REVIEW ARTICLE

Current Practice of Using Technology in Health-care Delivery in Saudi Arabia: Challenges and Solutions

Duaa A. Simsim[1], Ziyad S. Almalki[2], Nehad J. Ahmed[2]

[1]Bachelor of Doctor of Pharmacy, Pharmacist, Alawi Tunsi Hospital, Makkah, Saudi Arabia, [2]Department of Clinical Pharmacy, College of Pharmacy, Prince Sattam Bin Abdulaziz University, Al-Kharj, Riyadh, Saudi Arabia

Abstract

The use of technology in delivering health-care services in Saudi Arabia is a significant step to take. Several application systems were implemented now in Saudi Arabia and provide medical services. This paper explores the current practice of using technology in health-care delivery in Saudi Arabia and brought to light the impact of technologies in health-care delivery on patients and their reported barriers. This is a narrative review which was conducted of published articles as well as gray literature on the application of technology in delivering medical care. Studies that met the following criteria were included: Addressed a relevant aspect of technology in health-care delivery; written in English; published between 1994 and June 2020; qualitative and quantitative study designs, systematic reviews, and primary and secondary research. The findings reveal evidence that utilizing technologies in delivering health services in Saudi Arabia are growing; however, it remains low. It has been found that inadequate infrastructure, lack of awareness of the importance of these technologies, shortage of professionals, lack of an information management plan, lacking a national plan for medical data exchange, and lacking a national regulator were among the main barriers. To achieve greater acceptance and use of technologies to deliver health-care services in our region, health workers should ensure that the services provided reflect as closely as possible local services and that social and religious culture is taken into account in the community. The findings of this study are also valuable for governments, organizations, and health policymakers to develop plans and policies to enhance the use of technology in delivering health-care services in Saudi Arabia.

Key words: Barriers, health-care services, health-care delivery, Saudi Arabia

INTRODUCTION

With a land area of nearly 2,150,000 km^2, Saudi Arabia is the fifth largest state in Asia and comprises most of the Arabian Peninsula.[1] Saudi Arabia consists of cities, some populated islands, and villages. Ensuring that all people within a society, and particularly those living in remote rural areas, have fair access to quality health care is essential.[2] While the Saudi Arabia health-care system has massively increased in recent decades, the accessibility of services for individuals living in remote or rural areas has not been wholly handled.[3] One of the reasons restricting this service is the geographical distance, lack of doctors and hospitals, and the difficulty of driving to significant towns where such care is available. As a result, the demand for quality care in rural areas is growing.[4]

In the delivery of health care, the country faces serious challenges. These challenges include increasing demand due to a rapid population increase, high health-care costs, unequal access, and a weak electronic health system (eHealth).[3] The technology plays a significant role in delivering health care, allows clinicians to update information quickly, it provides the patients with easy access to the information and helps in creating an interactive format that can improve the patients' understanding of information.[5] In addition, the technology plays a significant role in supporting hospitals with a paperless

Address for correspondence:
Nehad J. Ahmed, Department of Clinical Pharmacy, College of Pharmacy, Prince Sattam Bin Abdulaziz University, Al-Kharj, Riyadh, Saudi Arabia.
E-mail: n.ahmed@psau.edu.sa

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model that has a shortened delivery time. Recent advances in technologies have expanded the range of health-care delivery options.[6] There are more methods for health-care organizations to leverage a smartphone for care transformation than ever before, providing appropriate tools, for example, telehealth, e-prescribing, telemedicine, and electronic medical record.[6,7]

Telemedicine makes it possible to reduce these disparities in health care between rural and urban communities.[8] Telemedicine in patients, particularly in older people, disabled people, and chronically ill, is becoming a significant improvement.[9] New technologies for the health-care sector play a key role in recent years in the growth of information and communication technology, along with mobile phones, offering connections anywhere and at any time.[9] Mobile health solutions (M-Health), for example, solve current health-care issues, including the number of lifestyle-related chronic diseases.[9]

