

Chapter 13

The Role and Use of Telemedicine by Physicians in Developing Countries: A Case Report from Saudi Arabia

Dana Alajmi

Independent Researcher, Saudi Arabia

Suleiman Alomran

King Saud University, Saudi Arabia

Mohamed Khalifa

*King Faisal Specialist Hospital and Research
Center, Saudi Arabia*

Ashraf El-Metwally

*King Saud Bin Abdul Aziz University for Health
Sciences, Saudi Arabia*

Amr Jamal

King Saud University, Saudi Arabia

Majed Al-Salamah

Independent Researcher, Saudi Arabia

Nasria Zakaria

*King Saud University, Saudi Arabia & Universiti
Sains Malaysia, Malaysia*

Mowafa Househ

*King Saud Bin Abdulaziz University for Health
Sciences, Saudi Arabia*

ABSTRACT

As technological advance leaps into the developing world, telemedicine is expected to significantly grow in many developing countries. It is important to investigate the awareness, preferences, requirements, perceptions and attitudes of physicians in Saudi Arabia towards the use of telemedicine technology. In order to promote the use of telemedicine among physicians, training should be focused on older professionals and those who show lower levels of IT knowledge and experience. This chapter uses the results of a survey that was conducted in the city of Al-Dammam, Saudi Arabia, which gathered information about physicians' awareness and attitude towards telemedicine. Most physicians reported high level of awareness of telemedicine and showed interest in using telemedicine technology in their work. Physicians' preference of using such technology was predicted by their awareness, knowledge and previous experience, using telemedicine and technology affinity. Physicians' willingness to use telemedicine was influenced by age, technology preparedness and practice.

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INTRODUCTION

Worldwide, the use of information technology and software applications constitutes an integral component of the daily workload in business, banking, industry, education and healthcare settings. Computers and the Internet, as a part of modern information and communication technologies (ICTs), have changed the way of how individuals communicate and exchange information. The development of computer technology and telecommunication services has had a significant impact on quality of health care especially for rural areas where access to quality health care has usually been an obstacle (Bashshur, 2002). Telemedicine is one of those technologies that have brought an opportunity for people who are living in rural areas to gain better accessibility and quality of healthcare services.

Over the past few years, user resistance and acceptance of technology has received more attention in healthcare research (Kim et al., 2010; Chau & Hu, 2002). Schopenhauer, a German philosopher in 1860, suggested that there are three stages for the revelation of each truth. "First, it is ridiculed; in the second, resisted; in the third, it is considered self-evident".

The same situation is applicable with regards to telemedicine technology. Telemedicine is one of the technologies that help facilitate medical care at a distance and have been found useful to reach those patients living in rural and underserved areas (Cox & Towle, 2012; Alajlani, 2010). Telemedicine can include various services ranging from the simplest form as store-and-forward to the highly specialized and sophisticated services, which can be found in academic medical centers. However, telemedicine is still not self-evident because it is still not an integral part of classic healthcare practice (Weiss, 2008). The successful adoption of telemedicine technology relies mainly on the recognizing of barriers to telemedicine. Physicians' attitude and acceptance are considered some of the main challenges for telemedicine. In order to overcome these issues and facilitate the adoption of innovative technologies, it is very important to understand the factors that affect the acceptance of telemedicine technologies by clinical staff in healthcare (Kim et al., 2010).

Telemedicine is about using information and communication technology (ICT) in order to deliver health care services at a distance (American Telemedicine Association, 2013; Currell et al., 2000). Telemedicine can provide the population in particular who are living in rural areas with the opportunity to gain better-quality healthcare services (Khalifehsoltani & Gerami, 2010; Bashshur, 2002). The industrial countries have had a significant amount of experience with the use of telemedicine during the last 50 years. In 1959, Nebraska Psychiatric Institute was one of the first health organizations that implemented telemedicine in the United States (Ramos, 2010; Jung et al., 2012). It utilized a television link to connect with Norfolk Hospital, which was 12 miles away. Such a link allowed physicians to communicate with both physicians and patients on the other end (Ramos, 2010).

In April of 1968, there were some other early implementations of telemedicine services in Massachusetts General Hospital where a microwave video was used to communicate with Boston Logan airport. With such a link, Massachusetts General Hospital was able to provide instant healthcare services to employees and passengers at the airport. The services provided at the Logan Airport included cardiology, dermatology and radiology services (Ramos, 2010; Adler, 2000). Since then, telemedicine has achieved significant progress in the developed world. In the 1970's, telemedicine became a separate field of study. In the 1990's, the innovation was increased due to the appearance of new technologies like the Internet and mobility services (Wade et al., 2010). Currently, there is a wide range of services already implemented in the industrial countries ranging from basic forms to complicated virtual reality services. These services can be used everywhere mostly in areas whereas a shortage physicians and

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specialist of specific medical condition. Moreover, there are various successful implemented projects, and plenty of the pilot projects under development that would change the way in which a healthcare is delivered (Bashshur, 2002).

Today, Telemedicine can be classified into three main categories; store-and-forward, live interactive services and hybrid model (Ramos, 2010). Store and Forward (SAF) technology is about capturing the medical data at one time and location and then transmitting the data to another location in convenient time to be assessed offline (Ramos, 2010; Devaraj & Ezra, 2011). SAF is used mostly in Radiology, Dermatology and Pathology (Ramos, 2010). The second model is called synchronous which is a live interactive technology that provides remote real-time communications between the patient and the specialist and it can be used in many activities same to those done in traditional face-to-face appointments such as physical examination, history review, and psychiatric evaluations (Ramos, 2010; Devaraj & Ezra, 2011). The last model is the hybrid which combines both of live interactive and store and forward consultation components which is primarily used for specific conditions, such as heart disease in cardiology specialty (Ramos, 2010).

