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Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia

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Summary Despite emerging evidence about the benefits of telemedicine, there are still many barriers and challenges to its adoption. Its adoption is often cited as a failed project because 75% of them are abandoned or 'failed outright' and this percentage increases to 90% in developing countries. The literature has clarified that there is neither one-size-fit-all framework nor best-practice solution for all ICT innovations or for all countries. Barriers and challenges in adopting and implementing one ICT innovation in a given country/organisation may not be similar — not for the same ICT innovation in another country/organisation nor for another ICT innovation in the same country/organisation.

To the best of our knowledge, no comprehensive scientific study has investigated these challenges and barriers in all Healthcare Facilities (HCFs) across the Kingdom of Saudi Arabia (KSA). This research, which is undertaken based on the Saudi

Abbreviations: HCFs, Healthcare Facilities; STN, Saudi Telemedicine Network; KSA, Kingdom of Saudi Arabia; TOE, Technology—Organisation—Environment; UTAUT, Unified Theory of Acceptance and Use of Technology; MOH, Saudi Ministry of Health; PHCs, Primary Healthcare Centres; OTN, Ontario Telemedicine Network; CPG, Clinical Practice Guidelines; ETSSM, the Evaluating Telemedicine Systems Success Model.

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Telemedicine Network roadmap and in collaboration with the Saudi Ministry of Health (MOH), is aimed at identifying the principle predictive challenges and barriers in the context of the KSA, and understanding the perspective of the decision makers of each HCF type, sector, and location. Three theories are used to underpin this research: the Unified Theory of Acceptance and Use of Technology (UTAUT), the Technology—Organisation—Environment (TOE) theoretical framework, and the Evaluating Telemedicine Systems Success Model (ETSSM). This study applies a three-sequential-phase approach by using three mixed methods (i.e., literature review, interviews, and questionnaires) in order to utilise the source triangulation and the data comparison analysis technique. The findings of this study show that the top three influential barriers to adopt and implement telemedicine by the HCF decision makers are: (i) the availability of adequate sustainable financial support to implement, operate, and maintain the telemedicine system, (ii) ensuring conformity of telemedicine services with core mission, vision, needs and constraints of the HCF, and (iii) the reimbursement for telemedicine services.

Introduction

The KSA healthcare system currently faces many difficult challenges and the MOH is under tremendous pressure from its government to develop a high-quality healthcare system and improve healthcare services to all residents, particularly in rural/remote areas [1—3]. In 2010, the MOH conducted a study into the adoption of telemedicine stating that telemedicine promises can alleviate many challenges of the KSA healthcare system [4]. In 2011, the MOH launched the first national project for telemedicine, referred to as the Saudi Telemedicine Network (STN), covering all Healthcare Facilities (HCF) [4]. The MOH cooperated with Canada Health Infoway and Ontario Telemedicine Network to provide guidance in developing a telemedicine roadmap for KSA, the STN roadmap, which was issued in 2013 [4].

Despite emerging evidence about the benefits of telemedicine, there are still many barriers and challenges to its adoption which is often cited as a failed project as 75% of them are abandoned or 'failed outright'; this percentage has increased to 90% in developing countries [5—10]. There is neither one-size-fit-all framework nor best-practice solution for all ICT innovations or for all countries [8,10—16]. The barriers and challenges in adopting and implementing one ICT innovation in a given country or organisation may not be similar neither for the same ICT innovation in another country/organisation nor for another ICT innovation in the same country or organisation [8,10—16]. Most countries/organisations are likely to face some common barriers and challenges in adopting a specific ICT innovation (e.g., telemedicine) with a significant degree of variation. However, each country/organisation will have its own unique sets of barriers and challenges related to its context and environment (e.g., macro-economic, culture, structure, social and political situation, potential users (e.g., acceptance, attitude), strategy and plan (e.g., standards, processes), and ICT innovation needs (e.g., equipment, infrastructure, speed, user-friendliness) [4,8,10,11,17—20]. Some of the barriers and challenges that may limit one ICT innovation in a given country/organisation may no longer exist, may partly diminish, or may become an opportunity for another ICT innovation, or countries/organisations [11,17]. Thus, the ultimate success of adopting and implementing telemedicine in a given country or organisation is ensured if these barriers and challenges are adequately addressed [21].