An electronic medical record can spontaneously alert the physicians to potential issues, including drug interactions, intolerances, and allergies to certain medications. Electronic medical records can be accessed from almost all medical facilities, which is very useful for physicians in assessing non-local patients, so the use of electronic medical records lead to greater patient care.[10] In addition to improving patient care, the advantages of entering data using a computerized system, including ease of workflow, improving public health, and lower health-care costs.[10] According to a study from the University of Michigan, using electronic health records can decrease the costs of outpatient health care by approximately 3% in comparison with using traditional paper medical records.[11]

When a new technology such as clinical decision support (CDS) system is introduced in a health-care setting, health-care specialists play a key role both in the acceptance and in the application process.[12] Therefore, health professionals must make use of emerging technologies to benefit from modern programs, or they cannot be implemented entirely. The acceptance of health-care professionals is considered an important need for the success of the health-care systems.[13,14] Albarrak *et al*. conducted a study in four leading hospitals in Riyadh to explore the knowledge, willingness, and perception of physicians toward telemedicine and found that most of the respondents (90%) agreed that telemedicine could save time and money and further help in delivering high-quality health-care services.[15]

Numerous application systems are implemented now in Saudi Arabia to provide medical services. This paper explores the current practice of using technology in health-care delivery in Saudi Arabia and also brought to light the impact of technologies in health-care delivery to patients and their implementation barriers.

In this study, three databases were used to find the published articles about the application of technology in delivering medical care: Google Scholar, Web of Science, and PubMed. The Boolean search operator "AND" was used to combine the search term "healthcare delivery" with the following terms: "Mobile technology," "technology," "virtual reality," "electronic health," "mobile health," "electronic health records," "patients," "e-prescribing," "personal health records," "telemedicine," "challenges," "remote monitoring," and "barriers." These search terms were applied to the abstract field across all three databases.

Different types of studies (such as systematic reviews and original articles) that were published between 1994 and June 2020 were included. Moreover, studies that met the following criteria were included: Written in English, addressed a relevant aspect of technology in healthcare delivery, and conducted in Saudi Arabia. Therefore, studies that did not focus on the use of technology in health-care delivery or not written in English or conducted in other country were excluded. Different references in the included articles were also searched for additional articles.

CURRENT PRACTICE OF USING TECHNOLOGY IN HEALTH-CARE DELIVERY IN SAUDI ARABIA

The usage of technology has attracted the attention of the Saudi government that has developed and implemented several initiatives. Recently, the Saudi Health Minister has developed a policy on e-health to make telemedicine accessible to health-care staff and patients and improve the quality of health care.[15] A 4-year (2008–2011) eHealth reform for the Saudi Ministry of Health has been developed in health-care institutions.[16,17] In 2011, the eHealth strategy was first applied in the hospitals of main cities only.[17] At present, most of the hospitals and health organizations are using digital technologies.

Shati conducted a study about mobile health applications that were developed by the Saudi Ministry of Health for the public and reported that all of the mobile health applications were released recently between 2017 and 2019, which means that the Ministry of Health is seeking for improving patient care using information technology such as using applications that facilitate the access of health-care specialists to health services from anywhere using smartphones such as Tataman, Sehhaty, Seha, Mawid, and Sehha for doctors.[18] In addition, the Ministry of Health specialists provide telephonic medical consultations to patients by calling 937 around the clock.[19]

In 2020, the Saudi Ministry of Health has launched Rest Assured (Tataman) application that aimed to monitor the conditions of people who are suspected of having coronavirus disease (COVID-19), to enhance their recovery procedures and maintain their safety, and to enable continuous monitoring of their health status.[20] Tataman

application is available in both English and Arabic. This application is one of the Ministry of Health's applications aimed at providing health and protection of domestic isolation or quarantine people and residents; to guarantee their safety and improve their recovery procedures.[21] Tataman application beneficiaries include suspected cases, contacts of confirmed cases, cases in domestic isolation or quarantine, and arrivals from abroad.[21] Tabaud application is developed to track coronavirus spreading. It also allows the users to know if they had contact with patients who were infected with coronavirus.[22] Tawakkalna is another application that was developed to show the users' health status and also allows people to contribute to breaking the infection chain.[22]