The implementation of telemedicine might be more effective in developing countries like Saudi Arabia since those countries are being challenged with medical services problems, financial needs, lack of resources and lack of healthcare professionals (Khalifehsoltani & Gerami, 2010; FBA et al., 2010). Telemedicine is one of advanced technologies that attempt to solve the problem related to the provision of quality healthcare. (Bashshur, 2002; Horsch & Balbach, 1999). The key objectives of telemedicine are to provide clinical decision support by sharing information among the healthcare providers, overcome geographical barriers by connecting consumers who are not in the same physical location and improve healthcare outcomes by enabling patients to manage their own healthcare (Bashshur, 2002; Horsch & Balbach, 1999).

The Kingdom of Saudi Arabia is one of the largest countries in the Middle East. It has a population of about thirty million people spread over the entire kingdom's area of more than two million square kilometers with hundreds of cities and villages. Over the past twenty years, Saudi Arabia has made tremendous progress in various sectors through ambitious development plans. Health sector has been given a high priority by heavily investing in building healthcare infrastructure including the latest diagnostic and therapeutic applications (El-Mahalli, El-Khafif & Al-Qahtani, 2012). With great advances of modern medical systems, and growing demand for qualified physicians and surgeons in Saudi Arabia, it becomes a necessity to find new and creative ways to help in achieving healthcare goals. In Saudi Arabia, the idea of telemedicine adoption was introduced as a supportive tool that could promote quality healthcare by enabling residents of remote areas in Saudi Arabia to benefit from the advanced central healthcare services easily and conveniently. The vast zone of Saudi Arabia and widespread population distribution across the country were key elements encouraged the establishment of national telemedicine network (El-Mahalli, El-Khafif & Al-Qahtani, 2012).

Telemedicine in Saudi Arabia was first launched by King Faisal Specialist Hospital and Research Center. The hospital is one of the largest specialist hospitals in the Middle East. It provides free medical care and accommodation for patients' in need of treatment inside and outside Saudi Arabia. Telemedicine services in Saudi Arabia allowed healthcare providers to connect directly with leading specialists around the world. The hospital is connected with George Washington University Hospital for continuing medical education purposes and with Massachusetts General Hospital in Boston for consultation purposes. The consultation telemedicine connect with Massachusetts General hospital included confirming the accuracy of radiology, histopathology reports and also patient management protocols. Nowadays telemedicine consultation between both hospitals is to a large extent limited to patient management protocols.

Some public and private sector hospitals in Riyadh, the capital of Saudi Arabia, and Jeddah, the second largest city, have contracted later with private healthcare services and plans providers to purchase patient management consultations. In 1993, Saudi government established an e-Health Center according to a royal decree. Since that time, the center has been delivering telemedicine services such as medical consultations and continuing medical education through international videoconferencing and fiber optic networks. At the beginning, the signed agreements for the telemedicine services have included only a few hospitals in Saudi Arabia and years later the number of connected sites for the national telemedicine network increased to twenty sites around the Kingdom of Saudi Arabia (Alyemeni, 2010).

Koch (2006) showed in his research that there is a lack of proper guidelines for successful implementation of telemedicine and home telehealth solutions while Broens et al. (2007) found that the patient's preferences, acceptance and attitude towards telemedicine are key factors that affect the development life cycle of the implementation of telemedicine services. The successful adoption of telemedicine projects is partly depended on the acceptance by both health providers involved and the patients (Chau & Hu, 2002; Kim, Chun & Song, 2009). The acceptance of telemedicine technology in turn can be affected by many factors where physicians' attitude towards telemedicine technologies is one of these factors that influence the meaningful use of telemedicine technology which in turn affect their acceptance towards telemedicine (Kim, Chun & Song, 2009; Eikelboom & Atlas, 2005; Meher, Tyagi & Chaudhry, 2009).

Studies showed that physicians' attitude towards technology is considered as a key predictor of the successful adoption of new technology in healthcare field (Esmailzadeh et al., 2011; Straub, 2009). Accordingly, physicians' attitude towards telemedicine can play a significant role in the successful adoption of telemedicine technology (Bashshur, 2002; Kim, Chun & Song, 2009; Esmailzadeh et al., 2011). With the increased use of telemedicine technology in healthcare, there has been resistance, and in some cases acceptance of these technologies as an alternative form of healthcare delivery (Kim et al., 2010), (Xue & Liang, 2007). Physicians find it difficult to adapt to these technologies for fear that such use might have a negative impact on patient/physician communications and adds another layer of complexity to their currently busy work schedule (Kim et al., 2010). Despite the importance of attitude factor in determining and predicting individual's behavior towards technology, many studies about the adoption of technologies have discounted the important role of attitude in predicting individual's acceptance towards technologies (Bashshur, 2002; Kim, Chun & Song, 2009; Ekeland, Bowes & Flottorp, 2010).

