

## Diabetic patients' willingness to use tele-technology to manage their disease – A descriptive study.

Basema Saddik PhD, MPH<sup>1\*</sup>, Norah Al-Dulaijan MSc(HI)<sup>1</sup>

1. College of Public Health and Health Informatics, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

### Abstract

**Objectives:** Diabetes mellitus is a public health concern worldwide. TeleHealth technology may be an effective tool for empowering patients in the self-management of diabetes mellitus. However despite the great impact of diabetes on healthcare in Saudi Arabia, no research has investigated diabetic patients' willingness to use this technology. This study investigates diabetic patients' willingness to use tele-technology as a tool to monitor their disease.

**Methods:** Data were collected from diabetic patients attending the diabetes education clinic at the Ministry of National Guard Health Affairs (MNGHA) in the Eastern region of Saudi Arabia over a three month period. A survey was developed which measured patients' willingness to use tele-technology in the self-management of their diabetes as well as their perceived expectations from the technology.

**Results:** The study found that the majority of patients were willing to use tele-technology to self-monitor their diabetes. However, a minority (11.3%) indicated willingness to use the system daily and only half indicated preference to use it once a week (53.8%). Patients who were younger, had higher education levels, were employed, had internet access and had Type II diabetes were significantly more likely to report willingness to use the technology.

**Conclusions:** Diabetic patients could be ready to play a more active role in their care if given the opportunity. Results from this study could serve as a baseline for future studies to develop targeted interventions by trialing tele-technology on a sample of the diabetic population. Patients with diabetes need to be in charge of their own care in order to improve health outcomes across the country.

**Keywords:** diabetes, self-management, tele-technology, willingness.

**Abbreviations:** Ministry of National Guard Health Affairs (MNGHA), Kingdom of Saud Arabia (KSA)

**Correspondence:** [saddikb@ksau-hs.edu.sa](mailto:saddikb@ksau-hs.edu.sa); [basema.saddik@gmail.com](mailto:basema.saddik@gmail.com)

**DOI:** 10.5210/ojphi.v7i2.6011

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## Introduction

Diabetes Mellitus is a public health concern worldwide. According to the World Health Organization (WHO), more than 347 million people worldwide have diabetes. In 2014, an estimated 4.9 million people died from diabetes and it is expected to become the 7th leading

cause of death in the world by the year 2030 [1]. This is no different in Saudi Arabia where diabetes mellitus is also considered a major public health problem with an overall comparative prevalence of 23.9% in the general population [2]. Diabetes has become more prevalent in Saudi Arabia with the change in dietary habits and the adoption of modern and sedentary lifestyles which have also led to the rise in obesity and other chronic diseases [3,4].

Effective management of chronic diseases including diabetes mellitus requires close cooperation between healthcare providers and the patient. Patients with chronic diseases are often the best to estimate the magnitude of their symptoms, problems and the effectiveness of any treatment [5] and chronic disease self-management is an important step to giving patients a better quality of life and improving patient health outcomes [6-9]. For instance, self-management in diabetes, has shown to prevent short-term complications as well as decrease the risk of long-term complications of diabetes [10]. The American Diabetes Association recognizes self-management in diabetes as the cornerstone of care for all patients who want to achieve successful health outcomes [11,12]. Self-management of diabetes has utilized various forms of technology including mobile health and the internet by providing short messaging services, smartphone apps for glycemic control and feedback through emails [13]. TeleHealth technology and tele-monitoring have also been found particularly useful for empowering patients in remote locations through video conferencing between patients and health care providers, uploading physiological data and receiving health care provider feedback [14-16]. Also known as an internet based self-management system or the “virtual clinic”, this technology offers the patient several advantages, such as communication with health care provider, access to information, and interaction with peers [9,17]. However, whilst we know that technology in health care can help to empower patients [18], it is important to know if specific patient populations are ready and willing to use the technology.

Previous studies on tele-monitoring in diabetes have measured patients perceived use of telemedicine in their health; however, these studies have focused on elderly patients [19-21]. To date, no research has investigated diabetic patients' willingness and acceptance of tele-technology in the management of diabetes despite its great impact on healthcare in Saudi Arabia. It is still unclear whether or not the general population of Saudi Arabia is ready for the implementation of tele-technology into their daily routines.

The current study seeks to focus on investigating diabetic patients' willingness to use tele-technology as a tool to monitor their disease. It will also determine the effect of patients' demographic characteristics, diabetes type and ability to access the internet on their willingness to use tele- technology. The study will also identify patients' expectations from an internet-based self-management system supported by tele-technology.

