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Barriers to Sustainable Telemedicine Implementation in Libya

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ABSTRACT

Despite the unlimited benefits of modern technologies, telemedicine services in Libya are facing many obstacles and problems. The evolution of E- health/ telemedicine in Libya is still in its early stages to overcome all these obstacles. This research study outlines and explores a set of factors with direct and indirect impact on the adoption of the telemedicine system in Libya. Structured data collection approach is used for data collection accompanied with a designed and distributed questionnaire and Structural Equation Modeling (SEM) is used to analyze the collected data.

The findings of this research study indicate that a lack of personnel with sufficient skills represents a real challenge as well as the poor of Information and Communication Technology (ICT) infrastructure that appears to be a big challenge. The study classifies and summarizes the factors that might hinder/enable the adoption/implementation of telemedicine in Libya period significant barriers faced by the Libyan health sector to the embracement of telemedicine technology have been addressed. The healthcare sector in Libya still failing to benefit fully from the potential advantages ICT can offer. However, this research study could provide a starting point for the research community in Libya to conduct further studies.

Keywords: *Telemedicine, E-health, Mobile Health, Structural Equation Modeling SEM, Sustainable of Telemedicine Implementation, Path analysis, ICT infrastructure.*

INTRODUCTION

Technology adoption on its own cannot fundamentally solve all the problems. During the spread of the Corona pandemic, most of the efforts of health organizations around the world were directed to adopting telemedicine to continue providing health services. The way we use telemedicine services has changed with the advent of the Internet in the 1990s, as the World Wide Web provided sharing of images, data and medical information as well as interaction through video communications. Linguistically, telemedicine means a medical care provided remotely to a patient in a separate location using two-way voice and visual communications. Telemedicine is defined as using electronic communication to improve patient health status by exchanging of medical information/data from one location to another and The World Health Organization (WHO) defines e-Health in general as the use of information and communication technologies (ICTs) for health.

Brown [1] defined telemedicine as a communicate technologies using of electronic information to support healthcare when distance separates the participants. There is a clear difference; Where the

World Health Organization defines telemedicine as remote healing by giving freedom of treatment without leaving the home. As for telehealth, it is a more general and comprehensive concept, and includes the use of technological advances to support and develop health care and public health. Telehealth extends to cover non-clinical events such as scheduling and completing medical education through the Internet, as well as training for physicians [2].

Using the internet services as a communication tool has also contributed to better disease management. Patients with chronic conditions are able to access individual medical records and treatment plans, consult with specialists at their convenience [3]. COVID-19 crisis has benefitted the utilization of telehealth services and support for physician and patient [4]. Qureshi, Qamar Afaq, et al [5] stated that several factors have been observed as the significant variables in defining the successful implementation and utilization of e-Health. However, the study shows that infrastructure plays a central role and it becomes extremely significant in the context of the developing countries.

In general, doctors are usually more positive about e-health than patients in developed countries. Previous research found that patients appeared hesitant to employ modern technologies [6]. The lack of qualified human resources and the lack of those with sufficient skills represents a real challenge for various e-health stakeholders across the world, and under these challenges, health care officials are intensifying striving to take advantage of information and communication technology, to eliminate obstacles to providing health care through Adopting telemedicine technologies, mobile health, and clinical information systems that can assist in remote disease management, and developing data exchange and cooperation between health agencies, which raises the efficiency of the workforce, and ultimately contributes to expanding the coverage of appropriate health care services to the largest possible number of the population [7].

Telemedicine could be in form of interactive medicine, also called live, in which the doctor communicates with the patient at the same time by video or audio or could be in form of remote patient examination, where portable medical equipment such as checking blood pressure, blood sugar and other important measurements are used. Also, telemedicine could be in form of share and send documents where, health care providers share information about a patient's health with more experienced professionals for case consultation. Telemedicine can be refined into three main types which are store-and-forward telemedicine, remote monitoring and real-time interactive services.