From a review of literature, we find a relatively small number of studies that were concerned with the perspective of physicians and patients. Jung et al. (2012) reported that there are several telemedicine services which already have been implemented in Korea and those services are expected to increase in the future. The study presented patients' attitude towards telemedicine services and showed that almost half of the participating patients are aware of telemedicine and 73% of participating patients actually preferred telemedicine (Jung et al., 2012). The study also showed that patient's residence, education and occupation are affecting patient's awareness of telemedicine, while patient's age and income impacted on the patient's preference of telemedicine services (Jung et al., 2012), on the other hand, Terschüren et al. (2012) examined physicians' acceptance of telemedicine services. Researchers of this study found that 36% of physicians are aware of telemedicine devices and 1.8% of them experienced using such technology (Terschüren, Mensing & Mekel, 2012). According to Meher et al. (2009) most physicians, of all ages, found telemedicine important. Contradictory results were reported by Gaggioli et al. (2004), who documented that some physicians were not interested in telemedicine or convinced with its usefulness in improving the quality of care. Physicians' beliefs of the latter study were mostly apparent with novice and older physicians who showed a lower level of knowledge and prior experience of telemedicine (Gaggioli et al., 2004; Hanson, Calhoun & Smith, 2009).

SAUDI ARABIA AS A CASE EXAMPLE: THE SURVEY STUDY

Despite all potential benefits of telemedicine, it has been slowly adopted in Saudi Arabia emphasizing the need for more studies that explore key factors combating the implementation of telemedicine services. Only few studies were conducted in Saudi Arabia to identify such factors. The objectives of this study were (1) to explore the factors that affect physicians' attitude in Saudi Arabia towards telemedicine technologies such as age, gender and work experience, and (2) to investigate physicians' opinions, requirements and priorities in telemedicine in order to support the meaningful use of telemedicine in Saudi Arabia. The research question guiding this study was "What is the attitude of physicians towards the adoption and use of telemedicine in Saudi Arabia?"

Study Setting

The survey among physicians was conducted in Imam Abdurrahman Bin Faisal Hospital, National Guard Health Affairs. This hospital was selected, as it is one of the leading hospitals in the Eastern Region of Saudi Arabia. The hospital was officially opened in 2002 with a capacity of 112 inpatient beds, over 85,000 outpatient visits annually and around 48,000 ER encounters. The hospital is JCIA accredited.

Study Design

An exploratory cross sectional study was conducted in order to identify the present attitude of physicians towards telemedicine services and to explore the factors that affect their attitude. The study determined the nature of the relationship between these factors and participants' attitude towards telemedicine.

Target Population and Sample Size

All 219 physicians, who work full-time at Imam Abdurrahman Bin Faisal Hospital constituted our target population. Invited physicians worked in nine medical departments: 8 in family medicine, 17 in surgery, 7 in anesthesia, 22 in internal medicine, 13 in obstetrics and gynecology, 12 in pediatrics, 18 in emergency medicine, 6 in medical imaging 4 in dental and 14 locums from different specialties. The study focused on physicians only, so other clinical staffs were excluded. The study used a convenience sampling method. Such sampling technique had been used because only the physicians who were in the hospital during the one-month data collection period were accessible to the research group. According to convenience sampling technique, a total of 121 physicians from all departments were invited to take part in this survey. Informed consent with a clear explanation of the project was distributed first together with the questionnaire. Out of a total of 121 doctors invited 93 completed the questionnaire giving a response rate of 77%.

Data Collection Method

For this cross sectional study, a self-administrated questionnaire was used to collect data from physicians. The survey included a mix of close-ended and open ended questions. The questionnaire assessed the knowledge, attitudes, opinions and perceptions of physicians towards telemedicine. It included 25

questions which were divided into four major categories: (1) Physicians' demographics; (2) Level of awareness about telemedicine services; (3) Accessibilities to telemedicine services; (4) willingness to use telemedicine services; (5) Preferences in telemedicine.

A pilot phase of the study was conducted in order to test the instrument and the survey procedures before the actual survey. The reliability and validity of the survey were both evaluated by distributing the questionnaire to 18 randomly selected physicians from the target population. Of whom 14 physicians replied and completed the survey. This pilot phase gave an initial insight of how the physicians from different medical specialty view and think about telemedicine technology. The pilot survey collected data about clarity of the questions and all required adjustments in the questionnaire were conducted based on such comments.

The survey was conducted in the time period from first of March 2013 to the first of April 2013. participants' responses were kept confidential, while only the investigators could identify individuals participated in the study in order to make people more comfortable in sharing the information. In order to increase the response rate, a contact in advance was established with respondents to let them know about the survey and its purpose. Moreover, a follow-up reminder email was sent to non-responding physicians.

Study Variables

Independent variables included physicians' medical specialty, age, gender, years of practice and technology exposure. In order to detect telemedicine preferences according to specific age, five age groups were designed within the questionnaire. Gender of the participants was also scanned in order to examine different styles and attitudes toward the use of telemedicine for both males and females. Medical specialty was surveyed for investigating differences in attitude in various medical specialties. Technology affinity was measured in order to learn how physician's attitude towards technology influences their preferences in telemedicine. For dependent variables, physicians' awareness was assessed, as well as physicians' confidence of telemedicine were measured Physicians' willingness to use telemedicine was also used as the dependent variable in some parts of the analysis.

Data Analysis

Data were coded and entered into Statistical Package for Social Sciences (SPSS). Descriptive analysis was conducted first and results were depicted in tables. To examine factor that significantly had an effect on physicians' opinions, t-test and ANOVA were used. Spearman correlation test was also used to determine the relationship between the study's quantitative variables. The level of significance was set to ($P < 0.05$). The least squares difference Post hoc analysis was carried out for the factors that significantly influenced physicians' attitude in order to identify the points of differences.

