Jordan Journal of Applied Science
Natural Science Series

Mini-Review

Using telemedicine in Saudi Arabia's healthcare system during COVID-19 pandemic

Abdullah Almilaibary[1*]
[1]Department of Family and Community Medicine, Faculty of Medicine, Albaha University, Saudi Arabia.

ARTICLE INFO

Article history:
Received 29 Dec 2022
Accepted 5 Mar 2023
Published 30 Jun 2023

DOI: 10.35192/jjoas-n.v17i1.1806

***Corresponding author:**
Department of Family and Community Medicine, Faculty of Medicine, Albaha University, Saudi Arabia.

Email: aalmilaibary@bu.edu.sa

Keywords:
Telemedicine
COVID-19
Pandemic
Saudi Arabia's healthcare system

ABSTRACT

Background: The World Health Organization declared the coronavirus disease 2019 (COVID-19) outbreak a pandemic on March 11, 2020, citing more than 720,000 cases reported in over 203 countries by March 31, 2020. The response plan included early diagnosis, patient isolation, symptomatic monitoring of contacts, suspected and confirmed cases, and public health quarantine. The Ministry of Health (MOH) in Saudi Arabia faces pressure to develop and enhance healthcare services to meet the needs and expectations of the population, particularly those living in rural areas, due to significant challenges in the country's healthcare system. To limit the risk of transmission, telemedicine, especially video consultations, has been promoted and expanded. Telemedicine can enhance healthcare delivery in the absence of in-person visits in the current pandemic situation. In this study, the use of telemedicine during the COVID-19 pandemic within Saudi Arabia's healthcare system is assessed.

Introduction

A global epidemic strikes around once per generation, creating disaster in healthcare systems around the world. Because epidemics aren't as common as other diseases, health-care providers have less experience with how to deal with them (1). In the past 20 years, three documented cases of animal coronaviruses have spread to people, leading to a serious pandemic like the coronavirus disease 2019 (COVID-19) outbreak. In Wuhan, China's Hubei Province, an outbreak of respiratory distress syndrome was linked to coronavirus before the end of 2019 (2). The virus swiftly spread throughout China and the rest of the world, including Saudi Arabia, before the World Health Organization (WHO) on March 11, 2020, declared it a global pandemic (2, 3). Nearly half a million COVID-19 cases had been confirmed in Saudi Arabia as of June 10, 2021, with over 7,000 deaths. On March 2, 2020, Saudi Arabia has its first confirmed case of the new Corona Virus (4).

In the COVID-19 era, regular outpatient clinics provide a serious health danger to the visiting patient as well as the provider (5). Whereas, COVID-19's public health emergency piqued public interest and demand for telemedicine around the world, resulting in a rapid spread of this care modality as an integral aspect of outpatient care delivery (6). A significant decrease in in-person consultations has been observed in combination with an increase in the usage of televisits and remote patient monitoring. Last but not least, telemedicine has shown to be an essential tool for preventing the spread of disease by boosting patient monitoring, encouraging early diagnosis, enabling prompt treatment of afflicted persons, and providing continuity of care for vulnerable patients with numerous chronic illnesses (7, 8).

In the past, telemedicine has existed for more than a century; it is not a recent development (9). It has been established that the earliest people to utilize telemedicine to communicate information about health-related events like outbreaks and epidemics were the ancient hieroglyphs (10). Furthermore, some communities employed smoke signals to warn neighboring cities of illness (11). The telephone and typewriter completely changed how patients and doctors conveyed health information at the start of the nineteenth century (12).

The most significant development in the application of telemedicine happened in 1948 when the first radiologic images were phoned from Eastern Pennsylvania over a 24-mile radius(13). In the latter part of the 1960s, telemedicine was promoted as a method of providing healthcare by NASA and the Nebraska Psychology Institute(14). Because medical attention was necessary while in space, doctors could keep an eye on astronauts' vital signs and provide diagnosis and treatment while they were in orbit (15). Later, in the 1980s, radiologists began receiving images for telemedicine consultations using teleradiology devices (16). The internet began to develop more and more during the 1990s, which made telemedicine deployment easier. It is evident that telemedicine has expanded over the past couple decades as a result of the growing advancements and uses of ICT (15).

