

Evaluating the Readiness of Mobile Technology with Respect to e-Health for Medication in Saudi Arabia: An Integrative Perspective

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Fahad M Al-Anezi

Community College, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia

Objective: The objective of this study was to evaluate the readiness of Saudi Arabian patients towards the adoption of the e-health system through the use of mobile phones.

Methods: In this research, a cross-sectional survey was carried out using a self-administered structured questionnaire. According to the results, 354 people viewed the questionnaire and 129 respondents were selected to assess the adoption of the e-health system in Saudi Arabia. The data were collected during February–March 2020.

Results: More than half of the respondents (63.6%) were women and almost half of the participants (48.0%) were married. Most of the surveyed patients suffered from cardiovascular diseases and diabetes. Almost all the participants (99.0%) had their personal mobile phone and used the Internet on these devices. Most of the participants did not trust or believe in online health services or online medical consultations and did not spend money on contracting health services through mobile phones. It is suggested that the lack of motivation to adopt the e-health system may be due to fear of privacy violations, fear of loss of personal data and information, lack of technical support, and mistrust in doctors who frequently use their cell phones to distract themselves during work-hours.

Conclusion: The results of this study revealed that the population of Saudi Arabia is reluctant to adopt the electronic e-health system promoted in the Saudi Vision 2030 strategic plan. To change this behavior, it is necessary to develop awareness campaigns and strategies that suggest the importance of using e-health in the Saudi Arabian healthcare system. Additionally, it is essential that the network administrator implement procedures to protect the confidentiality and security of patients' medical records.

Keywords: Saudi Arabia, mobile phones, electronic health, adoption, e-health

Introduction

In the past three decades, the express development of information and communication technology (ICT) has caused significant advancement in the healthcare area, and some studies have shown that ICT-based e-health services noticeably affect the development of the healthcare sector.^{1,2}

It is worth mentioning that e-health is an emerging field in the intersection of medical informatics, public health, and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using

Correspondence: Fahad M Al-Anezi
Community College, Imam Abdulrahman Bin Faisal University, Saudi Arabia
Email fmoalanezi@iau.edu.sa

information and communication technology.³ Also, the World Health Organization (WHO) describes e-health as “the leveraging of the information and ICT to connect providers and patients and governments; to educate and inform healthcare professionals, managers, and consumers; to stimulate innovation in care delivery and health system management; and to improve our healthcare”.⁴ According to the WHO, the possibility that all people in the world receive high-quality health services at reasonable costs cannot be achieved without the support of e-health.⁵ The utilization of the ICT system certifies individual behavior, individual thinking, and individual’s commitment towards the global approach of healthcare services.⁶ In general, e-health is related to the use of telecommunications, digital technologies, the Internet, computers, processors, smart phones, and other mobile systems, to facilitate the enhancement of healthcare services.⁷

Many developed countries have invested a substantial amount of resources to continue implementing and improving e-health systems to lower their costs and to improve the quality of life.⁸ Recent studies show rapid progress in the utilization of electronic health system in developed countries and these countries are now increasing their wings from the existing quality of health toward the digital healthcare system.⁹ The digital healthcare system increases healthcare quality, affordability, accessibility, reduces cost of medical treatment, contributes to minimize medical errors, improves workflow, etc.¹⁰ Similarly, e-health improves diagnosis and treatment, reduces waiting times, and facilitates diseases prevention and care coordination.¹¹ Though e-health has good prospects for providing improved health services and quality to people at a lower cost, its adoption and acceptance processes are not equally straightforward; in reality, understanding the acceptance or rejection of new information systems is regarded as a challenge in the field of information systems.¹²

Regarding Saudi Arabia, it is a diverse and fast progressing country and its GDP was 0.3% in 2019.¹³ Like other countries, the population of Saudi Arabia is also increasing rapidly. According to the United Nations projections, the population of Saudi Arabia in 2025 will increase by 40% compared to 2020.¹⁴ The increase in population will increase the demand of medical health facilities. Also, out of 190 countries, Saudi Arabia healthcare system stands at 26th position, and about