Results

According to the personal demographics data section, as shown in table 1, different specialties participated in different proportions, 95% of participating physicians were between thirty and sixty years old, three quarters of the participants were males, most of the participants had over six years of medical experience and most of participants had moderate technology skills and affinity.

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Table 1. Characteristics of participating physicians According to medical specialty, age group, gender, years of practice and level of technology affinity (N=95)

Characteristic	N=95	Percent
Medical Specialty (N=95)		
Family Medicine or GP	7	7.5
Gynaecology	14	15.0
Internal Medicine	14	15.0
Paediatrics	8	8.6
Neurology	2	2.2
Ophthalmology	2	2.2
Radiology	3	3.2
Others	4	4.3
Anaesthesia	6	6.5
Surgery	17	18.3
Dental	3	3.2
Emergency Medicine	14	15.0
Age Group (N=95)		
Less than 30	1	1.1
30- 39	36	38.7
40-49	29	31.2
50-59	24	25.8
More or equal to 60	4	4.3
Gender (N=95)		
Female	24	25.8
Male	71	76.3
Years of Practicing (N=95)		
Less than 1	2	2.1
1 – 5	6	6.4
6 – 10	29	30.9
11 – 20	36	38.3
More than 20	21	22.3
Level of Technology Affinity (N=95)		
Low	4	4.2
Moderate	84	89.4
High	10	6.4

The study also showed the participants' background about telemedicine. As seen from table 2, the majority of the physicians were aware about telemedicine with 72%; 15 physicians (16%) described their knowledge about telemedicine as not knowledgeable, 53 physicians (56.4%) as somewhat knowledgeable and 24 physicians (24.5%) as knowledgeable. Physicians reported receiving information about telemedicine from different sources; 29.8% got information from their colleagues, 19.3% from practicing, 40.4% from media, 3.5% from lectures and 7% from survey.

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Table 2. Physicians' awareness about telemedicine

Physicians' Awareness About Telemedicine (N=92)	N	Per cent
No	26	28.3
Yes	66	71.7
Physicians' Knowledge about Telemedicine (N=92)		
Not knowledgeable	15	16.3
Somewhat knowledgeable	53	57.6
Knowledgeable	24	26.1
Source of Knowledge (N= 78)		
Colleagues	34	29.8%
Practicing	22	19.3%
Media	46	40.4%
Survey	8	7.0%
Lectures	2	3.5%

With respect to physicians' accessibility to telemedicine, the study found that 47.3% of physicians have never used telemedicine, 11.8% rarely used it, 28% sometimes used it, 6.5% often used telemedicine and 6.5% have been always using this technology. Those physicians who used telemedicine previously, actually used different types of telemedicine and for different purposes; 29 physicians (36.7%) used interactive video, 12 physicians (15.2%) used store and forward technology, 22 physicians (27.8%) used shared computers, 12 physicians (15.2%) used telemetry and 4 physicians (5.1%) used different types of telemedicine. Table 3 shows that 12 physicians (11.8%) used telemedicine for administrative purposes, 40 physicians (39.2%) used telemedicine for continuous medical education, 14 physicians (13.7%) used telemedicine for second opinion, 7 physicians (11.8%) used telemedicine for diagnosis, 12 physicians (11.8%) used telemedicine for follow up, 2 physicians (7.8%) used telemedicine for emergency cases and 8 physicians (7.8%) used telemedicine for other purposes.

Table 4, describes physicians' willingness to use, their perception and preference of telemedicine. Most physicians were enthusiastic and willing to use telemedicine technology, but with the need of further research on the effectiveness of telemedicine. (53.2%) of physicians agreed and (39.4%) strongly agreed that they would use interactive video in their practice if it was available or attend continuing medical education via telemedicine. Additionally, Most of physicians either agreed (56.5%) or strongly agreed (40.2%) that use of telemedicine can enhance the communication process in healthcare either between the physicians themselves, physicians and patients or healthcare centers. With regards to the physicians' preferences in telemedicine, there was a variation in physicians' perspective due to different purposes of telemedicine use. Most physicians agreed and strongly agreed that patient is more likely to receive better quality of care in case they had seen the specialist in person with 48.2% and 47.1 respectively. Physicians disagreed that telemedicine might be effective in emergency cases and Post-surgical follow-up with 44.9% and 34.5% respectively. On the other hand, 40.4% of sampled physicians agreed that use of telemedicine might be effective for preventive care. Physicians strongly agreed and agreed that use of telemedicine might be effective for second opinion and home health care with 48.9%, 43.5 and 40.2, 47.1 respectively. Additionally, 46.7% of physicians agreed that use of telemedicine might be effective for acute, nonemergency care. Most of physicians 51.1% believed that their specialty can readily be adapted to the use of tele-consultation. Finally, (51.1%) of physicians strongly agreed and 45.7% agreed that telemedicine can enhance educational opportunities.

