

Successes and Challenges in the Implementation and Application of Telemedicine in the Eastern Province of Saudi Arabia

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Abstract

Telemedicine is the practice of healthcare using audio, video, and data communications. The aim of this study was to determine the perceptions of health professionals at hospitals adopting and not adopting telemedicine on its benefits and challenges, and their willingness to use it. The study was conducted at one hospital not adopting telemedicine and three hospitals adopting telemedicine. It was a cross-sectional descriptive study, and the target population was health professionals. Data collection methods included two paper-based questionnaires. Nonparametric statistical analysis and descriptive statistics were used. The study concluded that although telemedicine is promising and the Ministry of Health in Saudi Arabia has allocated a huge budget for e-health, the telemedicine modalities used were very limited. The percentage of adoption of telemedicine by health professionals was low in comparison to the high interest of nonadopters. Nonadopters' perception of benefits was higher than that of adopters. The most frequently cited benefits among adopters were improving the quality of care, enhancing access to healthcare, and providing patient care and management. However, adopters' perceptions were low for other benefits such as easy use of the network, the use of store-and-forward telemedicine, and the ability to follow up after face-to-face contacts. The greatest barrier as perceived by health providers was the lack of knowledge about telemedicine. Dissemination of information about telemedicine and proper training of health professionals on its use are recommended.

Keywords: telemedicine; perception; health providers; Saudi Arabia

Introduction

Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve patients' health status.¹ The World Health Organization (WHO) defines telemedicine as "the delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing health of individuals and their communities."² The Institute of Medicine defines telemedicine as "the use of electronic information and communications technologies to provide and support health care when distance separates the participants."³

Telemedicine applications vary greatly and can be divided into three major categories. The first is patient monitoring or home care that enables medical professionals to monitor patients remotely using various technological devices, such as blood pressure monitors. It is primarily used for managing chronic diseases such as heart disease, diabetes mellitus, and asthma. The second category consists of interactive or real-time applications that use technology for online interaction between participants. These include teleconsultation, videoconferencing, telesurgery, and similar applications. The third category includes store-and-forward applications that use noninteractive technology. This category involves acquiring medical data (such as medical images, biosignals, lab results, etc.) and then transmitting this data to a doctor or medical specialist at a suitable time for assessment, as in teleradiology and telepathology.⁴⁻⁶

According to the Yale Telemedicine Center in a 1995 report, “Well-developed telemedicine programs have been around [in the United States] since the 1960’s, but telemedicine became a hot new concept only very recently when it was evident that health care reform was underway. There were 10 telemedicine programs in 1992, 20 in 1993, and it has been reported that in 1995–96 most US hospitals plan to implement some form of telemedicine program for clinical and/or administrative purposes. In the Yale Telemedicine Center there are a number of current and pending telemedicine projects at the School of Medicine: the Saudi-US Universities Project (SUSUP), the NASA Spacebridge Project, and other projects connecting Yale to other hospitals in Connecticut and nationwide.”⁷

A website promoting telemedicine in India states that “providing health care services via telemedicine offers many advantages. It can make specialty care more accessible to underserved rural and urban populations. Video consultations from a rural clinic to a specialist can [alleviate] prohibitive travel and associated costs for patients. Video conferencing also opens up new possibilities for continuing education or training for isolated or rural health practitioners, who may not be able to leave a rural practice to take part in professional meetings or educational opportunities.”⁸ Teleradiology and telepathology allow medical services to be delivered across vast distances and across national and international boundaries.⁹ In addition, telemedicine improves access to information and services, provides care not previously deliverable, improves quality control in screening programs, and reduces healthcare costs.¹⁰

According to one review, “although telemedicine clearly has a wide range of potential benefits, it has also some disadvantages. The main ones that can be envisaged are: a breakdown in the relationship between health professional and patient; a breakdown in the relationship between health professionals; issues concerning the quality of health information; and organizational and bureaucratic difficulties. On balance, the benefits of telemedicine are substantial, assuming that more research will reduce or eliminate the obvious drawbacks.”¹¹

On the other hand, there are several barriers to the practice of telemedicine. These barriers “were grouped in four areas: technological, organizational, human and economic. The main barriers identified were changes in the healthcare model caused by telemedicine, problems with strategic alignment, resistance to change in the (re)definition of roles, responsibilities and new skills, and lack of a business model that incorporates telemedicine in the services portfolio to ensure its sustainability.”¹² Other barriers include licensing and costs for technology.¹³

In a vast country like Saudi Arabia, access to healthcare services in remote and rural areas is of prime importance. Also, the Ministry of Health in Saudi Arabia faces the difficult challenge of providing high-quality care to the entire population and improving access to healthcare services. A national strategic plan therefore stressed the importance of adopting a national telemedicine network.¹⁴

The e-Health Center in the King Faisal Specialist Hospital & Research Centre (KFSH&RC) in Riyadh was established in 1993 by a royal decree. The hospital is considered the highest tertiary care institution in the Middle East, and the e-Health Center takes responsibility for helping it accomplish its mission of providing high-quality care for every citizen in Saudi Arabia. The center utilizes fiberoptics and international videoconferencing via Saudi Telecommunication Company (STC) with a view to facilitating access to medical consultations and disseminating healthcare educational activities. Moreover, the National Telemedicine Network has increased from 5 to 22 centers, and 5 more are under study or in the process of implementation.¹⁵⁻¹⁷

Gap in Knowledge

To the researchers' knowledge, no studies have been conducted in Saudi Arabia assessing the health professionals' perceptions regarding the benefits and challenges of telemedicine. Also, no studies have been carried out to assess health professionals' willingness to use telemedicine.