This 1970s term, which literally translates as "healing from afar," describes how information and communication technology (ICT) is used to improve patient outcomes by increasing access to healthcare and medical data (17). "Health care services, where distance is a critical factor, are delivered 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," is the general explanation that the World Health Organization has accepted" (18). According to the Institute of Medicine, telemedicine is "the use of electronic information and communication technologies to provide and support healthcare when distance separates the participants" (19).

Real-time, store-and-forward, and hybrid are the three modified telemedicine models. In order to request the diagnosis and best course of action, the first, store-and-forward method, usually depends on health care providers exchanging medical data via email or web-based administration. Second, real-time telemedicine applications like video conferencing and telesurgery that required participant online engagement, the third type is a combination of both (20). Sharing medical information among healthcare professionals in order to facilitate clinical decision-making and overcome geographical obstacles is one of the primary goals of telemedicine (21).

Access and Barriers

The Telemedicine provides services such as educate patients and their families, in addition to other curative and preventive services (coaching). Despite the technology financial and ethical barriers, Telemedicine was a helpful technology during the pandemic period. (22). According to the study conducted in Saudi Arabia for adopting

telemedicine hospitals, the researchers affirmed there are some barriers to the implementation of telemedicine (23).

But during the coronavirus pandemic progress has been fostered the activation process that was due to social distance during the epidemic beside the mature technology (24). So, we will compare the numbers of No-show patients before and after pandemic "Monthly", it will work as a performance indicator for continuity of care in Out Patient Department (OPD).

The OPD suffering from patients do not attend to their appointments that led to ineffective crowding in-clinic appointment and inefficient use for OPD services. The absence of patients is due to patients who live far from the medical center. Also, patients with long visit appointment that do not require medical intervention, but they only need to follow-up with a Most Responsible Physician (MRP), which makes them susceptive to boredom and absenteeism, especially the elderly among them and those with disability(25) .

The respond of the physician to the sudden needs during the pandemic lead to expanding telemedicine services. In addition, Telemedicine helps hospitals to maintain the continuity of care during the pandemic, especially in OPD services and avoid the anticipated risk for delays(26). Saudi Telemedicine Unit of Excellence (STUE) works to edit telemedicine policies and regulation to improve the quality of services (27).

Many studies have long indicated that Telemedicine has considerably impacted on health care services quality, particularly in rural areas where medical services tend to be inaccessible (28, 29). The major key to successful adoption of the telemedicine is to understand its barriers. The telemedicine is an essential solution to overcome the problem related to the distance between the patient's accommodation and hospital. As well as, healthcare professionals' knowledge about Telemedicine is important, and thus its success in the future. So, the success of Telemedicine relies on user's acceptance and the patients as well (30).

On the other hand, the place of residence will not limit the living area (Home place) for the patient. The patients may be in prison or a nursery care institution and the telemedicine services will be as a blessing for those patients with the limited access to medical service either for consultation or treatment services (31).

Most of the researchers choose one group of age, but the literature finds that the patient's age may not be statistically significantly different in another viewpoint results. That will clarifying that the Telemedicine will be empowering patient family especially in child and patient with a disability that called patient and family education services (32). Even in practitioners side, the study conducted in Eastern province hospitals, Saudi Arabia, authors found that there was no such statistically significant association between interesting in implementing Telemedicine of respondents and any of the demographic variables (33). The study will assess the relationship between the number of No-show patients with patient age and place of residency. Moreover, due to many factors affect the patient commitment such as their education or the familiarity with new technology devices in another word poor infrastructure.