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Table 3. Physicians' accessibility to telemedicine technology

How Often Physicians Used Telemedicine	N	Percent
Never	44	47.3%
Rarely	11	11.8%
Sometimes	26	28.0%
Often	6	6.5%
Always	6	6.5%
Common Uses of Telemedicine (N=57)		
Interactive Video	29	36.7%
Store and Forward	12	15.2%
Shared Computer	22	27.8%
Telemetry	12	15.2%
Use Other	4	5.1%
Purpose of Using Telemedicine (N=58)		
Administrative	12	11.8%
CME	40	39.2%
Second Opinion	14	13.7%
Diagnosis	12	11.8%
Follow Up	12	11.8%
Emergency	4	3.9%
Other	8	7.8%

Table 4. Physicians' willingness to use, perception and preference of telemedicine

	Strongly Agree		Agree		Disagree		Strongly Disagree		Don't Know		Total
	N	%	N	%	N	%	N	%	N	%	
Willing to use telemedicine	37	39.4	50	53.2	4	4.3	3	3.2	0	0	94
Telemedicine & communications	37	40.2	52	56.5	3	3.2	2	2.1	0	0	94
Telemedicine with Physical Examination	40	47.1	41	48.2	2	2.4	2	2.4	9	9.6	85
Telemedicine with Emergency Medicine	7	7.9	25	28.1	40	44.9	17	19.1	5	5.3	89
Telemedicine with preventive care	24	27	36	40.4	19	21.3	10	11.2	10	10.6	89
Telemedicine with second opinion	45	48.9	40	43.5	5	5.4	2	2.2	7	7.4	92
Telemedicine with post-surgical follow-up	13	15.5	25	29.8	29	34.5	17	20.2	10	10.6	84
Telemedicine with acute, nonemergency care	25	27.8	42	46.7	22	24.4	1	1.1	4	4.3	90
Telemedicine with home health care	35	40.2	41	47.1	9	10.3	2	2.3	7	7.4	87
Telemedicine with physician's specialty	15	17.0	45	51.1	18	20.5	10	11.4	6	6.4	88
Telemedicine with educational	47	51.1	42	45.7	3	3.3	0	0	2	2.1	92

Table 5. Relationship between physicians’ characteristics and their awareness, willingness to use and their preferences of telemedicine

	Age Group		Gender		Medical Specialty		Years of Practicing		Technology Affinity	
	F	Sig.	F	Sig.	F	Sig.	F	Sig.	F	Sig.
Telemedicine & Awareness	4.299	.073	.425	.516	1.577	.129	3.544	.401	.034	.855
Willing to use telemedicine	.565	.019	.492	.485	1.470	.165	.947	.441	.047	.019
Telemedicine & Preferences	1.762	.001	.839	.362	.740	.671	1.023	.060	.000	1.000

Table 5 shows the relationship between specific physicians’ demographics and physicians’ awareness, willingness to use telemedicine and physicians’ preferences of telemedicine technology. The statistical significance differences were found between respondents age group and physicians’ willingness to use (P=.019) and their preferences of telemedicine (P=.001). Technology affinity of respondents was significantly affecting physicians’ willingness to use of telemedicine technology (P = 0.19). Additionally, respondents’ awareness of telemedicine significantly affected their willingness to use of telemedicine ((P<0.001) and physicians’ preferences about telemedicine (P<0.001) (Table 6).

DISCUSSION

Telemedicine in developing countries still needs more consideration in order to improve the efficiency of healthcare accessibility. Despite the potential benefits of telemedicine in Saudi Arabia due to its vast area and widespread population distribution, the availability of telemedicine services is considered low in comparison with developed countries (El-Mahalli, El-Khafif & Al-Qahtani, 2012). In addition, there are very few studies that had discussed the status, adoption, implementation and patient awareness of telemedicine services in Saudi Arabia, even though there are telemedicine services being provided at both public and private hospitals (El-Mahalli, El-Khafif & Al-Qahtani, 2012; Goldberg et al., 1994). Many of the studies show that the attitude towards telemedicine is one of the key factors that influence adoption, however, not much is known about the attitude towards telemedicine or physicians’ willingness to use it in Saudi Arabia. The factors that may influence the use and adoption of telemedicine is still unknown (Kim, Chun & Song, 2009; Ekeland, Bowes & Flottorp, 2010).

The reported findings of the current study revealed that the majority of our surveyed physicians were aware of telemedicine (72 per cent, Table 2) regardless of their personal characteristics, and almost half of them had never experienced the use telemedicine (47.3 per cent, Table 3). This result was

Table 6. Relationship between awareness and accessibility factors and physician’s willingness to use and their preferences of telemedicine

	Awareness		Accessibility	
	F	Sig.	F	Sig.
Willing to use telemedicine	15.836	.000	1.550	.195
Telemedicine & Preferences	25.306	.000	.870	.486

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consistent with the findings of the study that was conducted in the North Rhine-Westphalia, Germany, which investigated the physicians' awareness and attitude towards home tele-monitoring as one type of telemedicine services. Although the majority of physicians approved the idea of using telemedicine in different healthcare settings, this good attitude is age-determinant. The proportion of the physicians who disliked the use of telemedicine is slightly increased for older physicians with age greater than 50 years. The per cent of opponent is heavily increased with older physicians greater than 60 years. Such result is comparable to the findings of the study by Terschuren et al., 2012 where showed that the most of the resistance of telemedicine is mostly appeared with older physicians. On the other hand, the findings are contradicted by a Saudi study by El-Mahalli et al. (2012) which found that older physicians have strong intension to use telemedicine and the reason is probably because their experience which gave them more insights about the improving the efficiency and quality of healthcare using new technological tools. The findings also showed that physicians' willingness to the use of telemedicine was differed when investigating physicians' technology affinity. Physicians with low and intermediate levels of technology affinity were more enthusiastic and eager to use to telemedicine than the physicians with high level of technology affinity. The study suggested that the reason of those findings is that physicians with high level of technology affinity might be more resistant to telemedicine technology because of their knowledge of technical problems that may occur as a result of the use of these services. In contrast to physicians' age and technology affinity, the gender, medical specialty and years of practicing did not affect the willingness and preferences of telemedicine in study's sample.