2037 healthcare clinics and 244 hospitals (government and non-government) operate in this country.¹⁵ To achieve the goal of providing free health services to the citizens, Saudi Arabia delivers services via the Ministry of Health (MoH), private health service providers, and government health service providers.¹⁶ To provide better free services, the Saudi government allocated about 4 billion (Saudi Riyal) to the health system.¹⁷

A number of issues pose challenges to the healthcare facilities/sectors of Saudi Arabia. The most important challenge is the non-availability of professional doctors or nurses (<0.94 per 1000 people) regardless of spending a huge amount of resources. Moreover, lifestyle pattern and diseases, financial constraints, poor accessibility are other important challenges. Keeping these challenges in mind, the Saudi government is keen to invest in different ICT-based e-health services.¹⁸ Recent studies showed that despite huge spending on various tools like Electronic Medical Coverage (EMC), Electronic Medical Record (EMR), Electronic Health Record (EHR), Picture Archiving and Communication Systems (PACS), the government still face barriers in the adoption of the e-health systems.^{1,19} These barriers include cultural norms, illiteracy, inadequate knowledge of computer, and other IT skills.¹⁸

Healthcare is the priority sector in the Saudi Arabia’s vision 2030 strategic plan, in which the key factor is the improvement of healthcare facilities for the residents of Saudi Arabia.²⁰ E-health and other ICTs are core components of vision 2030. Currently, the e-health system is under progress and a previous study indicated that this system was established in Saudi Arabia in late 2008.²¹ Now, it is in the second phase of progress and the government spends annually between 10% and 15% of the budget on the development of the e-health system throughout the country. After this operating time, it is necessary and important to perform an e-health readiness assessment that could provide some advantages, such as: (1) avoiding huge losses in time, money, and effort; (2) avoiding delays and disappointments among planners, staff, and users of services; and (3) facilitating the process of change in the institutions and communities involved, from the stage of firmness and resistance to change to the stage of implementation of the e-health system.²² Therefore, this study is an attempt to evaluate the readiness of patients to adopt the e-health applications in Saudi Arabia through the use of mobile phones.

Methods

Study Settings and Participants

A cross-sectional survey was used to evaluate the individuals' attitude towards e-health readiness, and the data were collected using a self-administered structured questionnaire. In this process, a group of Saudi Arabian citizens were asked to participate on a voluntarily basis and the average time taken to complete the survey was approximately 10 minutes. Only patients from Saudi Arabia were included and full privacy of the participants was maintained during the study.

Description of the Questionnaire

The questionnaire was based on the literature review about the utilization of mobile phones among medical professionals, students, and patients for healthcare services.^{23,24} The questionnaire consisted of 37 validated questions and was divided into 7 sections. The first section deals with general demographic information of the respondents. The second section was related to knowledge about the overall health profile of the participants. The third section deals with awareness of the electronic health system in the region. The fourth part deals with the availability, training, and utilization of mobile phones. The fifth considers the utilization of mobile tools and applications (apps) for healthcare services. The sixth section deals with the trust of respondents on online healthcare services, and the seventh with the cost of online healthcare services. The questionnaire was initially designed in English and then was translated into Arabic by two professional Arabic translators. The Arabic version of the questionnaire was designed using the QuestionPro application.

Data Collection

A link was generated for accessing the survey and the data were collected during February–March, 2020. According to the survey results, 354 people viewed the questionnaire, and 171 of them started the survey. Forty-two respondents were removed from the survey for lack of responses. After removing them, 129 respondents were selected to access the readiness for the adoption of the e-health system in Saudi Arabia.

Validation of the Questionnaire

To evaluate the questionnaire, a pilot study was conducted with 10 randomly selected participants from the college of Business & Marketing, Imam Abdulrahman Bin Faisal

University, Saudi Arabia. Based on the feedback from the pilot study, a few changes were made to the questions' formulation and some grammatical errors in Arabic were corrected. The responses observed in the pilot study were consistent. The Cronbach's alpha value was calculated to test the reliability of the survey. The alpha value was 0.886. This value suggested that the questionnaire was reliable.