Store-and-forward telemedicine, also known as asynchronous telemedicine, health care or medical service providers share patients' medical information and data with a doctor or specialist in deferent location. The information and data exchanged could be lab reports, records, or videos [8]. This method is effective for medical providers to collaborate with others as everyone can review and analyze information and diagnoses. Remote monitoring, is based on using a set of technical devices and equipment to follow and monitor health and clinical indicators of a patient remotely. This method is used to follow-up and manage patients with high risk and patients suffering from chronic diseases such as diabetes and heart disease and arteries. Real-time interactive services can provide immediate advice to patients who need medical attention using different media such as telephone, Internet, and real-time videoconferencing software instead of physically visiting the doctor and may include primary or urgent care or medication management [9]. This paper aims to review and discuss some important factors that obstacle the implementation and utilization of the telemedicine in developing states like Libya.

ICT Infrastructure

The adoption and utilization of telemedicine projects in Libya requires significant investments in information and communication technology infrastructure in all most the health sector. The lack of basic infrastructure in the fields of information and communication in the Libyan health sector facilities, represent a major challenge to the adoption and implementation of telemedicine initiatives at the national and regional levels. In Libya, the lack of national programs and initiatives for health information systems (HIS) and the medical imaging technology PACS (picture archiving and communication system) greatly obstruct and delay the success adoption of telemedicine in hospitals and health centres, especially small ones located in rural areas.

Facilitating condition is recognised as 'the extent wherein a patient believes that organizational infrastructure facilitates him/her to use telemedicine health services' [10]. Authors like Nysveen and Pedersen [11] asserted that the availability of infrastructure facilitate user and enhance their skills towards the use of telemedicine applications. Information and communications technology infrastructure ICT is consisting of both virtual and physical resources that support the storage, flow, analysis, and processing of data [12].

Use of Technology and Technology Acceptance

Information and communication technologies (ICTs) have been widely used to support and to deliver health services recently because ICTs' products [e.g., health information systems (HIS)] can improve the quality, efficiency, and equity of health care services delivery [13]. Many patients are unable to use technology. Medical care is universal for people of all generations, but people of some age groups, such as the elderly, can face problems in dealing with modern technology in order to obtain medical services.

User acceptance is often a critical figure in the success/failure of the implementation of any new information system [14]. In order to examine user behaviour towards the adoption of technology, the unified theory of acceptance and use of technology (UTAUT) was established by Venkatesh et al. [15]. In telemedicine field, this theory has been considered by several researchers to explore user behaviour towards the adoption of telemedicine systems. The user in this case can be patients and/or health sector workers (doctors, nurses, etc.).

The UTAUT involves four primary elements, named as: performance expectancy, effort expectancy, social influence and facilitating condition. The Performance expectancy factor is characterized as 'degree in which patient trusts that the utilization of telemedicine services will expand his/her undertaking execution' [15]. Figure (1) shows the TAM model and the factors utilized in TAM.

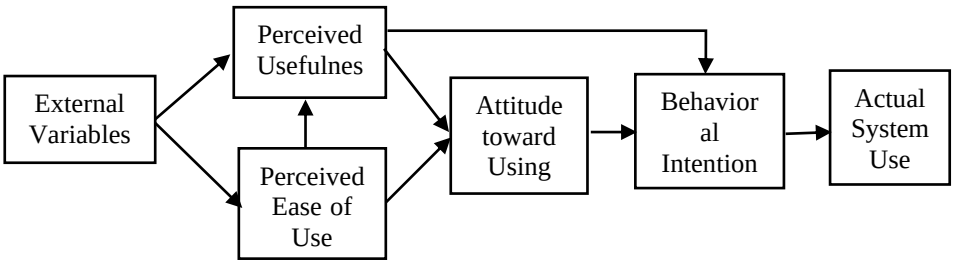

Figure 1. Technology Acceptance Model (TAM) [8].

Earlier studies have confirmed a significant relationship between performance expectancy and adoption of telemedicine health services [16] [17] [18]. A study by Tubaishat [19] shows that perceived ease of use and perceived usefulness had a positive impact on the determination to use EHRs. The same research study shows that the nurses assured a positive awareness of the usefulness and ease-of-use of EHRs, and their acceptance of the technology.