The current study also showed that telemedicine was preferred in certain healthcare settings such as second opinion, acute and nonemergency cases. On the other hand, physicians did not prefer telemedicine in healthcare settings that are related to emergency, preventive care and post-surgical follow-up cases. In addition, the study showed that most of the physicians preferred face-to-face consultations for cases related to physical examination. This result is similar to the findings noted by Whitten and Love (2005) which reported face-to-face consultation as an ideal type of medical encounter. Older physicians have been found to dislike telemedicine in emergency cases and home healthcare. Moreover, there was some relationship between physicians' awareness and their preferences of telemedicine. Most of the physicians who did not prefer the use of telemedicine in preventive care, second opinion and education were not aware about telemedicine as others.

FUTURE DIRECTIONS AND WAY FORWARD

In conclusion, telemedicine technology could have bright and promising future in Saudi Arabia when it gets more attention and consideration from decision makers. Telemedicine provide users with promising solutions that could maintain the healthcare in the area-wide of the Kingdom especially with the shortage of medical experts. In the current study, it has been found that physicians' acceptance, preferences and wiliness to use telemedicine technology are influenced by physicians' characteristics such as age and technology affinity. Physicians' knowledge and awareness about telemedicine is also found to be key determinants of physicians' preferences and intention to the use of telemedicine technology. The current study reported a variation of physicians' preferences. This difference in physicians' perspectives occurred mainly because of the diversity of telemedicine models and different services provided by telemedicine technology. For this reason, additional studies should be conduct focusing on physicians' attitude towards each model and service of telemedicine and to explore new avenues of interaction

through social media and mhealth, especially in the developing world. (Paton, Househ & Malik, 2013; Aldabbagh, Alsharif & Househ, 2013; Kushniruk et al., 2013; Ababtain, Almulhim & Househ, 2013; Househ, 2013; Borycki et al., 2011; Almutairi et al., 2011; Househ et al., 2012a; Househ et al., 2012b; Househ, Borycki & Kushniruk, 2012; Househ, 2014)

The main recommendations that can shape the way forward includes basically identifying and overcoming the challenges facing the processes of developing, implementing, utilizing the evaluating telemedicine. It is important as much to provide the proper support, promotion and enhancement of telemedicine in Saudi Arabia. Each of these challenges needs to be studied thoroughly and each needs a plan to overcome. Challenges facing telemedicine and many other types of health informatics applications could be classified into human, professional, technical, organizational, financial and legal or regulatory challenges (Khalifa, 2013). Telemedicine development and implementation might remain in the pilot phase and may not succeed in scaling-up to robust products that are used in daily practice. Some studies identified and classified determinants, which would influence the future implementations of telemedicine interventions, into five major categories: (1) Technology, (2) Acceptance, (3) Financing, (4) Organization and (5) Policy and Legislation. Each category contains determinants that are relevant to different stakeholders in different domains. Accordingly, technology challenges need building good technical infrastructure and continuous support, users' training, enhancing systems usability and quality from the patient perspective, while acceptance challenges need improving attitude and usability, from the physicians and other providers' perspectives, being evidence based and the effect of diffusion and dissemination, the financial challenges needs proper planning of the investment for both initiating projects and maintaining their operations. Organizational challenges need developing managerial awareness and commitments towards such projects while the upper most level of challenges, the policy and legislation need direct intervention of the state, ministry of health and national policy makers. (Broens et al., 2007; Wootton, 2008; van Gemert-Pijnen et al., 2011; Mair et al., 2012; Hendy et al., 2012)

REFERENCES

- Ababtain, A. F., Almulhim, D. A., & Househ, M. S. (2013). The state of mobile health in the developing world and the Middle East. *Studies in Health Technology and Informatics*, 190, 300–302. PMID:23823455
- Adler, A. T. (2000). A cost-effective portable telemedicine kit for use in Developing countries (Doctoral dissertation, Massachusetts Institute of Technology).
- Alajlani, M. (2010). Issues facing the application of telemedicine in developing countries: Hashemite Kingdom of Jordan and Syrian Arab Republic (Doctoral dissertation, Brunel University, School of Information Systems, Computing and Mathematics).
- Aldabbagh, D., Alsharif, K., & Househ, M. S. (2013). Health information in the Arab world. *Studies in Health Technology and Informatics*, 190, 297–299. PMID:23823454
- Alyemeni, M. (2010). *Five Year Program to Transform Healthcare Delivery in Saudi Arabia*. Saudi Arabia Ministry of Health.
- American Telemedicine Association. (2013). *What is telemedicine*. Retrieved from <http://www.americantelemed.org/about-telemedicine/what-is-telemedicine>

The Role and Use of Telemedicine by Physicians in Developing Countries

Bashshur, R. L. (2002). Chapter 1: Telemedicine and health care. *Telemedicine Journal and e-Health*, 8(1), 5–12. doi:10.1089/15305620252933365 PMID:12020402

Borycki, E. M., Househ, M. S., Kushniruk, A. W., Nohr, C., & Takeda, H. (2011). Empowering Patients: Making Health Information and Systems Safer for Patients and the Public. Contribution of the IMIA Health Informatics for Patient Safety Working Group. *Yearbook of Medical Informatics*, 7(1), 56–64. PMID:22890342

Broens, T. H., Vollenbroek-Hutten, M. M., Hermens, H. J., van Halteren, A. T., & Nieuwenhuis, L. J. (2007). Determinants of successful telemedicine implementations: A literature study. *Journal of Telemedicine and Telecare*, 13(6), 303–309. doi:10.1258/135763307781644951 PMID:17785027