Ethical Approach

The study was conducted in accordance with the Declaration of Helsinki and the ethical approval was received from the Imam Abdulrahman Bin Faisal University. In addition, the participants were ensured of their privacy and anonymity to participate in the survey. The survey data were stored in the QuestionPro database, which was password protected and only accessible by researchers. In addition, the participants were fully informed about the purpose and data usage of the study, which was strictly for academic purpose. The informed consent was obtained from the participants electronically. Accordingly, all the guidelines proposed by the ethical committee of the mentioned university were followed.

Statistical Analysis

Microsoft Excel and IBM SPSS statistics were used to generate the descriptive statistics of the data and the item-level results of each question of the survey. In addition, Cronbach's alpha value was calculated to test the reliability of the survey. *P*-values were also calculated. A significance level of 5% was used for the analyses.

Results

Demographic Information of Respondents

The demographic information of respondents is shown in [Table 1](#). According to this table, a total of 129 respondents participated in the survey, and the majority of them were females (63.6%, *n*=82). Also, 48.0% (*n*=62) of the respondents were married. The results showed that 7.6% (*n*=10) of the participants completed the high school diploma, 31.0% (*n*=40) passed out the college level studies, 48.8% (*n*=63) of the respondents completed the graduate level education, and 12.4% (16) completed other institutional studies. The results showed that most of the respondents were job holders (53.5%, *n*=69); they are either businessmen or students.

Table 1 Demographic Information of Respondents (n=129)

Variables	n (%)	Mean Value	P value
Gender			
Male	47 (36.4)	1.64	0.0483
Female	82 (63.6)		
Education			
High school diploma	10 (7.6)	4.65	0.795
College	40 (31.0)		
Degree	63 (48.8)		
Other	16 (12.4)		
Marital status			
Married	62 (48.0)	2.87	1.920
Widowed	2 (1.5)		
Divorced	10 (7.7)		
Separated	2 (1.5)		
Single	51 (39.5)		
Never married	2 (1.5)		
Occupation			
Businessman	4 (3.1)	2.64	0.882
Job holder	69 (53.5)		
Student	25 (19.4)		
Other	31 (24.0)		

Information About the Overall Health Profile of the Respondents

In this survey, 2 questions were asked to know about the overall health profile of the respondents. The answers to these questions are shown in [Table 2](#), where it is observed that the majority of the respondents (81.2%, n=105) were not taking medication. Also, most of the respondents suffered from cardiovascular diseases and diabetes.

Knowledge of the Respondents About the e-Health System

In this survey, a question was asked to find out if the participants had knowledge of the e-health system. In this regard, out of 129 participants, 79 of them (61.4%) indicated that they had knowledge about this system.

Use of Mobile Phones by the Respondents

[Table 3](#) describes the use of mobile phones by the respondents. This table indicates that 99.0% (128/129) of the respondents were using their own mobile phones. Also, 34.9% (45/129) of the participants received healthcare messages.

Table 2 Overall Health Profile of the Respondents (n=129)

Variables	n (%)	Mean Value	P value
Are you currently taking any medication?			
Yes	24 (18.8)	1.81	0.039
No	105 (81.2)		
Have you been diagnosed with any of the following diseases?			
Hypertension			
Yes	124 (96.1)	4.84	0.018
No	5 (3.9)		
Cardiovascular diseases			
Yes	129 (100)		
No	0 (0)		
Diabetes			
Yes	121 (94.1)		
No	8(5.9)		
Obesity			
Yes	129 (100)		
No	0 (0)		
Other			
Yes	114 (88.2)		
No	15 (11.8)		

Utilization of Mobile Phones for Healthcare Services

According to [Table 4](#), most of the participants (80.1%) knew that they could call doctors through their mobile phones. Mixed responses were noted in questions related to doctor advice on diseases or treatments. Also, all participants did not answer some questions.