## **Materials and Methods**

### **Study setting**

The study was conducted at a 112 bed hospital of the Ministry of National Guard Health Affairs (MNGHA) in the Eastern region of the Kingdom of Saudi Arabia (KSA). It is considered one of the leading hospitals in the Eastern region due to the international accreditation from the Joint Commission for International Accreditation (JCIA). The hospital provides services in General Surgery, Internal Medicine, Gastroenterology, Pediatrics, Obstetrics and Gynecology, Family Medicine, Ophthalmology, Dentistry, Endocrinology, Orthopedic Surgery, Pulmonary and

Neurology. The division of Endocrinology provides inpatient and outpatient services in the general area of endocrinology and metabolic disease. The outpatient services provided by endocrinology include several clinics and in particular weekly diabetic clinics which are run with the help of a dietitian and diabetic educator to promote and assist diabetic patients in self-management of their disease.

### **Study participants**

All patients who attended the diabetes education outpatient clinic at MNGHA – Eastern region over a three month period were invited to participate in the study. A total of one hundred and forty nine patients aged 18 and over were invited to participate. Convenience sampling was used due to the accessibility of diabetic patients from within the diabetes education clinics. From the 149 patients invited to participate in the study, data were collected from 102 patients hence giving this study a response rate of 69%.

### **Study instrument**

This cross-sectional exploratory study utilized a questionnaire to collect data on patients' readiness and willingness to use tele technology in the self-management of their diabetes. Several studies on assessing willingness and readiness for self-management of chronic diseases were reviewed and a modified version of the Buysse et al questionnaire was used in this study [22]. The final version of the questionnaire consisted of 22 items under 6 domains including patient demographic data, internet accessibility, quality of information received from the physician, self-management habits and patients' willingness to use tele technology through an internet based self-management system. Patients were also asked about their expectations from an online self-management system. The questionnaire was created in English and piloted to ensure clarity and consistency between survey items. To ensure face and content validity of the survey instrument, the survey was sent to a group of experts for commenting. The expert panel which consisted of health professionals, a dietitian and a health informatician reviewed the contents of the survey in terms of content accuracy, clarity and comprehensiveness and whether or not the survey met its objectives. As a result, the phrasing of some questions were modified and format was edited for clarity and comprehensibility. The questionnaire was then translated to Arabic and back translated to English to ensure accuracy of translation. The final version of the survey was distributed to the patients attending the diabetic education clinic. The purposes of the study were explained to the participants and certain concepts such as tele-technology, self-management and internet were explained to the patients to ensure complete understanding of specific terms.

### **Data analysis**

Data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 17.0 for Windows. Data were analyzed using descriptive statistics for demographic variables and Chi-Square and Monte Carlo exact tests to examine the relationship between certain demographic variables and patients' willingness to use tele-technology through an online self-management system. All *p* values quoted are two sided; with an alpha level set at 0.05.

## Research approval

Research approval was granted by the University Scientific Research Committee in King Saud bin AbdulAziz University for Health Sciences in September 2012 and by the National Guard Health Affairs Hospital – Eastern Region in April 2012

## Results

There were more female patients than males in the study with ages ranging between 18 and over 50 years. As shown in Table 1, almost all of the participants were Saudi nationals and more than half of the participants had a secondary education or higher. Nearly half of the patients had Type 2 diabetes and the majority of patients were diagnosed with diabetes as adults.

Figure 1 shows that the majority of patients evaluated the quality of information they received from their doctor highly and reported that their questions were always answered sufficiently. In terms of their diabetes self-management habits, a high percentage reported that they measured their blood sugar levels at home and only half reported doing so regularly (46%). Of the patients who reported using a method to document their self-management, almost all (95.3%) reported using a paper diary as their current method for documentation.

**Table 1:** Demographic Characteristics of the Study Participants

<i>Characteristic</i>	<b>Frequency(N)</b>	<b>(%)</b>
<b>Age</b>		
18 – 28 years	14	14.7
29 – 39 years	35	36.8
40 – 50 years	20	21.1
51 + years	26	27.4
<b>Gender</b>		
Male	43	44.8
Female	53	55.2
<b>Nationality</b>		
Saudi	90	95.7
Non-Saudi	4	4.3
<b>Marital Status</b>		
Single	12	12.5
Married	81	84.4
Widow	3	3.1
<b>Education Level</b>		
Read and write	18	18.9
Primary	12	12.6
Intermediate	10	10.5
Secondary	30	31.6
College/University	25	26.3
<b>Family Income Per Month (SR)</b>		
< 5,000	14	17.1
5,000 -	49	59.8
10,000 -	14	17.1
15,000 +	5	6.0