Equipment and Tools Cost

Doctors usually need electronic equipment and tools such as a computer, mobile phone, tablet, microphone, camera, etc. in order to activate the telemedicine services within the clinic, which in turn are a bit expensive. Telemedicine is not limited to the acquisition of these devices only, but the types of these devices of high quality and large capacity must be acquired, which doubles the price needed to purchase those [20].

Electronic devices may not be available in many doctors' offices because they have not been approved in advance, which requires careful thought about how to provide technology in addition to high-speed Internet. On the other hand, the technology may not be available in the hands of many patients who may not have computers or modern mobile phones in order to receive medical services remotely.

Electronic Payment Methods

Austin defined electronic payment system EPS as an approach of inter-organizational information system (IOS) for monetary exchange, linking many individual users and institutions/organizations.

Telemedicine services usually require electronic payment, which makes it difficult for most patients who prefer to pay in cash, due to the lack of safe and easy electronic payment methods.

Research Problem and Question

The research problem focusses on whether developing countries, such as Libya can take an advantage of the rapid development of information systems and technology. The study examines the reasons behind the failure in the Libyan health sector to adopt and successfully implement telemedicine system and the following questions summarize the research problem.

RQ1. What factors are responsible for telemedicine adoption failures in countries with less developed economies, such as Libya?

RQ2. To what extent has telemedicine system been deployed in Libya?

RQ3. What factors have been obstacles the success/failure of the adoption of telemedicine system in Libya?

METHODOLOGY

A questionnaire and three interviews were organized to rate the successful development of telemedicine system in Libya. During the interviews, the researcher focused upon ICT infrastructure, technology acceptance, tools & equipment cost and the electronic payment challenges. The obtained data were processed and analyzed using the Statistical Package for Social Sciences (SPSS) where findings are presented as descriptive statistics. The findings are also presented in the form of tables, and charts to enable easy report interpretation and readability. As such significant values (p-values) are provided in various sections of results. In addition, p-values were validated.

Analysis and Discussion

Descriptive statistics

Both construct validity and internal consistency were examined using Cronbach's alpha (.805).

Variables were checked to ensure that they met the assumptions of normal distribution and multicollinearity, which also referred to as collinearity or ill-conditioning. Multicollinearity was assessed by examining the tolerance and Variance Inflation Factor (VIF). The assumption about reasonable independence among predictor variables was satisfied and no multicollinearity issues were observed (Table 1).

Table 1. Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	ICT Infrastructure	.658	1.520
	Technology Acceptance	.652	1.533
	Tools and Equipment	.801	1.249
	Electronic Payment	.746	1.341
a. Dependent Variable: Telemedicine System			

Table 2 showed that the simple correlation R value = 0.549, which indicates a good degree of correlation, and the R2 value = 0.302, which indicates the extent of the total variation in the actual telemedicine system, indicating that the dependent variable telemedicine system was influenced by 30.2% by the independent variables ICT Infrastructure, Technology Acceptance, Tools and Equipment, and Electronic Payment.

Table 2. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.549[a]	.302	.290	.56277
a. Predictors: (Constant), Electronic Payment, Tools and Equipment, ICT Infrastructure, Technology Acceptance				

As can be seen from ANOVA results showed in Table 3 the probability value is lower than 0.05 as the level of significance is 0.000. Therefore, use of technology/technology acceptance, tools & equipment, electronic payment methods and ICT infrastructure simultaneously showed a significant influence on the actual telemedicine system.

Table 3. ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33.537	4	8.384	26.473	.000[b]
	Residual	77.594	245	.317		
	Total	111.131	249			
a. Dependent Variable: Telemedicine System						
b. Predictors: (Constant), Electronic Payment, Tools and Equipment, ICT Infrastructure, Technology Acceptance						

The obtained coefficient values in (table 4) showed that significant values were obtained for ICT infrastructure (0.000) and no significant values were obtained for technology acceptance (0.024), tools and equipment (0.207), and electronic payment methods (0.685)

Table 4. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.522	.267		5.702	.000
	ICT Infrastructure	.414	.063	.431	6.553	.000

	Technology Acceptance	.157	.069	.150	2.268	.024
	Tools and Equipment	.079	.063	.075	1.265	.207
	Electronic Payment	-.024	.059	-.025	-.405	.685

Path analysis and model fit

We used the path analysis technique to examine the validity of the model and to examine pathways through which variables influence each other. The model showed in figure (2) used to map the relationship between variables and the tables 5 through 9 summarizes the model fit indexes.