Different service of Telemedicine

As has been reported in the literature, 75% of teleneuropsychiatric visits were routine follow-up, and only 10% of them need inpatient care. It will help physicians to give patients consultation in their health status and re-prescribing the medication remotely unless the patient needs more investigation to incase of new complication appears (34). However, patients will be more satisfied and comfortable if they use tele psychiatry service. The study found the relationship between patient privacy and the tele psychiatry service, but in this study, no data related to patient confidentiality (28).

From another perspective, the Telemedicine was more effective in rehabilitation follow-up (coaching sessions). And through the randomized control trial study, the result shows that telemedicine service reduces home visits burden on the physical therapist as well as the economic burden (35). So, the study assessed the different type of visit versus telemedicine utilization and if there is a relation between the follow-up visits and the utilization.

In a quantitative study at the Koforidua Regional Hospital, Ghana, all the participants (100) revealed that they have heard about Telemedicine. Also, 90% of the participants believed that Telemedicine helps to diagnose and treatment (36). In some cases, patients need to attend physically to the clinic to allows physicians assess them by many techniques such as (Inspection, Auscultation, Palpation, and Percussion of the abdomen) that's why virtual visit will not help in this situation.

Cost-effectiveness

The study conducts in the US reports that the best feature for Telemedicine is decentralization. The services help the practitioner to follow up with the patient, especially in chronic illnesses and non-emergency patients. Provide efficient services about 200-300 billion per year cost saving 20% reduction in cardiovascular mortality due to telemedicine services plus 73% in ED visits and 65% in admission for pulmonary diseases (35).

Unfortunately, we cannot include the cost of services as a variable in this study due to free services provided by Saudi MOH facilities. Although practicing telemedicine benefits the providers, it also benefits the patients. Many studies are likely to believe that Telemedicine is advantageous. The health worker state that Telemedicine promotes healthcare services accessibility, improve health care quality and decrease health care expenses in Nigeria (37).

The transformation will activate the insurance coverage for all health care beneficiaries, and Telemedicine will help them to cut the cost of services when they apply short-term operation due to technological advance. The health care organizations tend to remove waiting room, examination room and screening as well due to virtual visits this will defiantly cut the fixed cost for operation.

Time and steps reduce

Due to travel expenses, routine hospital visits can be costly, especially in rural locations. People favor telemedicine in the Covid-19 Pandemic period because it makes face-to-face interaction less hazardous. Fortunately, using video conferencing or other virtual technology for telemedicine services can reduce the number of medical visits. Telemedicine, thus, reduces treatment costs and saves time for both the patient and the medical professional. Additionally, because of its quick and useful features, it helps simplify hospital and clinic workflows (22).

Additionally, the researchers express that at hospitals adopting Telemedicine; their waiting time has been reduced around 13 min in average. The result indicates that 39 minutes versus 52 minutes was between the physical visits and virtual visits as well as steps of patients flow; this was one of the telemedicine benefits (38). Another study conduct in India was using WhatsApp as a remote screening module to examine patients with the oral malignant disorder in the state of attending to the clinic by capturing five pictures following the doctor directions (39). Moreover, one of the most important benefits of Telemedicine is achieving higher productivity. The study conducted in Dhaka, Bangladesh revealed that about 78% of medical worker agreed that e-health might lead to increase the productivity in the workplace (40).

Telemedicine services in Saudi Arabia

The ministry of health (MOH) in Saudi Arabia is under pressure to create and enhance healthcare services to satisfy the requirements and aspirations of all residents, particularly those residing in rural locations, as the country's healthcare system faces numerous obstacles. With a population of 33 million, Saudi Arabia is the biggest sovereign state in the middle east (24); As a result, solutions have to be found to cover a wide geographic area. In order to improve health care delivery, MOH implemented the Electronic Health System (E-health) in 2011 and used the Saudi Telemedicine Network (STN), the first national project that covered all health care sectors (23). In line with Saudi Arabia's 2030 vision, the Ministry of Health has approved numerous information and communication technology (ICT) policies and changes that will raise the standard of healthcare services and increase patient accessibility. One of these tactics that prioritizes the needs of patients and MOH is the use of telemedicine (41). King Faisal Specialist Hospital and Research Center was the pioneer in the usage of telemedicine in Saudi Arabia. One of the biggest specialized hospitals in the Middle East is thought to be KFSHRC. For people requiring medical attention both inside and outside of Saudi Arabia, it offers complimentary medical care and lodging (42).