Objectives

The project had the following objectives:

1. Determine the willingness of healthcare professionals in four facilities (three hospitals adopting telemedicine and one hospital not adopting telemedicine) in the Eastern Province of Saudi Arabia to use telemedicine technologies.
2. Determine the perceptions of healthcare professionals about the benefits and challenges of telemedicine usage in different healthcare facilities (three hospitals adopting telemedicine and one hospital not adopting telemedicine) in the Eastern Province of Saudi Arabia.

Methods

Study Setting

The study was conducted at the following settings:

- King Fahd Hospital of the University (KFHU) in Al-Khobar, Eastern Province, Saudi Arabia, which represented a health facility not adopting telemedicine.
- Dammam Central Hospital (DCH), a health facility adopting telemedicine, in Dammam, Eastern Province, Saudi Arabia, and connected with KFSH&RC in Riyadh.
- Qatif Central Hospital (QCH) in Qatif, which is adopting telemedicine and is connected with KFSH&RC in Riyadh.
- Arabian American Oil Company (ARAMCO) hospital in Dhran, which is adopting teleradiology.

Study Design

The study is a cross-sectional descriptive study.

Target Population and Sample Size

Healthcare professionals (physicians, nurses, radiologists, pathologists, technicians, etc.) at different study settings were included in the study. They were classified as adopters and nonadopters as follows:

- **Nonadopters:** This category includes professionals at KFHU in Al-Khobar. Participants totaled 252 for a response rate of 56 percent (the questionnaire was distributed to 450 healthcare professionals).
- **Adopters:** This category included professionals at three hospitals: DCH, QCH, and ARAMCO. Participants totaled 144 for an overall response rate of 57.6 percent (the questionnaire was distributed to 250 healthcare professionals). Adopters included the following:
 - DCH: Participants totaled 70 for a response rate of 70 percent (the questionnaire was distributed to 100 healthcare professionals).
 - QCH: Participants totaled 54 for a response rate of 54 percent (the questionnaire was distributed to 100 healthcare professionals).

- ARAMCO: Participants totaled 20 for a response rate of 40 percent (the questionnaire was distributed to 50 healthcare professionals).

Data Collection Technique and Tools

Researchers intended to use two web-based questionnaires. However, great difficulty was encountered in collecting the e-mail addresses of the health professionals. Accordingly, two paper-based questionnaires were designed, distributed to the healthcare professionals, and collected after four weeks (May 2011). The first questionnaire was designed specifically for KFHU (the hospital not adopting telemedicine). The survey collected data regarding demographic and professional characteristics of the healthcare providers, their perceptions on the benefits and challenges of telemedicine, and their willingness to use telemedicine technology. (See Appendix A). The second questionnaire was designed for the hospitals adopting telemedicine (DCH, QCH, and ARAMCO). This survey also collected data regarding demographic and professional characteristics of healthcare providers, their perceptions on the benefits and challenges of telemedicine, and their willingness to adopt telemedicine. (See Appendix B).

A Likert scale was used on both questionnaires to determine the benefits of adopting telemedicine as perceived by health professionals. It ranged from 1 (strongly disagree) to 4 (strongly agree).

Ethical Consideration

An approval from the committee of research ethics of Damman University was obtained and submitted to all study settings.

Data Analysis

Nonparametric statistical analysis was performed using SPSS version 19. Descriptive statistics were used in the form of frequencies and percentage for categorical variables and mean and standard deviation for continuous variables. The chi-square test was performed to measure the association between some of the variables under study. The Kruskal-Wallis test was conducted to assess any significant statistical differences among the perceptions of more than two groups. Statistical significance between variables of $p \leq .05$ was used.

Inclusion Criteria

Healthcare professionals willing to participate in the study and working in the study settings were included in the study. In hospitals adopting telemedicine, only those healthcare providers adopting telemedicine were included.

Exclusion Criteria

In hospitals adopting telemedicine, healthcare providers not adopting telemedicine were excluded from the study.

Results

Table 1 shows that majority of participants at KFHU and at hospitals adopting telemedicine were male (57 percent and 67 percent respectively), with mean age of 37 ± 11 years and 40 ± 9 years respectively, and were of Saudi nationality (52 percent each). Most commonly, they had less than 10 years of experience (49 percent and 42 percent respectively). Regarding the profession of nonadopters, general physicians represented 26 percent. Other professions, including graduates in applied medical sciences, nurses, lab technicians, and medical students/interns, represented 30 percent. For adopters, general physicians accounted for 15 percent, and other professions represented 27 percent.