Each HCF site in KSA is likely to have different sets of barriers and challenges in adopting and implementing telemedicine (i.e., enabling their HCFs sites to join the STN) as there are different types of HCFs participating in the KSA healthcare system (e.g., Primary Healthcare Centres (PHCs), hospitals, medical cities, etc.). In addition, these different HCFs types belong to different sectors (e.g., MOH sector, military sector, private sector, etc.) and are located in urban area or rural/remote area [22,23]. Therefore, each HCF may have its own motivations and expectations, different business drivers, needs, Clinical Practice Guidelines (CPG), funding incentives and different priorities and agendas [4,8,10,18,19,24].

Research objectives

To the best of our knowledge, no comprehensive scientific study has investigated the challenges and barriers related to the adoption and implementation of telemedicine systems in all HCFs across the KSA and at a national level. This research is undertaken based on the STN roadmap and in collaboration with the MOH. It is aimed at identifying the principle predictive challenges and barriers in adopting and implementing telemedicine in the context of the KSA and investigating the degree of variation within all HCFs sectors, types, and locations.

Research methodology and research design

Theoretical bases

Oliveira and Martins [25] argue that it is important to combine more than one theoretical model to achieve a better understanding of the implementation of the ICT innovations, as such an integrated methodology can provide a holistic approach [26,27]. Therefore, three theories are used to underpin this research. Firstly, the Unified Theory of Acceptance and Use of Technology (UTAUT2), developed by Venkatesh et al. [28] is used to explain acceptance and use of ICT innovations in a consumer context [28,29] (e.g., [30] and [31]). In this study, this theory is chosen since HCFs sites in KSA are considered as the consumers for the STN. Secondly, the Technology—Organisation—Environment (TOE) framework, developed by Tornatzky et al. [32] is chosen since it is an organisational-level theory that clarifies the technological, organisational, and environmental dimensions which can influence adoption and implementation decisions of any ICT innovations in any organisations [17]. The TOE framework has been shown to be a helpful tool in understanding how organisations adopt and implement ICT innovations [33] and each HCFs site in KSA is considered as an organisation. Finally, the Evaluating Telemedicine Systems Success Model (ETSSM), developed by Hu [34] which is a revised model of the DeLone and McLean (D&M) of Information Systems is applied.

The research approach

This study applies the source triangulation and the data comparison analysis technique [37] using a mixed method approach. The findings of this research are based on results obtained from different sources by using three different methods. These methods are: (i) literature review, (ii) interviews, and (iii) questionnaires. The source triangulation enhances the reliability and validity of the research and gives credibility to the results [35,36].

The underlying paradigm

The philosophy of pragmatism is adopted in this research. Scott and Briggs [38] and Johnson and Onwuegbuzie [37] stated that the results of comparison data fit fully under pragmatist philosophy. The pragmatism paradigm provides the best appropriated base to support research of ICT in healthcare since the healthcare field and clinical practice takes a pragmatic approach [38].

