Are Malaysian Diabetic Patients Ready to Use The New Generation of Health Care Service Delivery? A Telehealth Interest Assessment

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Abstract

Background: The idea of launching an internet-based self-management program for patients with diabetes led us to do a cross-sectional study to find out about the willingness, interest, equipment, and level of usage of computer and internet in a medium- to low-social class area and to find the feasibility of using e-telemonitoring systems for these patients.

Methods: A total of 180 patients with type 2 diabetes participated in this study and fulfilled the self-administered questionnaire in Diabetes Clinic of Primary Medical Center of University Kebangsaan Malaysia Medical Centre; the response rate was 84%. We used the universal sampling method and assessed three groups of factors including sociodemographic, information and communication technology (ICT), willingness and interest, and disease factors.

Results: Our results showed that 56% of the patients with diabetes were interested to use such programs; majority of the patients were Malay, and patients in the age group of 51–60 years formed the largest group. Majority of these patients studied up to secondary level of education. Age, education, income, and money spent for checkup were significantly associated with the interest of patients with diabetes to the internet-based programs. ICT-related factors such as computer ownership, computer knowledge, access to the internet, frequency of using the internet and reasons of internet usage had a positive effect on patients' interest.

Conclusion: Our results show that among low to intermediate social class of Malaysian patients with type 2 diabetes, more than 50% of them can and wanted to use the internet-based self-management programs. Furthermore, we also show that patients equipped with more ICT-related factors had more interest toward these programs. Therefore, we propose making ICT more affordable and integrating it into the health care system at primary care level and then extending it nationwide.

Keywords: Healthcare delivery, healthcare services, self-assessment, type 2 diabetes, telehealth

Introduction

One of the main causes of premature death in patients with diabetes is its complications that can mostly be avoided. Research shows that the prevalence of type 2 diabetes is remarkably increasing (1). Furthermore, World Health Organization (WHO) reported that diabetes will increase by approximately 42% in developed countries and 170% in developing countries. In addition, WHO report also states that in Asia, there will be a 3-fold increase in the disease prevalence and incidence of diabetic complications (2). Therefore, owing to the major health problems caused due to diabetes, we need strategies and innovative ways that need to be tested and challenged with to overcome the complications of diabetes.

To deal with such issues in human health care system, we need to develop new technologies and bring up new solutions. Integrating information and communication technology (ICT) with public health promotional strategies is an idea that may help health care providers in serving patients with diabetes more effectively and with low-cost applications (3). Malaysia, with the present and future ICT potential and infrastructures, is an ideal location to carry out such studies. To launch an internet-based program, knowing the prevalence of people's interest and willingness toward these programs and also gathering information related to their sociodemographic, equipment, and availability of computer and internet was highly essential. We tried to focus on the interest and willingness of diabetic patients towards internet-based self-management program in Malaysia.

Diabetes in Malaysia

In 1986, Malaysia's National Health and Morbidity Survey (NHMS) reported the prevalence of diabetes mellitus as 6.3%. After 10 years, in 1996, the prevalence increased to 8.2%, and in 2006, it reached to 14.9%. According to WHO, Malaysia will have a total number of 2.48 million patients with diabetes in 2030 compared to 0.94 million in 2000, which will be a 164% increase in 30 years (4). In case of diabetes management, a research conducted in main government hospitals in Malaysia in 2005 showed that most patients with diabetes had not received adequate care (1). Another study in Peninsular Malaysia showed that most of the patients were not properly under control and therefore they encountered a high prevalence of diabetic complications. According to the researchers, increasing incidence of diabetes must be tackled with stringent efforts; otherwise the country might face difficulties in treating patients with diabetes and the disease complications (4). Therefore, diabetes, as an important health issue in Malaysia, needs to be revisited and implemented with new interventions and then take a broad and cohesive public-health approach to challenge with.

Internet-based telemonitoring systems

In the past decade, usage of internet by the people in health care issues has increased to a greater extent, which is expected to continue in the future. In 2002, a study in the United States showed that more than 100 million Americans had used internet for performing search regarding health, and this number increased to 130 million by the year 2003 (5). Getting information from the internet has often lead patients to make their health decisions. A survey in this regard, by the Pew Internet and American Life Project, found that 41% of the patients said that "the Internet affected their decisions about going to a doctor, treating an illness, or questioning their doctor" (3).