Table 2 shows that there was no statistically significant association between the extent of KFHU respondents' interest in knowing about telemedicine and any of the demographic variables. The majority of respondents (88.5 percent), regardless of demographic characteristics, showed an interest in knowing about telemedicine.

Table 3 indicates that there was no statistically significant association between the extent of KFHU respondents' interest in implementing telemedicine and any of the demographic variables. The majority of respondents (79 percent), regardless of demographic characteristics, showed interest in implementing telemedicine at KFHU.

Table 4 demonstrates that 33.3 percent of health professionals at hospitals adopting telemedicine were actually implementing telemedicine and that there were statistically significant associations between actual implementation or usage of telemedicine at these hospitals with profession ($p = .000$) and years of experience ($p = .009$). The greatest implementation rates were among consultants (56 percent) and those with more than 20 years of experience (48 percent).

Table 5 shows statistically significant associations between attendance at teleconferences with facility ($p = .000$), age ($p = .008$), profession ($p = .010$), and years of experience ($p = .005$). Among participants at hospitals adopting telemedicine, the greatest rates of teleconference attendance were as follows: 85 percent of participants who worked at ARAMCO, 82.4 percent of participants older than age 50, 87.5 percent of participants who were consultants, and 83.9 percent of participants who had more than 20 years of experience attended teleconferences.

Table 6 shows that healthcare providers at hospitals not adopting telemedicine perceived that adopting telemedicine was beneficial (mean score of 3.30 or higher for all benefits). Table 7 shows that participants at hospitals adopting telemedicine had a mean score of more than 3 for all benefits of telemedicine except easy use of network (2.8), store-and-forward telemedicine (2.97), and follow-up after face-to-face contacts (2.96).

Table 8 shows that the barrier most commonly perceived by healthcare providers at hospitals not adopting telemedicine was lack of knowledge about the meaning of telemedicine and its applications, types, and benefits (71 percent), followed by lack of time to adopt telemedicine (39.7 percent) and then lack of importance of telemedicine (21 percent).

Table 9 demonstrates that barriers experienced by healthcare professionals at hospitals adopting telemedicine were lack of sufficient knowledge about other services/benefits of telemedicine (49 percent), followed by difficulty in the application of telemedicine (29 percent) and then lack of time to adopt telemedicine (22 percent).

Discussion

Willingness of Healthcare Professionals to Use Telemedicine Technologies

"Telemedicine is the practice of medicine at a distance... where patient and healthcare worker are in different places, and where the interaction may concern diagnosis, treatment/management, or education. Telemedicine deserves consideration because of the real needs of developing countries for healthcare access."¹⁸ Although telemedicine has existed in Saudi Arabia since 1993,¹⁹ no studies have been carried out to determine healthcare providers' perceptions of the benefits and challenges of telemedicine or their willingness to use it. "Feedback from service users [provides] insight into opportunities for improvement so that performance can be optimised."²⁰

Results of the present study revealed that the majority of healthcare professionals in KFHU were interested in knowing about telemedicine (88.5 percent, Table 2) and in implementing telemedicine technology (79 percent, Table 3) regardless of their demographic parameters. This was consistent with the results of Chismar and Wiley-Patton, which showed the importance of the perception of usefulness by physicians for their adoption and use of information technologies, particularly for clinical tasks.²¹ The findings were also consistent with the results of another study, conducted in Lagos, Nigeria, in which 78.1 percent of health workers indicated their willingness to adopt telemedicine in healthcare delivery if available and when given appropriate training on its usage.²²

In hospitals adopting telemedicine, it was found that only 33.3 percent of health professionals were actually implementing telemedicine (Table 4). In comparison, in Western Australia, 73 percent of survey respondents in healthcare facilities were using telemedicine.²³ Men had a higher rate of telemedicine adoption than women (37 percent and 26 percent respectively, Table 4). In Milan, Italy, 80 percent of

men were telemedicine adopters,²⁴ and in Hong Kong, “male physicians seemed to exhibit a slightly higher level of intention to use telemedicine technology than their female counterparts.”²⁵

Also, there were significant differences in actual implementation of telemedicine by profession ($p = .000$) and years of experience ($p = .009$; see Table 4). Consultants (56 percent) and those with more than 20 years of experience (48 percent) represented the highest frequency of actual implementation of telemedicine (Table 4). This might suggest that the older the healthcare provider, the stronger his or her intention to use telemedicine, perhaps because experience gives providers more insights about the need for new technological tools to improve the quality of care. This result contradicted the results of the survey of doctors in Milan, where physicians with higher seniority considered telemedicine to be of limited interest and were not convinced that it could improve clinical practice.²⁶

With the help of telemedicine, “doctors in rural areas of the world can observe state-of-the-art medical procedures that they would otherwise have had to travel thousands of miles to witness.”²⁷ Results of the present study clarified that there were statistically significant associations between attendance at teleconferences with facility ($p = .000$), age ($p = .008$), profession ($p = .010$), and years of experience ($p = .005$; see Table 5). Participants from ARAMCO, those older than 50 years, those working as consultants, and those with more than 20 years of experience showed the highest frequency of teleconference attendance (Table 5).