The research design and investigation procedure

The findings of this research are identified after triangulating and comparing the outcomes of three sequential phases. In the first phase, which was conducted between November 2013 and April 2014, a systematic and an extensive review of the literature on theories, models and frameworks was carried out; an analysis of key documentations from the MOH in KSA has revealed the existing barriers and challenges faced by the current telemedicine implementation projects. After filtration and exclusion based on the inclusion criteria, 60 studies which matched the inclusion criteria were grouped into three categories for further analysis. The first group consisted of 15 studies: 3 were related to telemedicine adoption and implementation in KSA, 4 concerned with adopting and implementing other ICT innovations within HCFs in KSA (e.g., HIS, EMR, etc.), and 8 with adopting and implementing any ICT innovation within any organisation in KSA (e.g., eGovernment, E-commerce, eLearning). The second group included 20 studies conducted in countries close to the KSA context namely the Middle East and North Africa regions; 11 of these focused on telemedicine adoption and implementation and 9 related to other ICT innovations within HCFs. The third group comprised 25 global studies related to developed countries, 10 of which were concerned with adopting and implementing telemedicine, 15 focused on others ICT innovations within HCFs. Narrative summary techniques were used; the similarities as well as differences between the findings from different research backgrounds were highlighted, and reasons for any differences from both an empirical perspective and

Table 1 The expected barriers and challenges of the second phase.

Barriers/challenges	Code
Users acceptance (i.e., clinical staff) and their willingness to utilise telemedicine.	UsAc
consumer acceptance (i.e., patients) and their willingness to be treated by telemedicine.	CoAc
The availability of adequate experts (Human Resource (HR)) in the HCF to implement, operate, and maintain telemedicine.	AoEx
The presence of approved strategy and plans (e.g., change management plan, etc.) in the HCF for implementing telemedicine.	StPl
The support of the HCF stakeholders and their willingness/commitment to make the required modifications in the business processes and bylaws.	ISSp
Ensuring conformity of telemedicine with the HCF structure.	StIm
Ensuring conformity of telemedicine with core mission, vision, and needs of the HCF and its constraints.	OrCn
The ability to bring competitive advantages to the HCF and solve challenges that currently face.	SeIm
Availability of required ICT infrastructure.	AICT
Availability of required Information of patients from their health records.	AInf
System quality (e.g., reliability, supportability, security, interoperability, privacy, functionality, etc.).	SysQ
Information quality (i.e., its accuracy, completeness, usefulness, relevancy, etc.).	InfQ
Culture and society constraints (i.e., compatibility of telemedicine with Islamic ethics and rules, human culture and traditional beliefs).	CSCo
Government and other external bodies' legislations and constraints.	GBLC
Industry characteristics and market structure.	ICMS
Support and quality of basic facilities and ICT infrastructure.	SQBF
Ensuring the economic feasibility and the commercial viability of telemedicine for the HCF.	EFCV
Ensuring the cost-effectiveness of telemedicine for the HCF patients.	CF4C
The reimbursement for telemedicine services.	Rimb
The availability of adequate sustainable funding/financial support from outside the HCF (e.g., from the KSA government).	SFOu
The availability of adequate financial resources in the HCF to implement, operate, and maintain telemedicine.	AFRI
Economic constraints and recession.	EcCo

an epistemological were considered capturing 63 barriers and challenges.

The second phase focused on these 63 barriers and challenges which have been discussed, aggregated, assessed, and nominated by interviews with 83 members of the strategic-level decision-makers representing all types of HCFs in KSA, and all sectors and locations. The interviews were conducted from May 2014 to February 2015 in the form of semi-structured interview questionnaire with open-ended questions. This has led to 22 expected barriers and challenges related to the implementation of telemedicine in KSA (Table 1).

The last phase was based on a questionnaire devised to measure the opinions of a representative sample size of the decision makers of HCFs across KSA about the findings of these 22 barriers and challenges. This questionnaire was available from April 2015 to September 2015 using two different types of media: paper-based and web-based, and in Arabic and English. The invitation to participate in the questionnaire was sent through emails provided by the MOH in KSA. The respondents were asked to answer the questions on a seven point Likert scale (where 1 = strongly no influence; 2 = no influence; 3 = somewhat no influence; 4 = uncertain; 5 = somewhat influence; 6 = influence; 7 = strongly influence).