Internet-based home telemonitoring systems are capable of evaluating, recording, monitoring, and managing the health care information. Such revolutions allow the patient and their caregiver to be easily connected. Thus, this enables the patients to share their health information with their caregivers. Patients get benefitted from this enhanced way of controlling and managing their disease and allow them to self-monitor from their home. This feature can reduce the future problems of the disease as well as reduce time and money expenditure (6).

Increasing patients' access to their own electronic medical records represents a new frontier in diabetes management. Web-based informatics programs create the potential to provide individuals with secure and convenient access to their personal medical information. Computer informatics systems have the ability to collect, analyse, and present clinical information to caregivers efficiently and to track the overall care of a population. In this method, the patient can enter his medical data into the system running in his home computer (PC), and if he has any questions, s/he can phone or e-mail the clinician who can view the data using a special software on his/her computer. Such special softwares create an efficient way to gather statistics of population subsets using different criteria and track the important issues such as elevated blood pressure level, the number of prescribed medicines, or any other problems (7).

Internet-based technology has become very important for better access to self-care management, which associates high-quality information with different mechanisms for self-assessment, behavior change, decision support, as well as cost reduction, higher quality of care, and equity of access to health care. Considering the aging population, this technology can bring up a reliable response to the growing demand for care. Furthermore, internet-based self-management programs can surely change the way health care services deliver. The value of internet-based technology is considerable in distributing health care in any time and place and also promote access to health care information and services for people in remote areas.

Methods

This is a cross-sectional study to find out the sociodemographic factors, ICT-related equipment, level of computer and internet usage, and interest of patients with diabetes to use a telehealth monitoring system. This study was conducted in the Diabetes Clinic of Primary Medical Center of University Kebangsaan Malaysia Medical Center (UKMMC). This center is visited by 60,000 patients per year, 900–1 050 patients per month, and approximately 80% of these patients have chronic diseases, including diabetes.

In this study, 210 patients with type 2 diabetes in the age group of 18–70 years participated. These participants had in at least past six months attended the Diabetes Clinic in Malaysia. We performed a universal sampling method on patients who attended the Diabetes Clinic during the past 3 months of this study which was a

voluntary-based participation. The following were the inclusion criteria: patients in the age group of 18–70 years with type 2 diabetes, provide informed consent, and those who are literate. Mental diseases and illiteracy were the exclusion criteria. A brief explanation was given to every respondent. Patients who volunteered to take part in this study were given an informed consent form and questionnaire to be filled by them. Of them, 186 patients answered and returned the questionnaires, giving a response rate of 88%. Data analysis was performed using Statistical Package for Social Sciences (SPSS) software version 16. For descriptive statistical data, mean and standard deviations were obtained. t test and Mann–Whitney tests were used to test the association of normal and non-normal continuous variables with the factors related to the interest in patients with diabetes to use internet-based programs (IBP). Normality of the distribution of variables was checked using skewness and kurtosis graphs and plots. Chi-square test was used to determine the association between categorical variables and interest of patients with diabetes to use IBP.

Results

Sociodemographic characteristics of the respondents

The frequency and percentage of sociodemographic characteristics including age, sex, ethnicity, education, marital status, and income are shown in table 1. Majority of the participants belonged to the age group of 51–60 years old (39.4%) followed by 61–70 years old (28.3%) and 41–50 years old (22.2%). The percentage of male patients (54.4%) was slightly more than female patients (45.6%). Mean age of patients with diabetes was 54.3 years. In this study, majority of the population was married (89%), and the largest ethnic group was Malay (56%), followed by Chinese (32%), and Indians (12%) ethnicity. Majority of the patients with diabetes attended secondary level (50%) followed

by college or university level (29%), elementary level (14%), and technical institute (6%). Median score of income was RM 1 500 (1 Malaysian Ringgit = 0.32 $US).