Perception of Healthcare Professionals about the Benefits and Challenges of Telemedicine

One study examining the benefits of telemedicine notes: “Now that worldwide satellite communication is available...telemedicine can be used in many different ways such as improving healthcare access, supporting health workers in isolated settings or addressing the shortage of specialist doctors.”²⁸ In our study, perceptions of participants at the hospital not adopting telemedicine on the benefits of telemedicine were higher for all benefits (mean score 3.30 or higher, Table 6) than the perceptions of participants at hospitals adopting telemedicine (Table 7). This could be attributed to the fact that expectations are high before the actual implementation of telemedicine, while after implementation, in which participants may have experienced difficulties, lack of proper training, or other hurdles, the situation may be different. Participants not adopting telemedicine viewed telemedicine as beneficial in terms of improving quality of care, enhancing access to healthcare services, providing patient care and management, and saving both time and money (Table 6). By comparison, in a new teaching hospital in Lagos, Nigeria, the “majority of respondents believed that [telemedicine] would enhance access to health care services (23.4%), improve quality of care (14.1%), and reduce health care expenditures (6%).”²⁹

Similarly, participants adopting telemedicine perceived the benefits of telemedicine as improving quality of care, enhancing access to healthcare, and saving time and money (Table 7). The study of Milan doctors indicated that the majority of doctors expressed moderate agreement that telemedicine enhanced quality of care,³⁰ while the main benefits noted by the respondents in that survey and a Canadian one were immediate response, easy accessibility, and time and money savings.^{31, 32}

The participants at hospitals adopting telemedicine perceived the least benefits as relating to easy use of the network, store-and-forward telemedicine, and follow-up after face-to-face contact (Table 7). This finding may be related to the fact that the telemedicine network was recently implemented in the Eastern Province, technical issues may be experienced while implementing store-and-forward telemedicine, training of users may not be sufficient, or patients might not show up for telemedicine follow-up as they do with face-to-face contact. The study of Milan doctors found that 9 percent of participants reported a lack of face-to-face contact between doctor and patient.³³

Participants at hospitals not adopting telemedicine perceived the lack of knowledge about the meaning of telemedicine and its applications, types, benefits, and so forth (71 percent), the lack of time to adopt telemedicine (39.7 percent), and the lack of importance of telemedicine (21 percent; see Table 8) as barriers to the use of telemedicine. Moreover, the main barrier facing participants at hospitals adopting telemedicine was lack of knowledge about the services and benefits of telemedicine (49 percent; see Table 9). This may be due to the lack of wide dissemination of information about telemedicine through

workshops, seminars, symposia, conferences, and so forth. Financial barriers and/or a lack of infrastructure was perceived as a barrier by participants at hospitals not adopting telemedicine (13.9 percent; Table 8). However, the Ministry of Health in Saudi Arabia allocated a total of 4 billion in Saudi riyal toward e-health programs in the period from 2008 to 2011.³⁴ Health professionals' resistance was also mentioned as a barrier by nonadopters (1.6 percent; Table 8). Literature has shown that the perceived usefulness of technology is the factor that contributes the most to physicians' intention to use or not to use telemedicine technology in their hospitals.³⁵

Other barriers for adopters were difficulty in the application of telemedicine, followed by lack of time to use or adopt telemedicine (29 percent and 22 percent respectively; Table 9). These findings contradicted those of other studies, which reported that budget and infrastructure were the two main factors inhibiting the adoption of telemedicine.^{36, 37} However, difficulty in the application of telemedicine goes hand in hand with the findings of Rogrove et al., who found that sophistication of the technology was the main barrier to the use of telemedicine.³⁸

Conclusion and Recommendations

Although telemedicine is a promising technology and the Ministry of Health in Saudi Arabia has allocated a large budget for e-health, telemedicine modalities used in the Eastern Province were very limited. The percentage of adoption of already existing telemedicine technologies by health professionals was low. However, the majority of respondents at KFHU, the hospital in the study that had not adopted telemedicine, were interested in learning about and implementing telemedicine. There were statistically significant associations between actual implementation of telemedicine at hospitals adopting telemedicine with profession and years of experience. The perception of participants not adopting telemedicine on its benefits was higher than that of those who had adopted telemedicine. The most frequently cited benefits among adopters were improving quality of care, enhancing access to healthcare, and providing patient care and management. However, the lowest-ranked benefits as mentioned by adopters were easy use of the network, the use of store-and-forward telemedicine, and follow-up after face-to-face contact. The greatest barrier as perceived by healthcare providers not adopting telemedicine was a lack of knowledge about the meaning of telemedicine and its applications, types, and benefits. For participants adopting telemedicine, the most frequently cited barriers were lack of sufficient knowledge about other services and benefits of telemedicine, followed by difficulty in the application of telemedicine and then lack of time to adopt telemedicine. Accordingly, the following are recommended:

1. Better dissemination of information about the state of the art of research and development in telemedicine via national programs to educate and train healthcare professionals. Increasing awareness could be achieved through seminars, workshops, symposia, conferences, and so forth.
2. Proper training of healthcare providers on telemedicine to improve their skills.
3. A decrease in other nonclinical activities required by health professionals adopting telemedicine to allow them to devote more of their time to adopting the various modalities of telemedicine.
4. Better utilization of the already existing telemedicine network and an increase in the number of telemedicine centers.

