine in the region. This can be due to the lack of sponsorship, feasibility studies, and capital expenditure for telemedicine technology (AL-Hadban & Kamarul Faizal Hashim, 2017; Khalifa, 2013; Stadelmann, 2012). Operational costs were viewed as the main barrier to adopting telemedicine in several Middle Eastern countries such as Iran, Saudi Arabi, Iraq, Yemen, Egypt, and Jordan (A Alaboudi et al., 2015; Ghani & Jaber, 2015a; Hussein & Khalifa, 2012; Saghaeiannejad-Isfahany et al., 2015). Most of these countries do not have well-defined standards and guidelines for telemedicine. In addition, the lack of stable funding or sponsorship by governments, hospitals, and international and regional organizations has been viewed as the main cause of early failure in many healthcare projects. We also found that spending restrictions imposed by the government and private hospitals have had a negative impact on telemedicine implementation and training of professionals. The economic constraints and recession in many Middle Eastern countries (e.g., Iran and Jordan) have been a barrier to implementing telemedicine.

3.2.6 Technological barriers

Technological barriers to using telemedicine were mostly related to the IT infrastructure in terms of the quality of the system, information, and service. The literature reported that the lack of system quality was the main barrier for users to adopt telemedicine in Iran, Saudi Arabi, Bahrain, Iraq, Yemen, Egypt, and Jordan (Al-Fadhli et al., 2015; AL-Hadban & Kamarul Faizal Hashim, 2017; Abdulellah Alaboudi, Atkins, et al., 2016). Efficient and cost-effective technical support was found to be a prerequisite for telemedicine application in these countries. A lack of technical support may negatively influence patient interest and intention to use telemedicine (Griffiths, Lindenmeyer, Powell, Lowe, &

Thorogood, 2006). In addition, issues with the quality of Internet (e.g., poor connectivity, low speed, and high utility cost) have been reported in the literature (Khalifa,(2013) as an ongoing challenge for the success of telemedicine systems. This affects communication between e-health providers and patients. Our review of the literature highlighted barriers in terms of data retrieval and data entry in the use of telemedicine. The majority of healthcare providers in these countries are still processing and storing patients' records using the traditional management system. Although the use of telemedicine provides an opportunity to create a digital database of patients, it also offers a major challenge in developing a centralized database to access patient records (Ghani & Jaber, 2015a; Khalifa, 2013). Furthermore, database access and log maintenance requires extensive training programs and clinical expertise for the doctors and medical staff (Raza et al., 2017).

4. Recommendations

Telemedicine has the potential to have a significant and lasting effect on healthcare systems in Middle Eastern countries. Despite the purported benefits of telemedicine applications (e.g., reducing healthcare costs and enhancing patients' accessibility), telemedicine is still less developed and utilized than other e-technologies. This study used a systematic review to identify progress in implementation and the main barriers that affect the adoption of telemedicine in the Middle East. Six main barriers were identified and mapped: organizational, financial, individual, cultural, legal, and technological barriers. As a result of exploring the barriers, several recommendations for decision-makers (see Table 2) were shaped to encourage and inform telemedicine utilization in the Middle East and overcome the main barriers. Table 2 provides a summary of recommendations that have emerged from the review and we argue that these recommendations would support further implementation of

telemedicine in the Middle East. The following recommendations are organized according to their priority order:

1. Organizational structure: this review recommends that health policy-makers move toward the integration of modern ICT facilities in order to enable access to electronic health records. It has been found that inadequate infrastructure such as computer, electricity power supply, Internet connection, and inadequate health information technicians could be managed by providing standard training programs for doctors and healthcare staff, allocating budget for long-term innovative projects, enhancing access to the Internet. It is also recommended that health initiatives should include a focus on health education and health promotion in order to increase public awareness of the benefits of ICTs in health services. Furthermore, it has been found that countries with least telemedicine utilization, such as Yemen, Iraq, Iran, Egypt, can move beyond their current utilization status by providing proper training for healthcare providers, increasing the number of telemedicine centers, and improving healthcare professionals' support. Several countries such as Saudi Arabi, Iran, Turkey, Iraq, and Yemen need to move toward more flexible, advanced, and high-performance organizational systems in order to provide health professionals with greater autonomy and decision-making capacity. In contrast, the failure of telemedicine projects in some countries has been attributed to the poor initial planning and infrastructure, and lack of change management. As such, it is recommended that policy and healthcare managers consider policies aimed at reorienting public funds to improve the quality and range of services. This includes capacity-building and education among healthcare professionals, as well as increasing the human resources in other telemedicine centers in order to support and train more healthcare professionals. It is also worth mentioning that careful attention should be paid to cost-effectiveness

analysis (during the design, implementation, and evaluation of telemedicine projects) along with a thorough consideration of the particular economic properties of a health service provider.