Medical information can be shared across consultants, who can then diagnose cases and make decisions about accepting them or giving instructions on how to handle them without transferring patients. The Ehalati Program is among the best examples of telemedicine deployment. In order to assist doctors in other organizations in sharing a patient's condition and giving medical advice without

moving the patient in a typical manner in non-emergency or routine instances, the Ehalati system was established in 1433. With the ability to save and forward messages, the system functions a lot like Hotmail. This facilitates the transfer of patient cases, complete with test findings and photographs, to doctors for review and subsequent forwarding to the hospital of referral (43).

Family physician's perception towards virtual care "Telemedicine" during COVID-19 pandemic

The smartphone-led digital revolution has advanced in all sectors of life, including healthcare, over the previous decade. The exponential increase in the use of the smartphone, as well as its counterparts in tablet technology and wearables like smart watches, complemented in this revolution. Wearable sleep technology is one of the applications that has evolved (44). Applications that record patient's electrocardiogram (ECG) and detect falls in elderly individuals. These programs have sped up the development of telemedicine by enabling patients and doctors to communicate via text, voice, and video in only a few seconds when paired with a high-speed internet connection (45).

Basic healthcare is widely recognized as the foundational and basic point of contact in the majority of healthcare systems in industrialized nations. Thus, it was essential to carry on with operations even in the face of a global epidemic (46). By reducing interpersonal contact, primary care is the most efficient strategy to prevent hospital stays and ER visits. Social distancing played a crucial role in halting the spread of COVID-19 and other infectious diseases (47). It has become necessary for many primary care doctors to use virtual or telehealth services more frequently as a way to stay providing care (30). A key factor in telemedicine's success is how doctors view it. Nevertheless, a few factors affect how doctors see telemedicine. To use telemedicine effectively, doctors need to have the necessary training, technological know-how, and understanding of established norms and standards (48).

A previous study reported that doctors agreed that telemedicine allowed for quicker access to healthcare; yet, participants stated that inadequate communication technology stood in the way of a more favorable consultation outcome (49). Physicians agree that telemedicine presents new opportunities to improve patient access to care by making it more convenient. Better opportunities for drug reconciliations, more time for patient counseling, and the chance to observe and assess patients' homes and establish connections with their families were all made possible by telemedicine visits (50). Conversely, some of them voiced concerns about the lack of physical examination, human interaction, and touch, which they felt undermined the expected rituals that usually fortify physician-patient relationships, as well as the fact that some vulnerable patients were unable to use or did not have access to the technology needed to participate in telemedicine visits. The experts also suggest that in order to prevent physician burnout, workflows may need to be carefully reviewed (51).

Nies et al. found that telemedicine adoption is less common among older physicians. Conversely, medical professionals over 60 were more likely to discontinue telemedicine use following COVID-19 than those under 60. The majority of doctors in pediatrics were eager to continue using telemedicine following COVID-19, whereas the lowest percentage of doctors in internal medicine were willing to do the same (52).

Providers that did not wish to implement telemedicine in the future cited a number of reasons, including lack of necessity, lack of physical patient contact, and concerns about inadequate patient care. In addition to urgent care, prescription refills, follow-up visits, patient convenience, and specific ailments, clinicians who believed telemedicine would be helpful noted. A study carried out in Lebanon indicates that telemedicine is used by most Lebanese doctors and has been made more popular by the COVID-19 outbreak. Where in the healthcare system does telemedicine have the potential to be deployed nationally and integrated (1).