Disease factors of the respondents

Table 2 shows the disease factors and characteristics of the respondents. Our results show that the majority of patients (85%) believed that their disease is under control. Only 3.9% believed that their disease was not under control, and 11% were unsure about their disease status. According to our assessment of number of visits among patients with diabetes for checkup, majority of them were referred to the Diabetes Clinic every 2–3 months (42.8%), followed by patients who visited the clinic every 6–12 months (28.3%). About 19.4% of these patients came every month or less for checkup. Majority (36.1%) of the patients spent 1 to less than 2 hours in each visit, followed by patients spending less than 1 hour (31.1%), 2 to less than 3 hours (28.3%), and finally, a small proportion of patients spent 3 to less than 4 hours or more in each visit. The median age of duration of diabetes was 6 years. The median amount of money that they approximately spent at each visit to the clinic was 10.0 Malaysian Ringgit with an interquartile range of 30.0.

ICT-related factors of the respondents:

Table 3 presents ICT-related factors. Our results show that 77% of patients had computer at home, at work, or both at home and work. About 70% of the patients had basic to advance knowledge of computer usage. More than half of the diabetic patients had access to internet at home or/and at work. Our results reveal that majority of patients (66%) use computer every day or often and 34% of them never use computer. Assessment of the reasons for using internet showed that more than half of the patients use internet for search purposes, online payment was the second reason, and e-banking was at the third reason. Furthermore, according to our analysis, a

Table 1: Socio demographic characteristic of respondent (n = 180)

	Groups	n	Percent (%)
Age (years)	18–30	4	2.2
	31–40	14	7.8
	41–50	40	22.2
	51–60	71	39.5
	61–70	51 Mean = 54.3	28.3 SD = 9.7

small proportion of patients also use internet for other purposes such as games and Facebook.

Interest and willingness of patients to use the internet-based self-management program

Results in table 4 show that majority of the patients (38.3%) had information about IBP for controlling their diabetes from before. About 48.9% were willing to use IBP to control their diabetes. About 47.8% liked to find out about new treatments using these kinds of programs. About 7.8% had seen such programs in the internet. About 27.8% liked to contact their doctors from home and 47.8% were not sure about contacting doctors from home. Answers regarding the question about their interest and expectations from this program gave the following results: 65.0% of patients liked to learn more about diabetes by using these kind of programs; 58.3% liked to see new drugs for controlling their diabetes; 58.3% liked to see new instruments; 32.8% liked to be able to e-mail their doctors to ask their questions; 26.7% liked to have online chat with their doctor and ask their questions; 47.2% liked to be able to see the history of their disease; 33.3% liked to visualise their progress with easy to read graphs and trends; 26.1% liked to meet other patients with diabetes within the community groups and discussion forums; 47.2% liked to share their statistics with their family, friends, or physicians; 32.2% wanted to get rid of that pen and paper log; and 42.8% liked to track and manage medications, food, and activity using these programs. Interpretation rate was based on median (Median = 8 out of 16 questions) of the total answers in the Interest section of the questionnaire. Median of the total answers was also calculated. Answers equal to or more than median were defined as "interest," and answers less than median were defined as "no interest" to use internet-based self- management program. Our results showed that more than half (56.1%) of the patients with diabetes have interest to use such programs to control their diabetes.

Association between sociodemographic, disease, and ICT-related factors with interest

Tables 5–7 show the association between sociodemographic, disease and ICT-related factors, and interest toward an internet-based self-management program for diabetic patients. Our results show a significant association between age and interest ($P < 0.001$). Mean [standard deviation (SD)] age of the respondents was 56.89 (8.16) and 52.28 (10.25) years with poor interest and good interest, respectively. t value was 3.27 which show that respondents who had good interest in internet usage belonged to younger age group. Income of the patients was not normally distributed. Mann–Whitney test was used to test

Table 2: Disease factors of the respondents (n = 180)

	n	Percent
Diabetes under control		
No	7	3.9
Not sure	20	11.1
Yes	153	85.0
How often come for check up		
Every month or less	35	19.4
Every 2-3 months	77	42.8
Every 4-5 months	17	9.4
Every 6-12 months	51	28.3
Waiting time for check up		
Up to 1 hour	56	31.1
1 to less than 2 hours	65	36.1
2 to less than 3 hours	51	28.3
4 hours and more	8	4.4
	Median	**IQR**
Duration of diabetes (years)	6.0	7.0
Money spent for each visit (Malaysian Ringgit = 0.32 $US)	10.0	30.0

the association between patients' income and their interest, and we found a significant association between these two variables ($P < 0.001$). With respect to education, patients who attended primary level were about 15.4% and showed good interest in IBP, whereas patients who attended higher education such as college or university degree showed more interest in IBP (84.9%).