2. Individual barriers: The results showed that there is a need to increase public awareness of the importance of technology in the region, as well as the training and education of key users (both healthcare professionals and patients). It is essential to consider the needs of individuals when developing and implementing e-health systems because perceived usefulness and advantages offered by the innovation are important facilitators of telemedicine use (Alsswey, Al-Samarraie, El-Qirem, Alzahrani, & Alfarraj 2020; Dantu & Mahapatra, 2013; Raza et al., 2017). It can be concluded that providing simplified administrative systems, combined with better use of technology, can add more value to the healthcare sector in Middle Eastern countries. In addition, policy makers may focus on promoting perceived organizational and individual barriers through providing the relevant training for patients and healthcare workers, which can help deepen understanding and support for telemedicine projects. Clinicians and managers in Middle Eastern countries also need to work together to come out with local action plans and support strategies to facilitate change in practice and skills. This can increase the beliefs in the benefits of change and confidence among healthcare workers in the ability to use telemedicine applications.

3. Financial barriers: It is recommended that telemedicine applications should be adapted to the local technological capacities and infrastructure. This includes providing range of integrated health strategies to improve the monitoring and evaluation of service quality. Both initial and ongoing costs are ongoing barriers that may disproportionately affect certain organizations that are lagging such practices in

small and rural settings. As such, future policies should be more directly aimed toward correcting these disparities. Policymakers should also consider ways to increase the appeal of electronic health record systems to older physicians, organizations that deal with large populations of low-income patients, and certain states that have lower adoption rates.

4. Legal and regulatory barriers: Providing comprehensive health policies and strategies can aid the development and adoption of telemedicine solutions in the Middle East. For example, health policy-makers may consider adopting the relevant legal and ethical standards to ensure a successful care delivery. This study recommends that healthcare providers target aspects of perceived susceptibility among their staff and patients. As telemedicine is not an integral part of healthcare systems in the region, there are no regulations or legislation that guide sustainability practices at multiple levels. In addition, judicial courts still do not accept electronic evidence. This study found that security and privacy were a major concern when it comes to the use of telemedicine. It is recommended that the process of building telemedicine in the region would require a parallel reconstruction of the medico-legal system in order to preserve the integrity of ethical practices such as confidentiality, informed consent, and liability. Meanwhile, health policy-makers may consider standardizing specific privacy regulations on the practice of telemedicine so that patients can feel secure about disclosing their personal information. This includes applying advanced security methods such as multilevel user access to personal healthcare records.

5. Technological barriers: It is recommended that healthcare providers in the Middle East to develop user friendly and effective telemedicine systems. For example, developers of telemedicine systems must ensure that health data can be successfully processed and transmitted across various healthcare platforms. Healthcare providers

should also ensure that the information they provide is relevant, accessible, and in multiple languages. In addition, telemedicine systems should be designed to ensure that access rights to healthcare information are only provided to those who are authorized. It is recommended that healthcare providers to make an effort to promote professional learning communities by making communication and the exchange of expertise with other countries frequently. Furthermore, healthcare policy makers may plan to fully adopt cloud computing technologies to enable healthcare workers collect, analyze, and visualize health data across departments.

6. Cultural barriers: Cultural resistance to change was another barrier to promoting successful implementation of telemedicine, which can be mitigated using pre-implementation plans such as public and special training courses within continuing professional development strategies, distribution of brochures, and manuals (Alsswey & Al-Samarraie, 2020). The involvement of key users in the development and implementation of systems and services can ensure that cultural needs are fully understood and embedded in the design and development process. For example, information on medical services, training, and support can be made available in the patients' and healthcare workers' mother tongues. In addition, promoting social networking activities/events can help support interaction and collaboration between healthcare professionals and patients in the telemedicine space.

This review provides an overview of the progress made in the Middle East in terms of the implementation and utilization of telemedicine. In so doing, we identified and mapped the range of barriers to implementation that have been experienced across projects and countries. It is recommended that researchers, healthcare leaders, and policymakers consider the results of this review when shaping future policies and practices related to telemedicine use in the Middle East.

Table 2: Recommendations for further implementation of telemedicine in the Middle East

Country	Barriers	Recommendation
Iran	Organizational barriers	- Improve ICT infrastructure - Provide appropriate training, workshops, seminars, conferences, and market campaigns - Incorporate telemedicine courses at the university level
	Legal barriers	- Formulate the policies, legislation, guidelines, and standards governing confidentiality, privacy, access, and liability - Improve the civil rights legislation - Set-up a legal agreement between the judiciary and the Ministry of Health and Medical Education - Set-up standards, credentials, and licensing to experts
	Individual barriers	- Increase awareness and understanding of a telemedicine system
	Financial barriers	- Increase support and funding of telemedicine projects - Formulate the central policies to mitigate overlap and duplicate costs
	Technological barriers	- Provide better communication facilities such as bandwidth and video conferencing facilities - Apply appropriate protection and anti-virus programs
	Cultural and societal barriers	- Promote clinical staff-patient discussions and referrals to health behavior change resources
Saudi Arabia	Organizational barriers	- Provide proper training through seminars, workshops, symposia, and conferences - Evaluate users' use of telemedicine over time - Increase the number of telemedicine centers in the country - Incorporate e-health courses in medical education programs - Redesign the medical and administrative workflow to comply with telemedicine specifications - Develop a strategic plan for the adoption, implementation, and future development of telemedicine
	Individual barriers	- Increase knowledge and awareness of patients about the benefits of telemedicine - Motivate healthcare professionals to attend various training telemedicine programs by using direct and indirect incentives
	Financial barriers	- Allocate proper funding and enough capital investments to overcome the high cost of telemedicine implementation - Design the annual budget to capacitate the high maintenance costs