In the research conducted at King Abdulaziz Medical City in Riyadh, Saudi Arabia, Altulaihi and his associates also noted that telemedicine holds a great deal of promise for delivering prompt, secure care that is appropriate for screening and management. However, as telemedicine is essential to lowering the risk of COVID-19 transmission and offering therapy to the entire population, it is important to support physicians in honing their telemedicine skills (2). Alakeel and her associates at Prince Sultan Military Medical City in Riyadh, Saudi Arabia, discovered in another study that family medicine doctors who used virtual services during the pandemic were generally happy with the services. They recommended conducting additional research to ascertain these technologies' continued usefulness after the pandemic ends (53).

Conclusion

The current research provides a review about the use of telemedicine in healthcare system during Covid-19 pandemic and the perception of family medicine doctors towards the use of it. The majority of physicians believed that telemedicine would be useful for providing care after the pandemic is over. Telemedicine has a number of advantages, including convenience, increased remote access to care, especially for patients in rural areas, and lower healthcare costs. In a range of disciplines, studies have demonstrated that telemedicine appointments can be as effective as in-patient visits. More study should be done to improve parts of the physical examination for telemedicine visits, particularly in specialties where close patient contact is a key component of the physical exam.

Declaration of Competing Interests

no potential conflicts of interest.

Data sharing plans

Data will be available upon request.

Funding

N/A.

References

1. Shaarani I, Ghanem A, Jounblat M, Jounblat H, Mansour R, Taleb R. Utilization of telemedicine by the lebanese physicians during time of pandemic. Telemedicine and e-Health. 2022;28(2):219-26. doi: 10.1089/tmj.2021.0090.
2. Altulaihi BA, Alharbi KG, Alhassan AM, Altamimi AM, Al Akeel MA, Altulaihi B, et al. Physician's perception toward using telemedicine during COVID-19 pandemic in King Abdulaziz Medical City, Riyadh, Saudi Arabia. Cureus. 2021;13(7). doi: 10.7759/cureus.16107.
3. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. Acta bio medica: Atenei parmensis. 2020;91(1):157. doi: 10.23750/abm.v91i1.9397.
4. Aljahdali MO, Alhassan AB, Albeladi MN. Impact of novel coronavirus disease (COVID-19) lockdown on ambient air quality of Saudi Arabia. Saudi Journal of Biological Sciences. 2021;28(2):1356-64. doi: 10.1016/j.sjbs.2020.11.065.
5. Mahmoud MA, Daboos M, Gouda S, Othman A, Abdelmaboud M, Hussein ME, et al. Telemedicine (virtual clinic) effectively delivers the required healthcare service for pediatric ambulatory surgical patients during the current era of COVID-19 pandemic: A mixed descriptive study. Journal of pediatric surgery. 2022;57(4):630-6. doi: 10.1016/j.jpedsurg.2021.11.018.
6. Mandal S, Wiesenfeld B, Mann DM, Lawrence K, Chunara R, Testa PA, et al. Is virtual care the new normal? Evidence supporting Covid-19's durable transformation on healthcare delivery. medRxiv. 2022:2022.03. 08.22272020. doi: 10.2196/38661.
7. Omboni S, Padwal RS, Alessa T, Benczúr B, Green BB, Hubbard I, et al. The worldwide impact of telemedicine during COVID-19: current evidence and recommendations for the future. Connected health. 2022;1:7. doi: 10.20517/ch.2021.03.
8. Keesara S, Jonas A, Schulman K. Covid-19 and health care's digital revolution. New England Journal of Medicine. 2020;382(23):e82. doi: 10.1056/NEJMp2005835.
9. Bakalar RS. Telemedicine: its past, present and future. Healthcare Information Management Systems: Cases, Strategies, and Solutions: Springer; 2022. p. 149-60. doi: 10.1007/978-3-031-07912-2_9.
10. Kichloo A, Albosta M, Dettloff K, Wani F, El-Amir Z, Singh J, et al. Telemedicine, the current COVID-19 pandemic and the future: a narrative review and perspectives moving forward in the USA. Family medicine and community health. 2020;8(3). doi: 10.1136/fmch-2020-000530.
11. Hurst EJ. Evolutions in telemedicine: from smoke signals to mobile health solutions. Journal of Hospital Librarianship. 2016;16(2):174-85. doi: 10.1080/15323269.2016.1150750.
12. Gogia S. Rationale, history, and basics of telehealth. Fundamentals of telemedicine and telehealth: Elsevier; 2020. p. 11-34. doi: 10.1016/B978-0-12-814309-4.00002-1.
13. Mullick AR, Rayhan N, Koly KN, Nahar K, Hossain I. Telemedicine and telehealth: a virtual care platform with prospects