In accordance with its vision for better quality and services, the Saudi Ministry of Health launched the Sehhaty application.[23] Sehhaty aims to enable people to access health and e-services offered by numerous health organizations in the Kingdom, such as coronavirus self-assessment test, vital signs updates, COVID-19 test appointment booking, retrieving and sharing sick leaves, tracking prescribed medicine, steps tracker, and other services that are related to individuals and families' health and health awareness.[23]

Seha is another E-health application that is designed to deliver an online medical consultation service through the Ministry of Health's accredited physicians in different specialties.[22] Furthermore, Mawid has the capacity to handle referral appointments and to keep, cancel, or rearrange appointments in the primary care centers, through the Ministry of Health's e-service.[22]

THE IMPACT OF TECHNOLOGIES IN HEALTH-CARE DELIVERY ON PATIENTS

Rowland *et al*. reported that about 2.5 billion people worldwide own cell phones, so mobile health has a tremendous capacity for enabling the opportunity to gain access by patients to diagnostics and care advice.[24] Notwithstanding existing diagnostic limitations, there is an immense opportunity and data to suggest clinically meaningful changes in morbidity and mortality in particular scenarios.[24] Some of the areas that "mobile health" applications assist with include medication management, chronic care management, diagnostics, medical reference, women's health, mental health, personal health records, fitness, and weight loss.[10] For example, an application designed to screen patients with lung cancer reported the consequences of signs of cancer recurrence in previously treated patients and so allowed for early reintervention and, therefore, improved the median survival more than the optimized standard imaging follow-up.[25] Applications are potentially influential platforms for the delivery of behavioral interventions because they can improve the engagement with the established policies and plans for the management and prevention of diseases through individualized dosing reminders, gamification, and personalized goal setting.[26] The applications, which are connected to wearable devices that monitor activity level and heart rate frequently, use additional behavior change practices such as self-monitoring and evaluation of physiological changes.[24] The body mass indexes were decreased by 0.43 kg/m^2, and considerably, more weight loss was observed in the meta-analysis of several existing studies evaluating the effects of smartphone functional apps to promote physical activity performance and weight loss.[27] Wu *et al*. studied the Benefit of mobile application-based interventions to support self-management of patients with diabetes and found that among adult outpatients with diabetes, the use of mobile app-based interventions results in a clinically significant decrease in glycated hemoglobin, mainly among those with type 2 diabetes.[28] Van der Meij *et al*. stated that the efficiency of a customized e-health procedure after abdominal surgery speeded up the return to normal activities in contrast to conventional e-health services and that it was recommended for patients undertaking various operations, such as gynecological, general surgical, or intermediate abdominal surgeries.[29] Linardon meta-analyzed several randomized observational studies of application supported software treatments for mental health disorders and observed a substantial impact on clinical results for the management of stress, anxiety, and depression, and enhancing patients' quality of life, of comparison to placebo groups, using mobile health applications.[30]

Mobile health applications could provide the patients with a structured education related to their diseases and treatments that are effortlessly accessible to the users.[24] One recent study showed that the use of an educational application with structured interactive content for patients with knee pain improved the level of perceived disease-related knowledge by 22% and the actual knowledge at clinical attendance by 52%.[31]

THE BARRIERS OF USING TECHNOLOGY IN HEALTH-CARE DELIVERY IN SAUDI ARABIA IN THE FULL EXTENT

Technology in health-care delivery plays a significant role in saving the patients' life, decreasing physician misapprehension, and reducing errors that will also reflect the health of patients.[32] The use of technology in health-care delivery is also supporting a gradual and smooth movement of information around an institute, aiding the hospitals to achieve a paperless concept and as a result reducing the time for health-care delivery.[6] However, there are several barriers to the implementation of technologies in health-care delivery and should be determined to overcome them.