<b>Occupation</b>		
Student	8	8.3
Housewife	37	38.5
Employed	36	37.5
Retired	11	11.5
Others	4	4.2
<b>Diabetes type</b>		
Type 1	13	14.6
Type 2	41	46.1
GDM <sup>^</sup>	22	24.7
I don't know	13	14.6
<b>When were you diagnosed with diabetes?</b>		
As a child/teenager	10	11.4
As an adult	78	88.6
<b>Do you have access to the internet</b>		
Yes I have easy access	36	38.7
Yes, but it's hard to access	16	17.2
No, I don't have access	41	44.1
<b>How often do you use the internet?</b>		
Sometimes, once a month or less	22	42.3
Regularly, once a week or less	8	15.4
Often, (daily to few times per week)	22	42.3

<sup>^</sup> Gestational Diabetes Mellitus

A high percentage of patients showed willingness to use tele-technology (62%) however only (11.3%) indicated they would use such a system daily and over half indicated possibly using it once a week (53%).

Patients perceived that tele-technology will improve communication with their doctor (94%), help them understand their diabetes better (94%), and help them communicate with other patients (82.3%).

Further analysis was performed to explore the relationship between the participants' demographic characteristics (age, gender, social status, education level, family income, occupation, and diabetes type) and their willingness to use tele-technology to monitor their diabetes as displayed in Table 2. A statistically significant difference was found between patients' willingness to use tele-technology and the patient's age, educational level, occupation and diabetes type. There was no significant difference found between patients' willingness to use tele-technology and whether or not they had previously used a method to document their diabetes ( $p=0.513$ ), however, patients who had access to the internet were significantly more likely to perceive using tele-technology to monitor their diabetes  $p\leq 0.001$  than patients who did not have internet access.

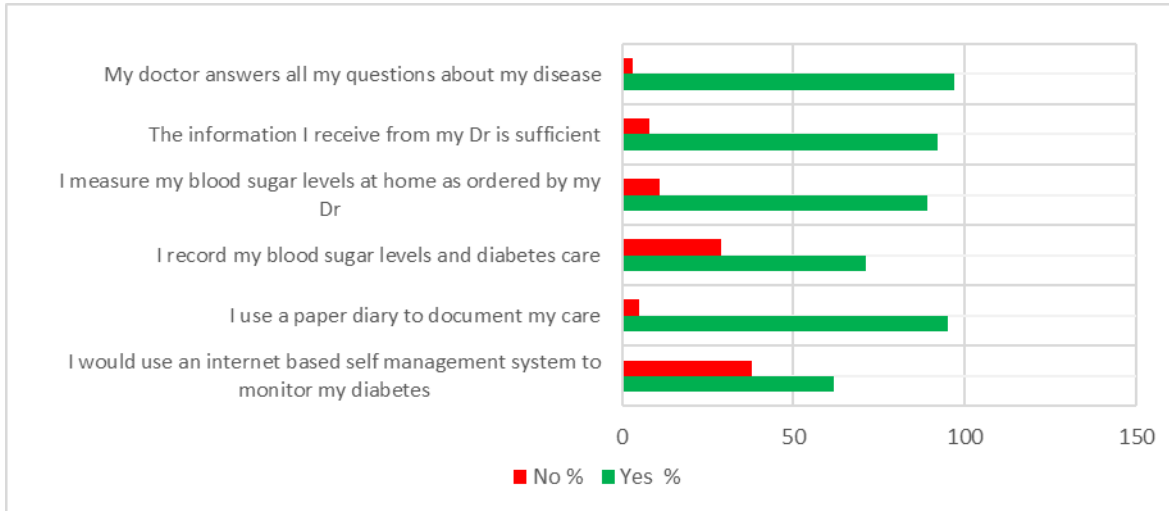


Figure 1: Patients' self-management habits and willingness to use tele-technology

Table 2: Relationship between Patients demographic characteristics and their willingness to Use Tele-Technology