Spending Money for Online Healthcare Services

In this survey respondents were asked about spending money for the online healthcare services. Among them, 17% of the respondents agreed in spending on online healthcare services. However, no one responded about the amount that they were spending on healthcare services using their mobile phones.

Trust of Respondents on Online Healthcare Services

The results indicated that most of the participants (84%) did not trust online healthcare services. Moreover, few

Table 3 Availability and Utilization of Mobile Phones Among Respondents (n=129)

Utilization of Mobile Phones	n (%)	Mean Value	P value
Do you have your own mobile phone?			
Yes	128 (99.0)	1.01	0.100
No	1 (1.0)		
Does any member of your house own a mobile phone?			
Yes	124 (96.0)	1.04	0.196
No	5 (4.0)		
How many mobile phones are owned by members of your house?			
Results were not reported			
Do you share your phone with others?			
Yes	32 (24.7)	1.75	0.434
No	97 (75.3)		
Do you use the internet on your phone?			
Yes	128 (99.0)	1.01	0.100
No	1 (1.0)		
How long have you been using your own mobile phone?			
Results were not reported			
Number of incoming calls, SMS and voice messages received per week related to?			
Healthcare	45 (34.6)	2.87	1.412
Other	84 (65.4)		

participants (4%) believed in the medications provided by the doctor without seeing the current situation of the patient.

Discussion

The results of this study about the readiness of Saudi citizens towards the implementation of the e-health system in Saudi Arabia revealed that the majority of the respondents owned mobile phones and used the internet on these devices. These results are in line with the high penetration rate of smartphones (87.43%) and the internet (88.0%) in Saudi Arabia in 2020.^{25,26} It is important to note that mobile phones allow users to search for medical advice, have access to personal health information, receive the results of medical examinations, plan appointments with doctors, access the internet to obtain medical information, etc.²⁷ According to Khatum et al, "Ownership of mobile

phones among the population and healthcare providers is the most important factor in supporting the large-scale implementation of mobile-based intervention".²⁸ Likewise, it was detected that more than half of the participants had knowledge about the e-health system. In this sense, the high rates of ownership of mobile phones by the participants and the availability of the internet through these devices suggested that there is great potential for the establishment of e-health systems in Saudi Arabia.

On the other hand, it was observed that most of the participants did not trust or believe in online healthcare services or in online medical consultations, and did not spend money to contract healthcare services through mobile phones. Undoubtedly, these negative perceptions about these issues are barriers that affect the successful implementation of e-health systems in Saudi Arabia.²⁹

Also, some important questions presented in Tables 3 and 4 were not answered by the respondents. Regarding Table 3, they did not answer the question "How long have you been using your own mobile phone? The answer to this question would have allowed knowing the experience of the participants to send and receive messages and to use the functionalities and applications available on the Internet. The lack of these skills represents a barrier to properly managing e-health systems.²⁸ Regarding Table 4, the participants did not answer the important question "Why will not you ask for medical services through your mobile phone? Obviously, the answer to this question would have indicated the willingness and tendency of the participants to ask and request the availability of medical services in the e-health system through their mobile phones. Among other interpretations, the lack of interest in answering the aforementioned questions suggests that participants do not care about the implementation of the e-health system in Saudi Arabia. In this regard, the implementation of new technologies usually faces obstacles to their final acceptance by users, as is the case of e-health technologies in some countries.³⁰⁻³²

In relation to these observations, it is convenient to mention that in addition to the availability of technologies, the will and motivation of people is important for the adoption of e-health systems.²⁹ In our opinion, the lack of motivation to adopt e-health services is associated with cultural and social aspects of the Arab people. Also, another reason why the majority of the population does not have confidence or motivation to adopt e-health systems is the fact that they consider that mobile phones are a source of distraction in health institutions where healthcare workers use them during working hours to send text