These recommendations will help to ensure that the benefits of existing and future investments in telemedicine technologies are fully realized.

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Table 1

Profile of Healthcare Providers at Hospitals Adopting and Not Adopting Telemedicine

Characteristics of Healthcare Providers	Not Adopting Telemedicine (n = 252)		Adopting Telemedicine (n = 144)	
	Number	%	Number	%
Gender				
Male	143	57	97	67
Female	109	43	47	33
Age in years	Mean ± SD = 37 ± 11		Mean ± SD = 40 ± 9	
<30	86	34	28	19
30–50	135	54	99	69
>50	31	12	17	12
Nationality				
Saudi	132	52	75	52
Non-Saudi	120	48	69	48
Profession				
General physician	65	26	21	15
Specialist	60	24	36	25
Consultant	51	20	48	33
Other ^a	76	30	39	27
Years of experience				
<10	124	49	61	42
10–20	95	38	52	36
>20	33	13	31	22

^a Graduates in applied medical sciences, nurses, lab technicians, and medical students/interns.

Table 2

Distribution of Healthcare Providers Not Adopting Telemedicine According to Their Interest in Knowing about Telemedicine

Characteristics of Healthcare Providers	Interest in Knowing about Telemedicine (n = 252)					
	Yes (n = 223)		No (n = 29)		Chi-square	p-value
	Number	%	Number	%		
Age in years						
<30	78	91	8	9	.626	.731
30 to 50	118	87	17	13		
>50	27	87	4	13		
Gender						
Male	130	91	13	9	1.897	.168
Female	93	85	16	15		
Nationality						
Saudi	116	88	16	12	.102	.749
Non-Saudi	107	89	13	11		
Profession						
General physician	60	92	5	8	6.156	.104
Specialist	48	80	12	20		
Consultant	45	88	6	12		
Other ^a	70	92	6	8		
Years of experience						
<10 years	111	90	13	11	.258	.879
10–20 years	83	87	12	13		
>20 years	29	88	4	12		

^a Graduates in applied medical sciences, nurses, lab technicians, and medical students/interns.

Table 3

Distribution of Healthcare Providers Not Adopting Telemedicine According to Their Interest in Implementing Telemedicine

Characteristics of Healthcare Providers	Interest in Implementing Telemedicine (<i>n</i> = 252)				Chi-square	<i>p</i> -value
	Yes (<i>n</i> = 199)		No (<i>n</i> = 53)			
	Number	%	Number	%		
Age in years						
<30	66	77	20	23	.712	.701
30 to 50	107	79	28	21		
>50	26	84	5	16		
Gender						
Male	111	78	32	22	.361	.548
Female	88	81	21	19		
Nationality						
Saudi	102	77	30	23	.480	.489
Non-Saudi	97	81	23	19		
Profession						
General physician	50	77	15	23	2.076	.557
Specialist	46	77	14	23		
Consultant	44	86	7	14		
Other ^a	59	78	17	22		
Years of experience						
<10	93	75	31	25	2.426	.297
10–20	78	82	17	18		
>20	28	85	5	15		

^a Graduates in applied medical sciences, nurses, lab technicians, and medical students/interns.

Table 4

Distribution of Healthcare Providers Regarding Their Actual Implementation of Telemedicine at Hospitals Adopting Telemedicine

Characteristics of Healthcare Providers	Actual Implementation of Telemedicine at Hospitals Adopting Telemedicine (n = 144)					
	Yes (n = 48)		No (n = 96)		Chi-square	p-value
	Nu mb er	%	Nu mb er	%		
Age in years						
<30	7	25	21	75	2.31	.314
30 to 50	33	33	66	67		
>50	8	47	9	53		
Gender						
Male	36	37	61	63	1.91	.167
Female	12	26	35	74		
Nationality						
Saudi	26	35	49	65	.125	.723
Non-Saudi	22	32	47	68		
Profession						
General physician	4	19	17	81	17.9	.000
Specialist	10	28	26	72		
Consultant	27	56	21	44		
Other ^a	7	18	32	82		
Years of experience						
<10	12	20	49	80	9.44	.009
10–20	21	40	31	60		
>20	15	48	16	52		

^a Graduates in applied medical sciences, nurses, lab technicians, and medical students/interns.