Characteristics	Would you use an internet-based self-management system to monitor your diabetes?				Total		Test of Significance
	Yes		No		N	%	P Value
	N	%	N	%			
<b>Age</b>							
18 – 28 years	14	100	0	0	14	100	<b>.006*</b>
29 – 39 years	22	66.7	11	33.3	33	100	
40 – 50 years	9	45	11	55	20	100	
51 + years	13	52	12	48	25	100	
<b>Education Level</b>							
Read and write	3	16.7	15	83.3	18	100	<b>.000*</b>
Primary	4	33.3	8	66.7	12	100	
Intermediate	6	66.7	3	33.3	9	100	
Secondary	23	82.1	5	17.9	28	100	
College/University	21	84	4	16	25	100	
<b>Occupation</b>							
Student	8	100	0	0	8	100	<b>.003*</b>
Housewife	15	41.7	21	58.3	36	100	
Employed	27	77.1	8	22.9	35	100	
Retired	6	60	4	40	10	100	
Others^	2	50	2	50	4	100	
<b>Diabetes Type</b>							
Type 1	13	100	0	0	13	100	<b>.006*</b>
Type 2	25	62.5	15	37.5	40	100	

GDM*	12	57.1	9	42.9	21	100
I Don't Know	4	33.3	8	66.7	12	100

● Gestational Diabetes Mellitus

\*Significant at  $P < 0.05$

## Discussion

This descriptive study has explored diabetic patients' willingness to use tele-technology to self-monitor and manage their diabetes. The majority of patients in the study were in favor of using such technology whilst only about one third of patients indicated reluctance to self-monitor their diabetes using technology. These results are supported by other studies where asthma patients were very interested in using tele-technology to monitor self-management [7]. In our study, of the patients who were willing to use the technology only a small number were willing to use it daily while more than half were willing to use the technology once a week. Effective diabetes self-management is an important element in the overall management of diabetes and is crucial in ensuring optimal health outcomes. The reasons for reporting a willingness to use the technology only once a week in this current study raises new concerns into the lack of awareness for the importance of daily monitoring of blood glucose levels in diabetics especially since our results also showed that although patients measured their blood glucose at home, less than half did it regularly. Our results further indicated that certain demographic characteristics determined patients' willingness to use the technology. Patients' age, level of education, occupation, diabetes type and internet access were all found to be significantly associated with their willingness to use the technology whilst gender, marital status, monthly income and previous use of diabetic care documentation were not. These results are supported by other studies where patients who had higher literacy levels were more likely to self-manage diabetes [23] and were willing to use tele-monitoring platforms to monitor and transmit their glycemic data [24]. However our results contradict other study results which showed that age, educational level and socioeconomic status were not associated with patients' willingness to use technology in self-management of asthma patients [8]. These differences may be due to cultural differences in our population where demographic characteristics may actually influence behavioral changes, motivation and efficacy in the management of chronic illnesses [25,26].

The current study also explored patients' perceived expectations from using an internet based self-management system. The majority of patients expected the system to help them with diabetes management, enhance their understanding of the disease, and improve communication with healthcare providers and mutual support from their peers. However, other research found that patients were less interested in using the technology for "mutual support" from other patients and were more inclined to use it to contact their healthcare providers only [8]. Again, these differences may be due to the cultural differences in this population.

## Limitations

This study had several limitations including the descriptive cross-sectional design of the study and the sampling technique used. Patients who are willing to use the technology may have been more motivated to participate in the study than those who were not and therefore the results cannot be generalized to the whole diabetes population. In addition, the population of the Eastern region of Saudi Arabia may be culturally different to the rest of the Saudi population, as different regions within the kingdom have culturally specific practices. Furthermore, patients' perceived



willingness to use the technology was measured by a self-reported single item survey. However, this study was seen as a preliminary investigation into the potential readiness and willingness to use technology for self-management of diabetes and possible other chronic diseases in Saudi Arabia and despite these limitations, the results from this preliminary study should not be ignored as they provide us with baseline results which will inform further in-depth qualitative research in this area. Further research should also look into different regions within the kingdom to provide a better generalization for the use of tele-technology in Saudi Arabia.

## Conclusions

This study has revealed positive willingness from diabetic patients to use tele technology as a tool to monitor and self-manage their disease. Patients' gender, marital status, monthly income and previous documentation of diabetic care did not influence their willingness to use the technology however factors such as education, occupation, diabetes type and internet access did. Certain demographic factors cannot be changed in a population however, this study also revealed that a vast percentage of patients in this population do not access the internet and for the introduction of such technology to be effective, infrastructure needs to be improved and patients educated on how to use it. This is crucial before implementation of any tele-technology. Furthermore, particular care should be taken to educate patients and raise awareness on effective self-management of this chronic condition.

## Financial Disclosure

The authors have no financial disclosures

## Conflict of Interest

The authors have no competing interests

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