Assessment of computer ownership revealed that those patients who had computer both at home and at work had significantly more interest to use IBP (83.1%) ($P < 0.001$). Furthermore, access to internet both at home and at work brought more interest (84.7%). Computer knowledge, even at the basic or moderate levels, helped 77% of the patients to have good interest in IBP. As shown in the table, interest among patients who use

computer every day was high (83.7%). More than 80% of the patients who used internet for email, online bill payment, e-banking, information search, and other purposes had good interest to use IBP; there was a significant association between these factors and the patients' interest ($P < 0.001$).

Discussion

In this article, we studied the interest of Malaysian patients with diabetes for using the internet-based self-management program to control their type 2 diabetes by considering their sociodemographic factors, disease factors, and ICT-related equipment. Our results showed that overall 56.1% of the patients had an interest

Table 3: ICT factors of the patients (n = 180)

	n	Percent (%)
Computer ownership		
At home	6	3.3
At work	69	38.3
Both home and work	65	36.1
Not have	40	22.2
Access to internet		
At home	39	21.7
At work	7	3.9
Both home and work	59	32.8
Not have	75	41.7
Familiarity to computer		
Not at all	55	30.6
Basic	35	19.4
Moderate	60	33.3
Advance	30	16.7
How often use computer		
Never	61	33.9
Sometimes per month	12	6.7
Sometimes per week	21	11.7
Everyday	86	47.8
Internet use for		
E-mail	90	50.0
Online bill payment	46	25.6
E-banking	40	22.2
Info search	94	52.2
Others	25	13.9

Table 4: Interest and willingness of patients about internet based programs (IBP) (n = 180)

	n	Percent (%)
Have info about IBP for diabetes		
Yes	69	38.3
No	111	61.7
Like to use IBP to control their disease		
Yes	88	48.9
No	43	23.9
Not sure	49	27.2
Like to use IBP to know new treatments		
Yes	86	47.8
No	44	24.4
Not sure	50	27.8
Ever seen IBP for diabetes control		
Yes	14	7.8
No	166	92.2
Like contact doctor from home		
Yes	50	27.8
No	44	24.4
Not sure	86	47.8
Patients expectations from IBP		
Learning more about diabetes.	117	65.0
See new drugs to control diabetes	105	58.3
See new instrument to control diabetes	105	58.3
Able to e-mail to your doctor and asking your questions	59	32.8
Online chat with your doctor and asking your questions	48	26.7
Able to see the history of your disease	85	47.2
Visualize your progress with easy to read graphs and trends	60	33.3
Meet other diabetics with community groups and discussion forums	47	26.1
Share your statistics with your family, friends or physicians.	85	47.2
Get rid of that pen & paper log, It's all online!	58	32.2
Track & manage meds, foods and activity	77	42.8

Table 5: Test statistics of sociodemographic, disease factors and the interest to use IBP (n = 180)

Factors		Interest				Association	P value
		Poor		Good			
		n	%	n	%		
Education	Primary	22	84.6	4	15.4	$\chi^2 = 36.97$	< 0.001
	Secondary	45	50.0	45	50.0		
	Technical Institute	4	36.4	7	63.6		
	College/University	8	15.1	45	84.9		
Age	Mean ± SD	56.89 ± 8 .16		52.28 ± 10.25		t = 3.27	< 0.001
Income		79	(43.9)	101	(56.1)	z = - 6.32	< 0.001
Money spent for every check up		7	9 (43.9)	101	(56.1)	z = - 4.46	< 0.001

P value of < 0.05 is considered significant.
Chi square test = χ^2, Mann Whitney's test = z,   Independent t test = t.

toward using such programs. This percentage was approximately close to the results of the study by Feil (8), who conducted an internet-based self-management program and found that of the eligible patients, 60% participated in the program.