Table 4 Utilization of Mobile Phones for Healthcare Services (n=129)

Utilization of Mobile Phones	n(%)	Mean Value	P value
Do you know that you can call the doctor in some specific number (emergency number) for medical treatment using a mobile phone?			
Yes	103 (80.1)	1.12	0.400
No	26 (19.9)		
How many times have you called to this number in the past 14 days?			
Results were not reported			
For what type of sickness did you call to this number?			
Results were not reported			
What advice did you get for your sickness after calling?			
To visit directly	12 (9.8)	3.098	0.961
No advice	15 (11.5)		
Others	49 (37.7)		
Do not know	53 (40.9)		
Did you take the advice?			
Yes	67 (52.4)	1.475	0.504
No	62 (47.6)		
Did the advice help you?			
Yes	72 (55.7)	1.443	0.0401
No	57 (44.3)		
How did it help you?			
Results were not reported			
Why did not you take the advice you received on the phone?			
Results were not reported			
In the future, will you ever seek medical advice from the number you called before?			
Results were not reported			
Why will you ask for medical services?			
Results were not reported			
Why will not you ask for medical services through your mobile phone?			
Results were not reported			

messages, read news, check social issues, surfing, shop online, and play games.³³ In the same way, aspects related to the privacy of patient information, costs, and lack of technical training and supporting staff are obstacles that accentuate people's lack of trust in the e-health system.^{34,35} In this sense, privacy and lack of trust are important parameters that need to be clarified in order to boost e-health readiness in Saudi Arabia.

Faced with this situation, motivational programs should be implemented to increase the awareness of the population towards the adoption of electronic health systems.³⁶⁻³⁸ It is also necessary to point out the

importance and potential of electronic health systems to manage cardiovascular diseases, diabetes, obesity, cancer, and other illnesses that afflict a large part of the Arab population.^{27,39-44} In the same way, measures must be implemented to ensure the confidentiality, privacy, and security of the patients' health records. In this regard, to improve data privacy it is recommended to install physical safeguards in such a way that only the authorized person with their user ID and a secure password can use the electronic applications. Also, this system must have an automatic logout after a certain time. Moreover, the app developers should do audits of the

data and keep the audit records. In addition, the network administrator should implement procedures to prevent the exploitation of the user data. Finally, it is necessary to promote the training and education of users about the e-health system and coordinate all the participants involved in the implementation process, such as health-care providers, patients, and the government.³⁶

The strength of this work lies in the fact that it is the first study that reveals the opinions of a group of patients about the adoption of the e-health system in Saudi Arabia. The findings of this research might be useful in guiding the government, policymakers, e-health implementers, and healthcare providers in Saudi Arabia, and other developing countries as well, to take measures aimed at motivating patients to adopt the electronic health system.

This paper has some limitations. Firstly, the results of this study cannot be generalized to all of Saudi Arabia because the sample size was small. On the other hand, the analysis of the findings was mostly frequency presentations of the responses and no quantitative statistical analysis has been done on the results that might restrict the examination of e-health readiness. Another limitation was that no question was asked for the age category of participants. Future work should be aimed at solving the aforementioned limitations and conducting similar studies involving all regions of the Kingdom of Saudi Arabia.

Conclusion

The results of this study revealed that the majority of the respondents are reluctant to adopt the electronic e-health system promoted in the Saudi Vision 2030 strategic plan. The main factors that hinder the readiness towards the adoption of e-health are lack of confidence in online medication and lack of trust in online healthcare services. This lack of motivation can be caused by fear of privacy breaches, fear of loss of personal data and information, lack of technical support, and the mistrust in doctors who frequently use their cell phones to distract themselves during working hours. To change this behavior, it is necessary to develop awareness campaigns and strategies that suggest the importance of using the e-health program in the Saudi Arabian healthcare system. In addition, it is necessary that the network administrator implement procedures to protect confidentiality and security of patient health records.

Disclosure

The author reports no conflicts of interest in this work.

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