& importance during COVID-19 outbreak. European Journal of pharmaceutical and medical research. 2020;7.
14. Singh S, Kumar P, Rehman F, Vashishta P. Telemedicine, Telehealth, and E-health: A Digital Transfiguration of Standard Healthcare System. Cloud IoT: Chapman and Hall/CRC; 2022. p. 143-61. doi: 10.1201/978-0-003-15557-7.
15. Schroeder GS, Clark JC, Gallagher M, Pandya S. Medical guidelines for suborbital commercial human spaceflight: A review. Acta Astronautica. 2021;187:529-36. doi: 10.1016/j.actaastro.2021.02.027.
16. Frehse AE. Overview and history of telehealth. Telemedicine: Overview and Application in Pulmonary, Critical Care, and Sleep Medicine. 2021:3-14. doi: 10.1007/978-3-030-64050-7_1.
17. Sood SP, Negash S, Mbarika VW, Kifle M, Prakash N. Differences in public and private sector adoption of telemedicine: Indian case study for sectoral adoption. Studies in health technology and informatics. 2007;130:257.
18. Aceto G, Persico V, Pescapé A. The role of Information and Communication Technologies in healthcare: taxonomies, perspectives, and challenges. Journal of Network and Computer Applications. 2018;107:125-54. doi: 10.1016/j.jnca.2018.02.008
19. Bollmeier SG, Stevenson E, Finnegan P, Griggs SK. Direct to consumer telemedicine: is healthcare from home best? Missouri Medicine. 2020;117(4):303.
20. Kim J, Jeon S, Kim D, Shin Y. A review of contemporary teleaudiology: Literature review, technology, and considerations for practicing. Journal of audiology & otology. 2021;25(1):1. doi: 10.7874/jao.2020.00500.
21. Tabaeeian RA, Hajrahimi B, Khoshfetrat A. A systematic review of telemedicine systems use barriers: primary health care providers' perspective. Journal of Science and Technology Policy Management. 2022. doi: 10.1108/JSTPM-07-2021-0106.
22. Haleem A, Javaid M, Singh RP, Suman R. Telemedicine for healthcare: Capabilities, features, barriers, and applications. Sensors international. 2021;2:100117. doi: 10.1016/j.sintl.2021.100117.
23. Alaboudi A, Atkins A, Sharp B, Balkhair A, Alzahrani M, Sunbul T. Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia. Journal of infection and public health. 2016;9(6):725-33. doi: 10.1016/j.jiph.2016.09.001.
24. Martinez KA, Rood M, Jhangiani N, Kou L, Rose S, Boissy A, et al. Patterns of use and correlates of patient satisfaction with a large nationwide direct to consumer telemedicine service. Journal of general internal medicine. 2018;33:1768-73. doi: 10.1007/s11606-018-4621-5.
25. Safdar KA, Emrouznejad A, Dey PK. An optimized queue management system to improve patient flow in the absence of appointment system. International Journal of Health Care Quality Assurance. 2020;33(7/8):477-94. doi: 10.1108/IJHCQA-03-2020-0052.
26. Garfan S, Alamoodi AH, Zaidan B, Al-Zobbi M, Hamid RA, Alwan JK, et al. Telehealth utilization during the Covid-19 pandemic: A systematic review. Computers in biology and medicine. 2021;138:104878. doi: 10.1108/IJHCQA-03-2020-0052.