Several studies studied the barriers of using technology in health-care delivery in Saudi Arabia. Almuayqil *et al*. investigated e-health barriers in Saudi Arabia and found

that health-care professionals and citizens perceived that lack of connectivity of health information services is the main reason for the failure of e-health, while information technology specialists believed that lacking medication safety is the primary barrier that leads to such a failure.[33] In the Eastern province of Saudi Arabia, El-Mahalli and others also examined telemedicine challenges in four hospitals. They stated that a lack of knowledge of telemedicine is the main barrier for health-care providers to implement telemedicine.[34]

Alanzi *et al*. evaluated the use of a mobile social networking system among diabetic patients of type 2 and demonstrated the need to improve terminology, learning factors, and system information to improve user satisfaction with the "Saudi Arabia Networking Support System."[35] Kaliyadan *et al*. evaluated the use of a 4G smartphone for mobile teledermatology. In their study, dermatologist photos of patients' skin were taking using the mobile, and after the diagnosis, the photo was sent to another dermatologist to compare both diagnoses. Kaliyadan *et al*. found that there was a high agreement of diagnoses among dermatologists. They also reported that about 14% of the participants refused photography of the skin lesions due to social or religious reasons.[36]

Al-Nasser *et al*. conducted a survey in Saudi Arabia on the current status of dental information technology to illustrate the recent applications of dentistry in Saudi Arabia and to identify challenges to expand dental information technology. They found that administrative management systems and digital radiography were the most used in Saudi Arabia. Web-based learning systems and computer-based assessments were available for dental educational applications. On the other hand, many challenges hindered the integration of dental software and medical health records, including the lack of IT infrastructure and the non-standardization of e-health applications.[37]

Al Saleem *et al*. reviewed the Saudi experience in the implementation of Electronic Lab Information Exchange (ELIE) within health-care organizations and showed that numerous Saudi health-care organizations are participating in ELIE.[38] The study also reported improvements in the workflow of the laboratory department and inpatient care.[38] However, the introduction of ELIE is complicated by many issues including resistance of personnel; weakness of information infrastructure; recruitment of skilled personnel to establish and enforce ELIE; protecting the safety and confidentiality of patient records; and developing specific rules and procedures to allow the data entry and lack of knowledge of the value of ELIE enforcement by the personnel.[38]

Alkraiji *et al*. conducted a study that explored the main barriers to the widespread adoption of health data standards in health-care organizations in Saudi Arabia and showed the main barriers included the lack of adequate policies, lacking a national regulator and a data exchange plan, technical barriers, and the switching costs to the standards.[39]

THE SOLUTIONS TO OVERCOME SOME BARRIERS

Technology in health-care delivery has the potential to have an essential and long-lasting effect on health-care systems in Saudi Arabia. Despite the purported benefits of the aforementioned applications, technology in health-care delivery is still less utilized and less developed than other technologies. By identifying the barriers that affect the adoption of these technologies in Saudi Arabia, several recommendations for decision-makers are shaped to inform and encourage the utilization of these technologies in Saudi Arabia and to overcome their implementation barriers.

It has been recognized that inadequate technology issues such as the internet, electricity, computer, and the shortage of health information technicians can be solved by introducing health care professional training services, expanding internet connectivity, and allocating a budget to innovative long-term projects.[40] In addition, to increase public awareness of the benefits of these innovations, it is recommended that government campaigns concentrate on wellness promotion and health education.[40] Saudi Arabia also wants to shift to advanced, flexible, and high-performance operational structures to improve the decision-making and accountability of health-care practitioners.[40]

Public understanding of the value of technologies and the preparation and training of medical practitioners and patients must be improved. When designing and applying technologies, it is essential to understand the individual needs and the benefits of advancement and potential value make the application of technologies significant.