	Legal and Regulatory barriers	- Formulate the policies, legislation, guidelines, and standards governing confidentiality, privacy, access, and liability for the use of telemedicine
	Technical barriers	- Increase the number of computer terminals at the point of care
		- Provide a user-friendly interface design to make the system less complicated and convenient for patients and staff
Iraq	Organizational barriers	- Improve the infrastructure necessary for the deployment of telemedicine projects
		- Provide appropriate and sufficient training programs
		- Provide on-site help and prepare skillful maintenance teams
	Individual barriers	- Increase awareness and benefits of using telemedicine
Egypt	Organizational barriers	- Establish a national-level body of e-health in the context of interoperability, cost-effectiveness, performance, and a monitoring and evaluation framework
		- Consider strategic and professional plans to develop and implement telemedicine
	Legal and Regulatory barriers	- Promote an e-health legal environment by developing the required legislative frameworks and administrative rules
		- Adopt a national e-health policy
	Financial barriers	- Support and fund research projects in telemedicine with international partners
		- Invest in cost-effective telemedicine applications
		- Allocate financial resources through partnerships between the public and private sectors
	Individual barriers	- Increase awareness and benefits of using telemedicine
	Cultural and societal barriers	- Promote clinical staff-patient discussions
Jordan	Organizational barriers	- Design the appropriate training programs for nurses and other healthcare professionals
	Financial barriers	- Increase expenditure in research and development
Syria	Organizational barriers	- Improve ICT infrastructure
		- Provide training, seminars, and market campaigns
		- Promote telemedicine applications by advertising
	Financial barriers	- Support and fund telemedicine projects
	Individual barriers	- Increase the awareness of technology

Turkey	Organizational barriers	- The government must cooperate with networking and medical industries to successfully adopt telemedicine
		- Computer engineers and academic members should be encouraged to work on databases for personal health records, and also on the format and standards of health records
	Legal and Regulatory barriers	- Formulate the relevant telemedicine policies, legislation, and guidelines
	Individual barriers	- Encourage health professionals to devote more time to adopting different telemedicine methods
Yemen	Organizational barriers	- Introduce ICT skills through training programs and policies for technology
		- Provide health statistical reports

5. Conclusion

This study reviewed 43 studies on the use of telemedicine in Middle Eastern countries. In countries such as Saudi Arabia, Iran, and Egypt, sensitive cultural issues (e.g., religious and social restrictions, resistance to change, traditional beliefs, literacy level, and linguistic distinction) were found to influence individuals' perceptions and attitudes toward accepting telemedicine. The study also found that adopting standardized training procedures is needed in order for healthcare workers in countries like Palestine, Syria, and Egypt to become familiar with the task and interface of telemedicine applications. Other privacy and legal issues in countries like Turkey, Iran, Jordan, and Yemen were found to play a role in convincing practitioners and patients of the value of telemedicine. In addition, lack of knowledge, skill, and experience in using technology was found to influence users' perceptions, trust, and motivation to use telemedicine applications, mostly in GCC and Jordan. It is anticipated that the failure of health providers to adopt a holistic approach, coupled with low technology literacy makes telemedicine implementation even more complicated. To achieve greater adoption and use of telemedicine in the region, the healthcare providers should ensure that the provided services reflects local service provision as closely as possible and should consider the social culture of the community. The outcomes

from this systematic review offers important recommendation to improve the interaction between physicians, support staff and software developers, as well as increasing awareness and so advocate the use of telemedicine in the region. The findings of this study are beneficial for organizations, governments, and health policymakers to develop strategies and policies to enhance telemedicine services in different hospitals in the region. This review can be generalized to countries that share similarities with Middle Eastern countries and are in a different cultural–economic situation.

6. Summary points

What was already known on the topic:

- Utilization of telehealth technology is offering a possibility in promoting healthcare delivery in Middle East countries.

- These technologies have been employed for managing some diseases across specific dimensions of use in some countries.

- Subsequently, the utilization of telehealth technologies have been separately studied in specific Middle Eastern countries for managing healthcare information.

What this study adds:

- An in-depth understanding of telemedicine progress in Middle Eastern countries was provided.

- Certain cultural, financial, organizational, individual, technological, legal and regulatory challenges were identified to prevent telemedicine from being fully used in Middle East countries.

- Recommendations were provided to policy makers to ensure successful utilization of telemedicine in these countries.

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