27. AlOsail D, Amino N, Mohammad N, editors. Security issues and solutions in e-health and telemedicine. Computer Networks, Big Data and IoT: Proceedings of ICCBI 2020; 2021: Springer. doi: 10.1007/978-981-16-0965-7_26.
28. Dham P, Gupta N, Alexander J, Black W, Rajji T, Skinner E. Community based telepsychiatry service for older adults residing in a rural and remote region-utilization pattern and satisfaction among stakeholders. BMC psychiatry. 2018;18:1-13. doi: 10.1186/s12888-018-1896-3.
29. Gowda GS, Manjunatha N, Kulkarni K, Bagewadi VI, Shyam R, Basavaraju V, et al. A collaborative tele-neurology outpatient consulation service in Karnataka: seven years of experience from a tele-medicine center. Neurology India. 2020;68(2):358-63. doi: 10.4103/0028-3886.280644.
30. Bakshi S, Tandon U. Understanding barriers of telemedicine adoption: a study in North India. Systems Research and Behavioral Science. 2022;39(1):128-42. doi: 10.1002/sres.2774.
31. Edge C, George J, Black G, Gallagher M, Ala A, Patel S, et al. Using telemedicine to improve access, cost and quality of secondary care for people in prison in England: a hybrid type 2 implementation effectiveness study. BMJ open. 2020;10(2):e035837. doi: 10.1136/bmjopen-2019-035837.
32. Adams RB, Nelson VR, Holtz BE. Barriers for telemedicine use among nonusers at the beginning of the pandemic. Telemedicine Reports. 2021;2(1):211-6. doi: 10.1089/tmr.2021.0022.
33. Yamashita M. Family coping with mental illness: a comparative study. Journal of Psychiatric and Mental Health Nursing. 1998;5(6):515-23. doi: 10.1046/j.1365-2850.1998.560515.x.
34. Shaughnessy L, Brunton S, Chepke C, Farmer JG, Rosenzweig AS, Grossberg G. Using telemedicine to assess and manage psychosis in neurodegenerative diseases in long-term care. Journal of the American Medical Directors Association. 2022;23(7):1145-52. doi: 10.1016/j.jamda.2021.12.033.
35. Gilboa Y, Maeir T, Karni S, Eisenberg ME, Liebergall M, Schwartz I, et al. Effectiveness of a tele-rehabilitation intervention to improve performance and reduce morbidity for people post hip fracture-study protocol for a randomized controlled trial. BMC geriatrics. 2019;19:1-9. doi: 10.1186/s12877-019-1141-z.
36. Frimpong KO, Asare S, Nomah DK, Antwi-Asante DO. Knowledge and perception of telemedicine among health professionals at the koforidua regional hospital, Ghana. Int J Healthcare Sci. 2017;4(2):96-103.
37. Shittu L, Adesanya O, Izegbu M, Oyewopo A, Ade A, Ashiru O. Knowledge and perception of health workers towards telemedicine application in a new teaching hospital in Lagos. Scientific Research and Essay. 2007;2(1):016-9.
38. Atanda A, Leyden K, Student M. Using telemedicine to pre-screen sports medicine patients in the ambulatory setting reduces wait times and maximizes provider-patient interaction. Orthopaedic Journal of Sports Medicine. 2019;7(7_suppl5):2325967119S00417. doi: 10.1177/2325967119S00417.
39. Vinayagamoorthy K, Acharya S, Kumar M, Pentapati KC, Acharya S. Efficacy of a remote screening model for oral potentially malignant disorders using a free messaging application: a diagnostic test for accuracy study. Australian Journal of Rural Health. 2019;27(2):170-6. doi: 10.1111/ajr.12496.