Chau, P. Y., & Hu, P. J. H. (2002). Investigating healthcare professionals' decisions to accept telemedicine technology: An empirical test of competing theories. *Information & Management*, 39(4), 297–311. doi:10.1016/S0378-7206(01)00098-2

Cox, J. V., & Towle, E. L. (2012). Business and Science: Lessons From the 2011 Cancer Center Business Summit. *Journal of Oncology Practice*, 8(2), 67–68. doi:10.1200/JOP.2012.000584 PMID:23077430

Currell, R., Urquhart, C., Wainwright, P., & Lewis, R. (2000). Telemedicine versus face to face patient care: Effects on professional practice and health care outcomes. *The Cochrane Library*. PMID:10796678

Devaraj, S. J., & Ezra, K. (2011, April). Current trends and future challenges in wireless telemedicine system. In *Electronics Computer Technology (ICECT), 2011 3rd International Conference on* (Vol. 4, pp. 417-421). IEEE. doi:10.1109/ICECTECH.2011.5941933

Eikelboom, R. H., & Atlas, M. D. (2005). Attitude to telemedicine, and willingness to use it, in audiology patients. *Journal of Telemedicine and Telecare*, 11(8suppl 2), 22–25. doi:10.1258/135763305775124920 PMID:16375788

Ekeland, A. G., Bowes, A., & Flottorp, S. (2010). Effectiveness of telemedicine: A systematic review of reviews. *International Journal of Medical Informatics*, 79(11), 736–771. doi:10.1016/j.ijmedinf.2010.08.006 PMID:20884286

El-Mahalli, A. A., El-Khafif, S. H. & Al-Qahtani, M. F. (2012). Successes and Challenges in the Implementation and Application of Telemedicine in the Eastern Province of Saudi Arabia. *Perspectives in health information management/AHIMA*, American Health Information Management Association, 9(Fall).

Esmailzadeh, P., Sambasivan, M., Kumar, N., & Nezakhati, H. (2011). Adoption of technology applications in healthcare: the influence of attitude toward knowledge sharing on technology acceptance in a hospital. In *U-and E-Service, Science and Technology* (pp. 17-30). Springer Berlin Heidelberg. doi:10.1007/978-3-642-27210-3_3

FBA, A. W., Liddell, K., FBA, S. M., Rose, N., Smith, P. C., FRS, J. S. & Wootton, R. (2010). Medical profiling and online medicine: The ethics of 'personalised healthcare' in a consumer age (Doctoral dissertation, London School of Economics and Political Science).

Gaggioli, A., di Carlo, S., Mantovani, F., Castelnuovo, G., & Riva, G. (2004). A telemedicine survey among Milan doctors. *Journal of Telemedicine and Telecare*, 11(1), 29–34. doi:10.1258/1357633053430476 PMID:15829041

- Goldberg, M. A., Sharif, H. S., Rosenthal, D. I., Black-Schaffer, S., Flotte, T. J., Colvin, R. B., & Thrall, J. H. (1994). Making global telemedicine practical and affordable: Demonstrations from the Middle East. *AJR. American Journal of Roentgenology*, *163*(6), 1495–1500. doi:10.2214/ajr.163.6.7992754 PMID:7992754
- Hanson, D., Calhoun, J., & Smith, D. (2009). Changes in provider attitudes toward telemedicine. *Telemedicine Journal and e-Health*, *15*(1), 39–43. doi:10.1089/tmj.2008.0052 PMID:19199846
- Hendy, J., Chrysanthaki, T., Barlow, J., Knapp, M., Rogers, A., Sanders, C., & Newman, S. (2012). An organisational analysis of the implementation of telecare and telehealth: The whole systems demonstrator. *BMC Health Services Research*, *12*(1), 403. doi:10.1186/1472-6963-12-403 PMID:23153014
- Horsch, A., & Balbach, T. (1999). Telemedical information systems. *Information Technology in Biomedicine. IEEE Transactions on*, *3*(3), 166–175.
- Househ, M. (2013). The use of social media in healthcare: Organizational, clinical, and patient perspectives. *Studies in Health Technology and Informatics*, *183*, 244–248. PMID:23388291
- Househ, M. (2014). The role of short messaging service in supporting the delivery of healthcare: An umbrella systematic review. *Health Informatics Journal*. PMID:25038203
- Househ, M., Ahmad, A., Alshaikh, A., & Alsuweed, F. (2012a). Patient safety perspectives: The impact of CPOE on nursing workflow. *Studies in Health Technology and Informatics*, *183*, 367–371. PMID:23388315
- Househ, M., Borycki, E., & Kushniruk, A. (2014). Empowering patients through social media: The benefits and challenges. *Health Informatics Journal*, *20*(1), 50–58. doi:10.1177/1460458213476969 PMID:24550564
- Househ, M., Borycki, E., Kushniruk, A. W., & Alofaysan, S. (2012b). mHealth: a passing fad or here to stay. *Telemedicine and E-Health Services, Policies and Applications: Advancements and Developments*, 151-173.
- Jung, S. G., Kweon, H. J., Kim, E. T., Kim, S. A., Choi, J. K. & Cho, D. Y. (2012). Preference and awareness of telemedicine in primary care patients. *Korean Journal of Family Medicine*, *33*(1), 25-33.
- Khalifa, M. (2013). Barriers to health information systems and electronic medical records implementation. A field study of Saudi Arabian hospitals. *Procedia Computer Science*, *21*, 335–342. doi:10.1016/j.procs.2013.09.044
- Khalifehsoltani, S. N., & Gerami, M. R. (2010, January). E-health challenges, opportunities and experiences of developing countries. In *e-Education, e-Business, e-Management, and e-Learning, 2010. IC4E'10. International Conference on* (pp. 264-268). IEEE.
- Kim, J., DelliFraine, J. L., Dansky, K. H., & McCleary, K. J. (2010). Physicians' acceptance of telemedicine technology: An empirical test of competing theories. *International Journal of Information Systems and Change Management*, *4*(3), 210–225. doi:10.1504/IJISCM.2010.033076
- Kim, Y. J., Chun, J. U., & Song, J. (2009). Investigating the role of attitude in technology acceptance from an attitude strength perspective. *International Journal of Information Management*, *29*(1), 67–77. doi:10.1016/j.ijinfomgt.2008.01.011