The health sector in Saudi Arabia will bring more value by providing streamlined management processes and efficient use of technology. In addition, policymakers should focus on the removal of potential human or organizational obstacles to health-care staff and patients by offering adequate preparation to increase awareness and support for technology projects. Saudi Arabia policymakers and clinicians must also work together to develop local action plans and plans to help change practices and skills. This can increase the beliefs of health care workers in the benefits of change and increase their confidence in the ability to use health applications. Regarding the use of electronic health records, Ozair *et al*. reported that there are multiple strategies to lessen the risks and to overcome the barriers of the implementation of digital health records that include flexibility, leadership, adaptability, and teamwork.[41]

Comprehensive health strategies and policies can facilitate technology solutions in Saudi Arabia. For example, health

legislators can consider introducing the relevant ethical and legal standards to confirm the success of the implementation of technology in delivering health services. The review recommends that health care workers focus on aspects of their staff and patients' perceived susceptibility.

Saudi Ministry of Health has developed the 5-year action plan and the e-health strategy in collaboration with Saudi and international consultants. This strategy supports the Ministry of Health's key objectives that include measuring the performance of healthcare service delivery, patient care, connecting service providers with all health-care levels, and transforming health-care services in agreement with globally recognized health standards.[42]

One of the main technological concerns is privacy and the protection of massive health data. Health organizations collect, manage, and distribute massive volumes of data to provide reliable, productive services, but limited protection and a lack of technical assistance are the downsides.[43] Kim *et al*. argued that significant data security refers to three matters: Information security, access control, and data security.[44] In this regard, security approaches and measures must be implemented by health-care organizations to protect their big data, associated software and hardware, and both administrative and clinical information from external and internal risks.[43] The Committee of the National Research Council for Health Improvements has said that encryption technology is required to safeguard the security of data transmitted across the network and guarantee its integrity.[45]

Developers of these technologies must ensure successful processing and transmitting health data across various health-care platforms. In addition, health-care staff should also ensure available, accurate, and multilingual information they provide. In addition, these technologies should be designed to ensure that only the authorized workers are provided access rights to healthcare information. Health professionals are encouraged to work actively to cultivate technical learning communities through constant collaboration and sharing of experience with other nations. Furthermore, cloud computing systems may be built by politicians to help healthcare staff capture, interpret, and model health data across agencies. Sultan conducted a study about using cloud computing for health-care provision and reported that cloud computing has emerged in recent times as a backbone of the internet of things health-care systems.[46]

Religion is a central element in everyday life in Saudi Arabia. Therefore, a potential obstacle to the efficient usage of these technologies is cultural resistance to reform, which can be mitigated by numerous pre-implementation programs, such as brochures, guides, general, and special training classes, within professional development strategies. The participation of key users in systems and services development and implementation can confirm that cultural needs are entirely understood and embedded in the design and development process.

CONCLUSION

The promotion of telemedicine practice in Saudi Arabia is quite encouraging, but some decisive actions are required. Notably, using the technologies in health-care delivery can be a cost-effective approach by shifting treatment to prevention, decreasing hospitalization, and hospital consultations, which could generate revenue by saving the cost of treatment. In addition, patient waiting time can be reduced, and they would be able to receive quality health-care service in their environment. This paradigm shift is a choice for patient-centered care that will increase patient satisfaction and outcomes. Using technology on delivering health-care services in Saudi Arabia is a worthy choice serving the demands of patients in the community. Careful piloting, planning, and training of health-care professionals are imperative when devising any new telemedicine program to avoid errors and pitfalls.[47]

To familiarize health workers with the mission and the configuration of the technology, the study showed that specific training strategies were required. Moreover, privacy and juridical problems have been found in urging clinicians and patients of the importance of these systems. Furthermore, lack of competence and technical skills have been shown to impact users' trust and expectations. The health workers should ensure that services are administered as close as possible, to gain greater recognition and use of technology in health services delivery in our country, and that they take into account the religious and social context of the population. The outcomes of the study help design plans and policies aimed at the use of technology and providing health care in Saudi Arabia.

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