Data analysis and results

The data analysis was completed using Statistical Package for the Social Science (SPSS) software. The Kruskal—Wallis *H* test was used to find *P*-value which determines if there are statistically significant differences between two or more groups [39]. 905 responses were found to be complete and usable; this response rate of 43.6% has been approved to be representative and sufficient for the degree of accuracy/margin of error less than 5%. Table 2 summarises respondents' profiles.

Fig. 1 shows that 50% of the participants have identified only 11 out of 22 barriers and challenges as influential in their decision to adopt and implement telemedicine in their HCF site these are: SFOu, AFRI, OrCn, Rimb, InfQ, AICT, CF4C, CSCo,

Table 2 Descriptive statistics of respondents' profiles.

Measure	Item	Frequency	(%)
Job title in the MOH or any HCFs in KSA	C-Level executive	36	4
	Director/vice president/manager	558	62
	Director/Head of IT/ICT	173	19
	Healthcare policy makers and regulators	24	3
	Senior manager	82	9
	Administrator	32	4
Sector of the HCF	MOH	501	55
	Other governmental	94	10
	Private	253	28
	Military	57	6
Type of the HCF	PHC	264	29
	Specialised clinic	37	4
	Polyclinic centre	178	20
	Hospital	400	44
	Medical city	26	3
The HCF location	Urban area	718	79
	Rural/remote area	187	21

SysQ, SeIm, and StPl. Whereas, Table 3—5 show the most significant barriers and challenges identified by 50% of the participants based on their HCFs sectors, types and locations, respectively.

Discussion of findings

The findings of this research show that UsAc, ISSp, StIm, AInf, GBLC, ICMS, and EcCo barriers and challenges bear no influence by the decision makers of all HCFs in the context of KSA in adopting and implementing telemedicine in their HCF site. When the results of the questionnaire were classified based on the HCF sectors, types, or locations of the participants, four new principles emerged these are: CoAc, AoEx, SQBF, EFCV. The CoAc and EFCV barriers are significant in HCFs in the private sector, HCFs located in urban areas, or HCFs that are specialised clinics or polyclinic centres. As HCFs in the private sector are for-profit they should ensure the economic feasibility and the commercial viability of telemedicine for their HCF, and be aware of their consumers' (i.e., patients') acceptance. In terms of the existing of CoAc and EFCV barriers in the HCFs located in urban area, it could be explained as there are many HCFs located in urban area which are competing with each other. Each HCF in urban area is keen to ensure the economic feasibility and the commercial viability of telemedicine for the HCF and to maintain its consumers by gaining their satisfaction.

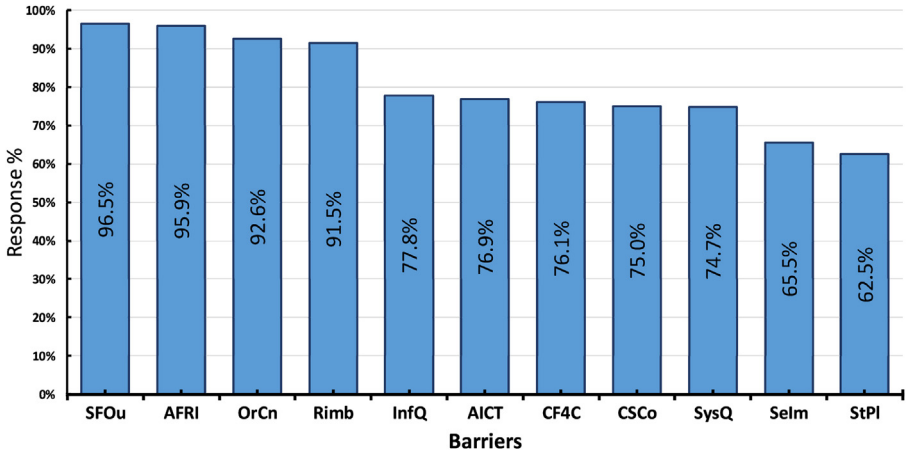

Figure 1 Principle barriers and challenges for all HCFs within KSA.