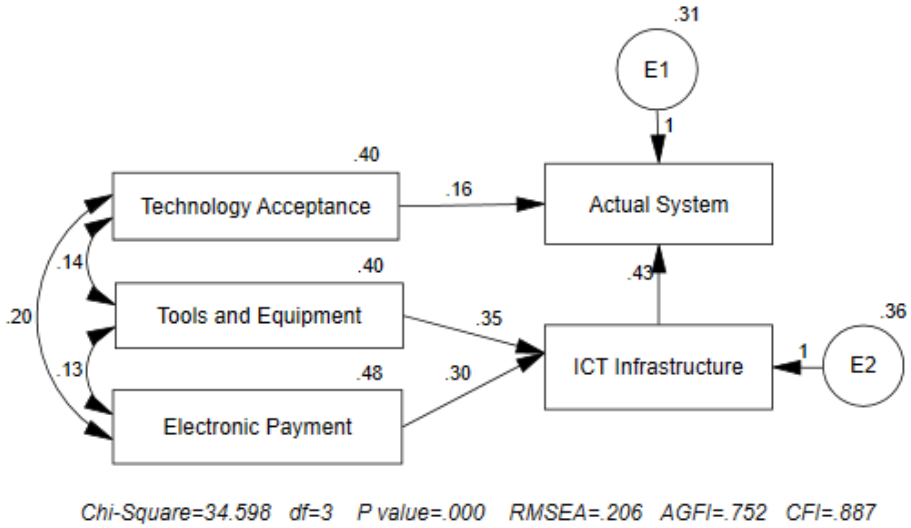

Figure 2. Model fit

Table 5. Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
ICTinfra	<---	TE	.352	.063	5.579	***	
ICTinfra	<---	EP	.300	.057	5.229	***	
AS	<---	TA	.162	.058	2.818	.005	
AS	<---	ICTinfra	.432	.053	8.207	***	

Table 6. CMIN: Chi-square statistics (Less is better)

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	12	34.598	3	.000	11.533
Saturated model	15	.000	0		
Independence model	5	289.543	10	.000	28.954

Table 7. RMR, GFI: root mean square residual (Smaller is better), Goodness of Fit Index (Greater than 0.9)

Model	RMR	GFI	AGFI	PGFI
Default model	.034	.950	.752	.190
Saturated model	.000	1.000		
Independence model	.144	.616	.424	.410

Table 8. Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.881	.602	.890	.623	.887
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Table 9. RMSEA: Root means square error of approximation

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.206	.148	.270	.000
Independence model	.335	.302	.369	.000

CONCLUSION

On despite the unlimited benefits, telemedicine services in Libya are facing many obstacles and problems, and the development and the adoption of telemedicine is still in its early stages to overcome all these obstacles. The study found out some financial and structural obstructions that Health sector in Libya facing when implementing sustainable telemedicine programs. The ICT infrastructure needed to be upgraded to support this kind of projects. Examples of these difficulties are the lack of reliable electronic payment methods, cost of computer/communications equipment, lack of communication skills, lack of Internet connection, government policies, lack of internet and poor broadband connection, training and edification to avoid technology reject and to empower the use of telemedicine system.

On despite of the disparities of the level of telemedicine usage in Libya, telemedicine is still in its early stages and needs an economic and technical support, taking into account all the factors that may hinder the success of its adoption and usage. The study showed that Libya as a developing country is facing significant barriers to implement real telecine system models due to limited related Initiatives and the poor of ICT infrastructure in all the country.

The study showed a set of factors with direct/indirect influence on the implementation of telemedicine system such as, adequate ICT infrastructure, government support and involvement of the hospital management, access to the Internet and at a low cost, relevant tools/equipment skills, adoption and support to electronic payment, training/ edification, and lack of other forms of e-Health system in most health sector institutions in Libya.

Declaration by Authors

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