Table 5

Distribution of Healthcare Providers Attending Teleconferences at Hospitals Adopting Telemedicine

Characteristics of Healthcare Providers	Teleconference Attendance (<i>n</i> = 144)				Chi-square	<i>p</i> -value
	Yes (<i>n</i> = 101)		No (<i>n</i> = 43)			
	Number	%	Number	%		
Facility						
QCH	58	82.9	12	17.1	19.984	.000
ARAMCO	17	85.0	3	15.0		
DCH	26	48.1	28	51.9		
Age in years						
<30	13	46.4	15	53.6	9.730	.008
30 to 50	74	74.7	25	25.3		
>50	14	82.4	3	17.6		
Gender						
Male	68	70.1	29	29.9	1.003	.989
Female	33	70.2	14	29.8		
Nationality						
Saudi	57	76.0	18	24.0	2.567	.109
Non-Saudi	44	63.8	25	36.2		
Profession						
General physician	13	61.9	8	38.1	11.304	.010
Specialist	24	66.7	12	33.3		
Consultant	42	87.5	6	12.5		
Other ^a	22	56.4	17	43.6		
Years of experience						
<10	34	55.7	27	44.3	10.714	.005
10–20	41	78.8	11	21.2		
>20	26	83.9	5	16.1		

^a Graduates in applied medical sciences, nurses, lab technicians, and medical students/interns.

Table 6

Perceptions of Healthcare Providers Not Adopting Telemedicine on Benefits of Telemedicine ($n = 252$)

Benefits of Adopting Telemedicine	Mean	SD
Provides patient care and management	3.36	.711
Saves time	3.30	.835
Saves money	3.88	.992
Easy use of network	3.45	1.034
Improves quality of care services	3.37	.735
Enhances access to health care services	3.33	.682
Videoconferencing is very beneficial.	3.45	.744
Store-and-forward telemedicine is beneficial.	3.46	.926
Interactive telemedicine, i.e., teleconsultation, tele-ICU, teleconferences, etc., is substantial.	3.45	.875
Second opinion is important.	3.58	.872
Follow-up after face-to-face contact is beneficial.	3.36	.847

Table 7

Perception of Healthcare Providers on Benefits of Telemedicine at Hospitals Adopting Telemedicine ($n = 144$)

Benefits of Adopting Telemedicine	Mean	SD
Provides patient care and management	3.22	.671
Saves time	3.13	.650
Saves money	3.11	.616
Easy use of network	2.80	.643
Improves quality of care services	3.26	.612
Enhances access to healthcare services	3.26	.626
Videoconferencing is very beneficial.	3.22	.681
Store-and-forward telemedicine is beneficial.	2.97	.679
Interactive telemedicine, i.e., teleconsultation, tele-ICU, teleconferences, etc., is substantial.	3.19	.679
Second opinion is important.	3.19	.672
Follow-up after face-to-face contact is beneficial.	2.96	.728

Table 8

Perceptions of Healthcare Providers at Hospitals Not Adopting Telemedicine on the Barriers/Challenges to the Use of Telemedicine ($n = 252$)

Perceived Barriers/Challenges	Number^a	%
Lack of knowledge about meaning of telemedicine and its applications/types/benefits, etc.	179	71.0
Lack of time to adopt telemedicine	100	39.7
Telemedicine is not important.	53	21.0
Financial barrier/lack of infrastructure	35	13.9
Health professionals' resistance	4	1.6

^a Some respondents mentioned more than one barrier.

Table 9

Perception of Healthcare Providers at Hospitals Adopting Telemedicine on the Barriers/Challenges to the Use of Telemedicine ($n = 144$)

Perceived Barriers/Challenges	Number	%
Lack of sufficient knowledge about other services/benefits of telemedicine	71	49
Difficulty in the application of telemedicine	42	29
Lack of time to adopt telemedicine	31	22

Figure 1

Perception of Participants on Benefits of Telemedicine at Hospitals Adopting and Not Adopting Telemedicine