Table 3 Principle barriers and challenges for each HCFs sector within KSA.

Barrier	HCF sector							
	MOH		Other gov.		Private		Military	
	Rank	Response (%)	Rank	Response (%)	Rank	Response (%)	Rank	Response (%)
CoAc	—	—	—	—	6	83.0	—	—
AoEx	12	57.1	12	51.1	—	—	12	54.4
OrCn	3	93.8	3	88.3	5	93.7	4	84.2
SeIm*	10	66.7	10	66.0	11	62.9	9	66.7
StPl*	11	63.9	11	60.6	13	60.5	11	63.2
InfQ	5	85.4	5	74.5	8	64.0	5	75.4
AICT	6	84.6	6	74.5	9	63.2	6	73.7
SysQ	9	82.4	8	71.3	12	61.7	7	70.2
CSCo	8	82.6	9	70.2	10	63.2	10	66.7
SQBF	13	56.3	13	50.0	—	—	—	—
SFOu	1	95.8	1	95.7	1	99.2	1	91.2
AFRI	2	95.2	2	93.6	2	99.2	2	91.2
Rimb	4	89.2	4	87.2	3	98.8	3	86.0
CF4C	7	83.0	7	74.5	7	64.8	8	68.4
EFCV	—	—	—	—	4	94.9	—	—

* *P*-value (Sig.) > 0.05.
—, the barrier not significant by 50% or above of the participants.

The AoEx barrier, as shown in Table 3, is significant in the HCFs belonging to all sectors in KSA except the HCFs belonging to the private sector. This finding could be explained as the HCFs in private sector usually have a budget and ability to hire experts. This barrier, as shown in Table 5, also is relevant to the HCFs located in rural/remote areas. This result is expected since the experts are usually available in urban areas and are limited in rural/remote areas. In addition, this barrier (i.e., AoEx) is significant in HCFs which are PHCs or specialised clinics (Table 4) as these two types of HCFs are small and usually with limited budget and HR.

The SQBF barrier, as shown in Table 3, is significant to the HCFs belonging to all sectors in KSA except those belonging to both the private and military sectors, as the HCFs in the military sector are regularly supported by the government

Table 4 Principle barriers and challenges of each HCFs type within KSA.

Barrier	HCF type									
	PHC		Specialised Clinic		Polyclinic centre		Hospital		Medical city	
	Rank	Response (%)	Rank	Response (%)	Rank	Response (%)	Rank	Response (%)	Rank	Response (%)
CoAc	—	—	13	59.5	6	66.9	—	—	—	—
AoEx	1	86.0	14	56.8	—	—	—	—	—	—
OrCn	3	92.7	4	83.8	4	96.6	4	92.3	5	80.8
SeIm	4	87.9	8	67.6	7	66.9	10	51.0	10	60.4
StPl	2	83.7	6	70.3	10	64.6	11	50.5	11	55.0
InfQ	7	92.0	11	62.2	8	66.3	5	75.0	8	73.1
AICT	5	91.3	9	64.9	9	65.2	7	74.0	7	73.1
SysQ	6	89.8	10	62.2	11	62.9	8	71.8	9	65.4
CSCo	8	88.6	7	70.3	12	62.9	9	71.0	4	84.6
SQBF	9	84.4	15	51.4	—	—	—	—	—	—
SFOu	12	93.9	1	91.9	1	100.0	1	97.0	1	96.2
AFRI	13	93.2	2	91.9	2	99.4	2	96.8	2	92.4
Rimb	11	85.2	3	86.5	3	98.3	3	93.0	3	92.3
CF4C	10	89.4	12	62.2	13	62.9	6	74.3	6	80.4
EFCV	—	—	5	75.7	5	80.3	—	—	—	—

—, the barrier not significant by 50% or above of the participants.

Table 5 Principle barriers and challenges of each HCFs location within KSA.