The Role and Use of Telemedicine by Physicians in Developing Countries

- Koch, S. (2006). Home telehealth—current state and future trends. *International Journal of Medical Informatics*, 75(8), 565–576. doi:10.1016/j.ijmedinf.2005.09.002 PMID:16298545
- Kushniruk, A. W., Bates, D. W., Bainbridge, M., Househ, M. S., & Borycki, E. M. (2013). National efforts to improve health information system safety in Canada, the United States of America and England. *International Journal of Medical Informatics*, 82(5), e149–e160. doi:10.1016/j.ijmedinf.2012.12.006 PMID:23313431
- Mair, F. S., May, C., O'Donnell, C., Finch, T., Sullivan, F., & Murray, E. (2012). Factors that promote or inhibit the implementation of e-health systems: An explanatory systematic review. *Bulletin of the World Health Organization*, 90(5), 357–364. doi:10.2471/BLT.11.099424 PMID:22589569
- Meher, S. K., Tyagi, R. S., & Chaudhry, T. (2009). Awareness and attitudes to telemedicine among doctors and patients in India. *Journal of Telemedicine and Telecare*, 15(3), 139–141. doi:10.1258/jtt.2009.003011 PMID:19364898
- Paton, C., Househ, M., & Malik, M. (2013). The challenges of publishing on health informatics in developing countries. *Applied Clinical Informatics*, 4(3), 428–433. doi:10.4338/ACI-2013-04-IE-0030 PMID:24155794
- Ramos, V. (2010, November). Contributions to the history of Telemedicine of the TICs. In Telecommunications Conference (HISTELCON), 2010 Second IEEE Region 8 Conference on the History of (pp. 1-5). IEEE. doi:10.1109/HISTELCON.2010.5735269
- Straub, E. T. (2009). Understanding technology adoption: Theory and future directions for informal learning. *Review of Educational Research*, 79(2), 625–649. doi:10.3102/0034654308325896
- Terschüren, C., Mensing, M., & Mekel, O. C. (2012). Is telemonitoring an option against shortage of physicians in rural regions? Attitude towards telemedical devices in the North Rhine-Westphalian health survey, Germany. *BMC Health Services Research*, 12(1), 95. doi:10.1186/1472-6963-12-95 PMID:22507694
- van Gemert-Pijnen, J. E., Nijland, N., van Limburg, M., Ossebaard, H. C., Kelders, S. M., Eysenbach, G., & Seydel, E. R. (2011). A holistic framework to improve the uptake and impact of eHealth technologies. *Journal of Medical Internet Research*, 13(4), e111. doi:10.2196/jmir.1672 PMID:22155738
- Wade, V. A., Karnon, J., Elshaug, A. G., & Hiller, J. E. (2010). A systematic review of economic analyses of telehealth services using real time video communication. *BMC Health Services Research*, 10(1), 233. doi:10.1186/1472-6963-10-233 PMID:20696073
- Weiss, S. (2008). The need for a paradigm shift in addressing privacy risks in social networking applications. In *The future of identity in the information society* (pp. 161-171). Springer US. doi:10.1007/978-0-387-79026-8_12
- Whitten, P., & Love, B. (2005). Patient and provider satisfaction with the use of telemedicine: Overview and rationale for cautious enthusiasm. *Journal of Postgraduate Medicine*, 51(4), 294. PMID:16388172
- Wootton, R. (2008). Telemedicine support for the developing world. *Journal of Telemedicine and Telecare*, 14(3), 109–114. doi:10.1258/jtt.2008.003001 PMID:18430271
- Xue, Y. & Liang, H. (2007). Analysis of telemedicine diffusion: the case of China. *IEEE transactions on information technology in biomedicine. IEEE Engineering in Medicine and Biology Society*, 11(2), 231-233.

KEY TERMS AND DEFINITIONS

Developing Countries: Are countries with an underdeveloped industrial base, and low Human Development Index (HDI) relative to other countries.

Healthcare: Is the diagnosis, treatment, and prevention of disease, illness, injury, and other physical and mental impairments in human beings.

Information Exchange: Is the bidirectional information transmission/information transfer in telecommunications and computer science.

Information Technology (IT): Is the application of computers and telecommunications equipment to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise.

Technology Affinity: Is the natural attraction towards and liking of technology, including high acceptance and preference of using technology.

Telemedicine: Is the use of telecommunication and information technologies in order to provide clinical health care at a distance.

User Acceptance: Is the level of accepting or resisting new technologies or changes by users, measured through meeting their requirements and needs.