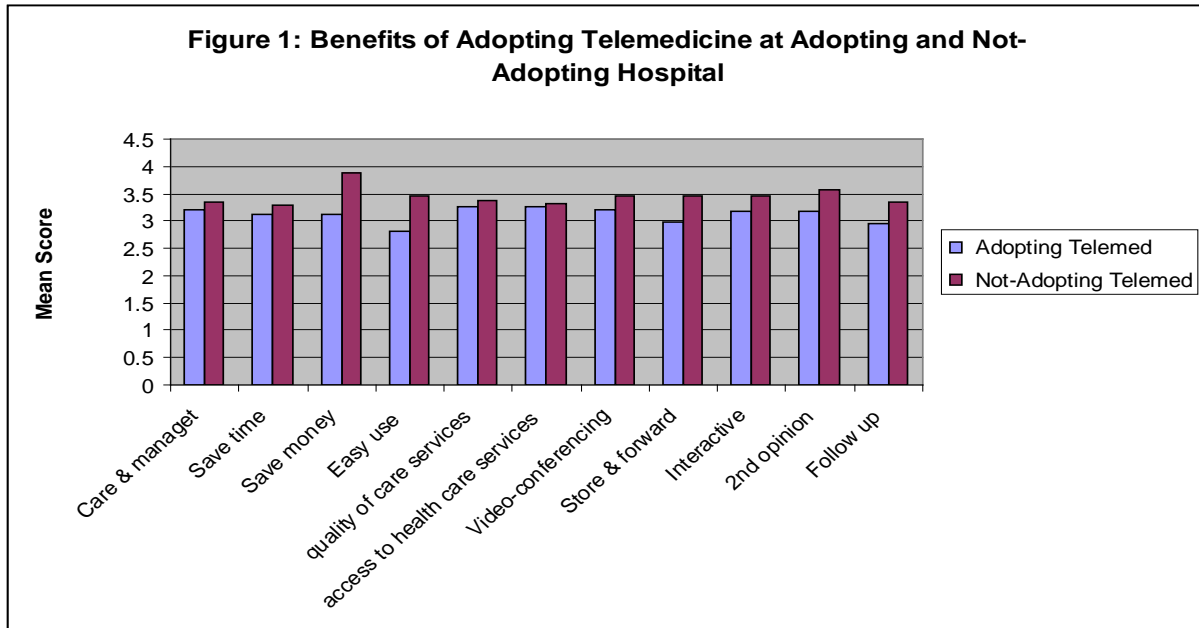


Figure 2

Perceptions of Healthcare Providers Not Adopting Telemedicine on the Challenges/Barriers to the Use of Telemedicine

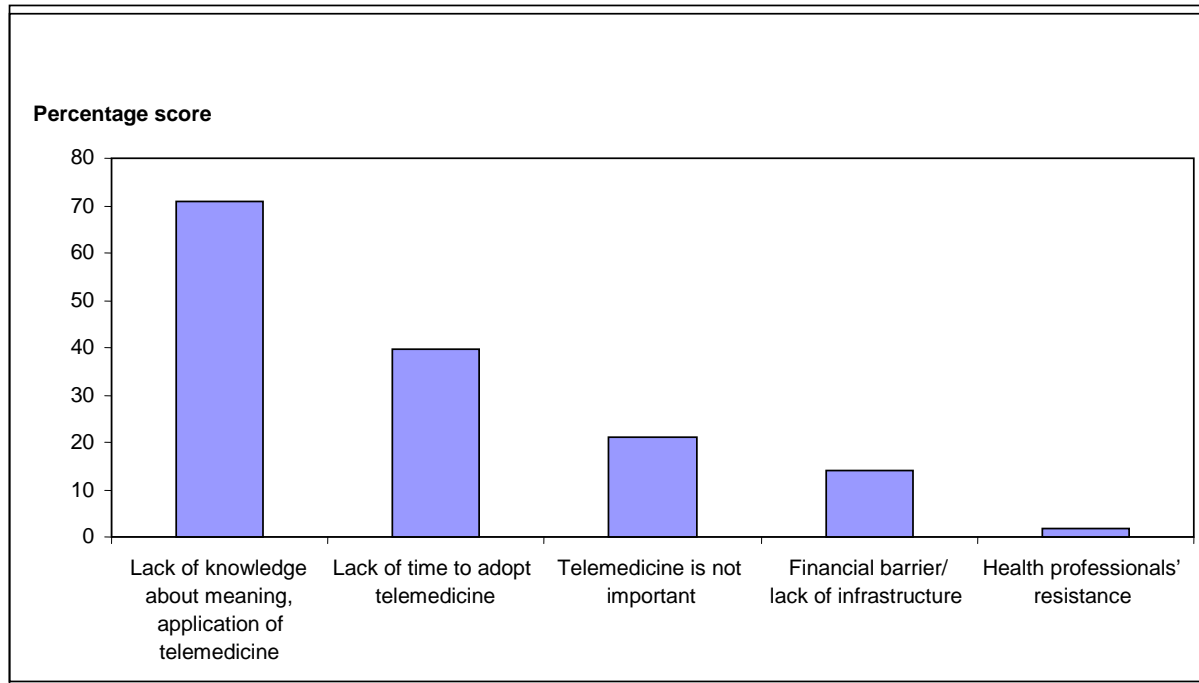
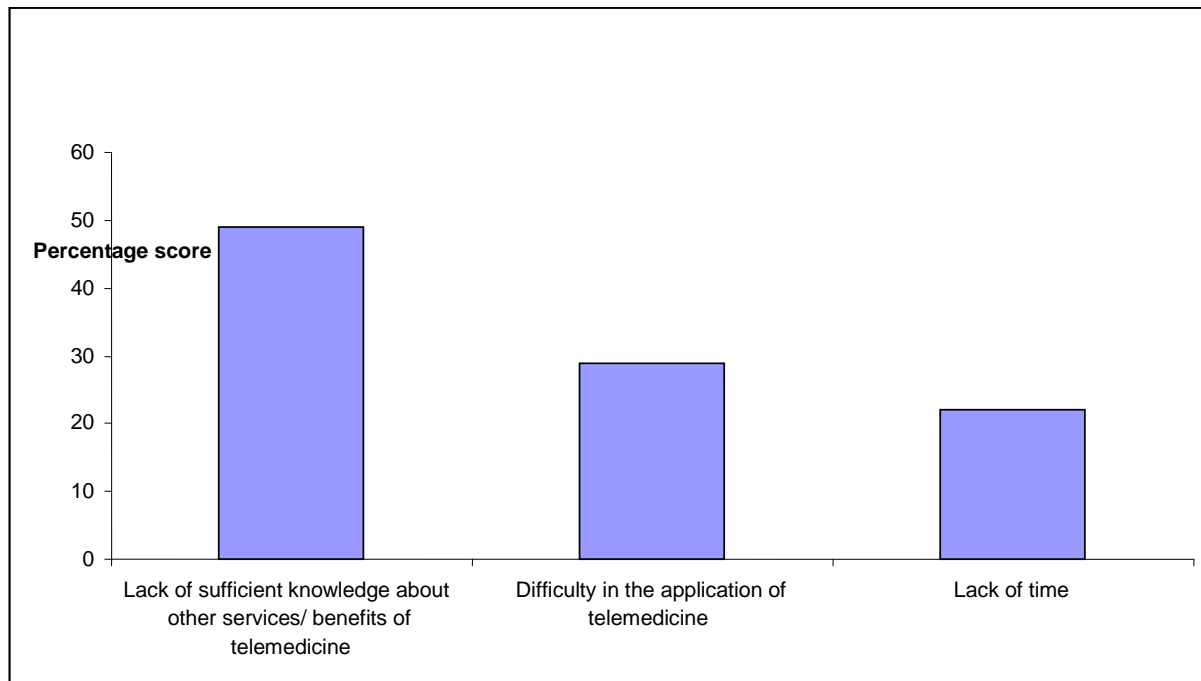