Barrier	HCF location			
	Urban		Rural/remote	
	Rank	Response (%)	Rank	Response (%)
CoAc	5	91.1	—	—
AoEx	—	—	11	69.0
OrCn*	3	92.8	3	92.0
SeIm	11	63.8	10	72.2
StPl*	12	61.0	12	68.4
InfQ	6	74.6	5	89.8
AICT	7	73.8	6	88.8
SysQ	10	71.7	8	86.1
CSCo	9	72.2	9	85.6
SQBF	—	—	13	66.8
SFOu	1	96.3	1	97.3
AFRI	2	96.0	2	95.7
Rimb*	4	91.8	4	90.4
CF4C	8	73.1	7	87.7
EFCV	13	50.1	—	—

* *P*-value (Sig.) > 0.05.
—, the barrier not significant by 50% or above of the participants.

which usually provides them with the necessary facilities and ICT infrastructure. However, the HCFs in the private sector are usually located in large cities which already have basic facilities and ICT infrastructure, besides, they usually have budget and ability to support ICT infrastructure in their area. The SQBF barrier, as shown in Table 5, is significant to the HCFs located in rural/remote areas but not to those HCFs located in urban areas. This result is expected since there is a lack of basic facilities and ICT infrastructure in rural/remote areas. Finally, the SQBF barrier is identified by HCFs which are PHCs or specialised clinic (Table 4), due to the fact that these two types, unlike the others, are usually scattered all over the KSA even in rural/remote areas which suffer from a lack of basic facilities and ICT infrastructure.

The results of the questionnaire were classified based on the HCF sectors, types and locations and tested by the Kruskal—Wallis *H* test; the *P*-value has showed that there are statistically significant differences between the underlying distributions of all barriers and challenges (except SeIm and StPl) across the HCF sector, and between the underlying distributions of all barriers and challenges across the HCF types. Furthermore, statistically significant differences have been identified between the underlying distributions of all barriers and challenges (except OrCn, StPl, and Rimb) across the HCF locations. These finding emphasises the ranking variation of the principle barriers and challenges among the HCF types, locations, and sectors.

Conclusion

The aim of this paper is to address the challenges and barriers facing the implementation of telemedicine in KSA. The literature review has elicited 63 barriers and challenges to the adoption and implementation of telemedicine. Our interviews, with 83 strategic-level healthcare decision-makers representing all types of HCFs in KSA, belonging to all sectors and located in urban, rural/remote areas, identified 22 out of the original 63 to be significant barriers and challenges in the KSA context. Our questionnaire, based on the 905 respondents, highlighted 11 barriers to be most significant in the KSA context. Furthermore, when the results of the questionnaire were classified based on the HCF sectors, types, or location, four new principal barriers and challenges were identified (i.e., CoAc, AoEx, SQBF, EFCV). The Kruskal—Wallis *H* test (*P*-value) showed that there are statistically significant differences between the underlying distributions of the majority of barriers and challenges across the HCF sector, types, and locations. These finding explains why the rank of the principle barriers and challenges is different between the HCF types, locations, and sectors. These findings showed that while each type, sector, or location of HCF within KSA is likely to face some common barriers and challenges in adopting telemedicine, each of them has also its own set of barriers and challenges and there is a significant degree of variation.

Authors' contributions

This research is from a chapter of the PhD dissertation of A. Alaboudi, which is supervised by Prof. A. Atkins and Prof. B. Sharp, both of whom are involved in all stages of the research process, providing direction and guidance in research methodology and design and analysis. A. Alaboudi carried out the design and coordinated the study, participated in most of the experiments and prepared the manuscript. Dr A Balkhair and Dr T. Sunbul participated in the study design and the questionnaire. Dr M. Alzahrani participated in the questionnaire and statistical analysis. All authors contributed to the design of the study as well as reading and approving the manuscript.

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Competing interests

None declared.

Ethical approval

Approval to conduct this research was granted by Faculty Research Ethics Committee at Staffordshire University and by Regional Research Ethics Committee at MOH.

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