40. Parvin R, Shahjahan M. Knowledge, attitude and practice on ehealth among doctors working at selected private hospitals in Dhaka, Bangladesh. Journal of the International Society for Telemedicine and eHealth. 2016;4:e15 (1-1).
41. Al Khashan H, Abogazalah F, Alomary S, Nahhas M, Alwadey A, Al-Khudhair B, et al. Primary health care reform in Saudi Arabia: progress, challenges and prospects. Eastern Mediterranean Health Journal. 2021;27(10):1016-26. doi: 10.26719/emhj.21.042.
42. Ali MA. Usage And Usability Of Health Mobile Applications During Covid-19 In Saudi Arabia-A Case Of Tawakkalna And Sehaty Application. International Journal of eBusiness and eGovernment Studies. 2022;14(2):411-31. doi: 10.34109/ijebeg.202214140.
43. Abusanad A, Alghamdi M, Bakkar M, Jazieh AR. General oncology care in the kingdom of Saudi Arabia. Cancer in the arab world. 2022:215-33. doi: 10.1007/978-981-16-7945-2.
44. Ajayi O, Bagula A, Maluleke H. The Fourth Industrial Revolution: A Technological Wave of Change. Industry 40-Perspectives and Applications: IntechOpen; 2022. doi: 10.5772/intechopen.106209.
45. Wixley H. Smart application for fall detection using wearable ECG & accelerometer sensors. arXiv preprint arXiv:220700008. 2022. doi: 10.48550/arXiv.2207.00008.
46. Haldane V, De Foo C, Abdalla SM, Jung A-S, Tan M, Wu S, et al. Health systems resilience in managing the COVID-19 pandemic: lessons from 28 countries. Nature Medicine. 2021;27(6):964-80. doi: 10.1038/s41591-021-01381-y.
47. Thu TPB, Ngoc PNH, Hai NM. Effect of the social distancing measures on the spread of COVID-19 in 10 highly infected countries. Science of the Total Environment. 2020;742:140430. doi: 10.1016/j.scitotenv.2020.140430.
48. Garavand A, Aslani N, Nadri H, Abedini S, Dehghan S. Acceptance of telemedicine technology among physicians: A systematic review. Informatics in Medicine Unlocked. 2022;30:100943. doi: 10.1016/j.imu.2022.100943.
49. Bhat KS, Jain M, Kumar N. Infrastructuring telehealth in (in) formal patient-doctor contexts. Proceedings of the ACM on Human-Computer Interaction. 2021;5(CSCW2):1-28. doi: 10.1145/3476064.
50. Donelan K, Barreto EA, Sossong S, Michael C, Estrada JJ, Cohen AB, et al. Patient and clinician experiences with telehealth for patient follow-up care. Am J Manag Care. 2019;25(1):40-4.

51. Indria D, Alajlani M, Fraser HS. Clinicians perceptions of a telemedicine system: a mixed method study of Makassar City, Indonesia. BMC medical informatics and decision making. 2020;20:1-8. doi: 10.1186/s12911-020-01234-7.
52. Nies S, Patel S, Shafer M, Longman L, Sharif I, Pina P. Understanding physicians' preferences for telemedicine during the COVID-19 pandemic: cross-sectional study. JMIR Formative Research. 2021;5 (8):e26565. doi: 10.2196/26565.
53. Alakeel RA, Alaithan AA, Alokeil N, Kofi M. Family physician's perception towards virtual care during COVID-19 pandemic: A cross -sectional study. Journal of Family Medicine and Primary Care. 2021;10(12):4514. doi: 10.4103/jfmpc.jfmpc_1157_21.