Figure 3

Perceptions of Healthcare Providers Adopting Telemedicine on the Challenges/Barriers to the Use of Telemedicine



Appendix A

Telemedicine Survey at Teaching Hospital Not Adopting Telemedicine

This survey will be used to determine opinion of healthcare professionals about telemedicine.

Name..... (Optional)

1) **Hospital Title:**

2) **Gender:** Male Female

3) **Age in years**.....

4) **Nationality:** Saudi Non Saudi

5) **Profession:**

- Consultant General Physician
 Specialist Other Specialty (specify)

6) **Years of experience:**

7) **Are you interested to know about telemedicine?** Yes No

8) **Are you actually interested to implement advanced telemedicine technologies, e.g., telepathology, teleradiology, telemedical education, teleconsultation, videoconferencing, etc.?** Yes No

9) **In your opinion what are the barriers/challenges of adopting telemedicine (you can choose more than one option):**

- Lack of time to adopt telemedicine
 Lack of knowledge about meaning of telemedicine
 Lack of knowledge about applications/ types of telemedicine
 Lack of knowledge about benefits of telemedicine
 I think it's not important
 Financial barrier
 Other reason, specify.....

In your opinion what are the benefits of adopting telemedicine:

Benefits of Adopting Telemedicine	Strongly Agree (4)	Agree (3)	Disagree (2)	Strongly Disagree (1)
10) Using telemedicine is beneficial to my patient care and management.				
11) Telemedicine helps save time.				
12) Telemedicine helps save money.				
13) Easy use of network				
14) Telemedicine can improve the quality of care services.				
15) Telemedicine can enhance access to healthcare services.				
16) Videoconferencing is beneficial.				
17) Store-and-forward telemedicine is beneficial.				
18) Interactive telemedicine, i.e., teleconsultation, tele-ICU, etc., is substantial.				
19) Second opinion is important.				
20) Follow-up after face-to-face contact is beneficial.				

Appendix B

Telemedicine Survey at Hospitals Adopting Telemedicine

This survey will be used to determine opinion of healthcare professionals about telemedicine.

Name..... (Optional)

1) Hospital Title:

2) Gender: Male Female

3) Age in years

4) Nationality: Saudi Non Saudi

5) Profession:

Consultant General Physician
 Specialist Other Specialty (specify)

6) Years of experience:

7) Do you actually implement advanced telemedicine technologies at your hospital, e.g., telepathology, teleradiology, telemedical education, teleconsultation, videoconferencing, etc.? Yes No

8) How many times do you attend teleconferences?

9) In your opinion what are the barriers/challenges of adopting telemedicine (you can choose more than one option):

- Lack of sufficient knowledge about other services/benefits of telemedicine
 Difficulty in the application of telemedicine
 Lack of time
 Other reason, specify.....

In your opinion what are the benefits of adopting telemedicine:

Benefits of Adopting Telemedicine	Strongly Agree (4)	Agree (3)	Disagree (2)	Strongly Disagree (1)
10) Using telemedicine is beneficial to my patient care and management.				
11) Telemedicine helps save time.				
12) Telemedicine helps save money.				
13) Easy use of network				
14) Telemedicine can improve the quality of care services.				
15) Telemedicine can enhance access to healthcare services.				
16) Video conferencing is beneficial.				
17) Store-and-forward telemedicine is beneficial.				
18) Interactive telemedicine, i.e., teleconsultation, tele-ICU, etc., is substantial.				
19) Second opinion is important.				
20) Follow-up after face-to-face contact is beneficial.				