In patients with diabetes, sociodemographic factors showed that most patients were in the age group of 51–60 years, male, married, Malay

Table 6: Association between ICT Factors and Interest to IBP (n = 180)

Factors		Interest to IBP				χ²	P
		Poor		Good			
		n	%	n	%		
Computer ownership	At home	3	50.0	3	50.0	46.76	< 0.001
	At work	31	44.9	38	55.1		
	Both	11	16.9	54	83.1		
	Not have	34	85.0	6	15.0		
Internet access	At home	12	30.8	27	69.2	48.77	< 0.001
	At work	3	42.9	4	57.1		
	Both	9	15.3	50	84.7		
	Not have	55	73.3	20	26.7		
Computer familiarity	Not at all	48	87.3	7	12.7	64.35	< 0.001
	Basic	13	37.1	22	62.9		
	Moderate	14	23.3	46	76.7		
	advance	4	13.3	26	86.7		
Frequency of using the computer	every day	14	16.3	72	83.7	62.68	< 0.001
	Sometimes per week	10	47.6	11	52.4		
	Sometimes per month	5	41.7	7	58.3		
	Never	50	82.0	11	18.0		

Table 7: Association between ICT Factors and interest to IBP (n = 180)

Factors		Interest				χ²	P
		Poor		Good			
		n	(%)	n	(%)		
Using internet for email	Yes	16	17.8	74	82.2	49.83	< 0.0001
(% within use internet for email)	No	63	70.0	27	30.0		
Using internet for online bill payment	Yes	11	23.9	35	76.1	10.01	0.002
(% within Internet use for online bill payment)	No	68	50.7	66	49.3		
Using internet for e-banking	Yes	7	17.5	33	82.5	14.54	< 0.0001
(% within Internet use for e-banking)	No	72	51.4	68	48.6		
Using internet for Search information	Yes	15	16.0	79	84.0	62.32	< 0.0001
(% within Internet use for search information)	No	64	74.4	22	25.6		
Using internet for other purposes	Yes	5	20.0	20	80.0	6.72	0.010
(% within Internet use for other purposes)	No	74	47.7	81	52.3		

ethnicity, in secondary level of education with median of income RM 1 500. Among these factors, age, education, and income were significantly associated with their interest in IBP ($P < 0.001$). Therefore, younger age and higher education with higher income were the factors for more interest toward internet-based self-management program.

Results of ICT-related factors showed that 77% of the patients had personal computer, which is a high computer ownership in this social class. The rate of computer ownership found in this study was more than the benchmarking stated in World Competitiveness yearbook 2008 (9) that mentioned 262 computers per 1,000 people in Malaysia. More than half of the patients had access to internet at home or/and at work. Our results agree with the World Competitiveness yearbook 2008 (9) that announced 56% of the population access to the internet in Malaysia. In this study, 70% of the sample population were familiar with computers at different levels, that is, from basic to advance. Feil (8) showed that even among new internet users, the interest toward an internet-based self- management program was high and for using the IBP, even basic knowledge of the computer is enough. Majority of the patients (64%) used computer every day or often. The following four factors were significantly associated with patients' interest: patients with computer ownership, more knowledge of computer, more often usage of computer, and more access to the internet had more interest to IBP ($P < 0.001$). Consequently, the ICT-related equipment would be enough to launch an internet-based pilot program for diabetic patients' self-care management.

Assessment of the reasons for usage of internet showed that more than half of the patients used the internet mostly for performing search followed by online payment and e-banking. All of these reasons were significantly associated with interest ($P < 0.001$). In contrast, Glasgow (10) found no significant differences between participants' interest and computer familiarity. Searching information by most of the patients can support their interest toward such program, and it will be a reason to support launching this program for patients with diabetes.

Among factors related to the disease, results showed that the majority of the patients had diabetes in a median of 6 years, perceived that their diabetes is under control, came to the clinic every 2–3 months, spend 2 hours' of time for checkup, and spend around 10 Ringgit Malaysia for each visit. Among these factors, money spent for each visit was significantly associated with interest ($P < 0.001$), which shows that patients who spent more money had more interest to use IBP. In contrast, Glascow (10) found that there were significant differences in age and duration of diabetes, and IBP users were slightly younger and had diabetes for a fewer number of years than non-users.

Considering our results, there is potential for Malaysian patients with diabetes to use internet-based diabetes self-management programs. Patients and caregivers always seek an appropriate and convenient access to the health care services because the service costs are important. ICT can offer convenient access and support to patients with diabetes by self-management programs (11). Although ICT cannot replace health care professionals but it has the ability to produce greater efficiencies in health care delivery system and makes human interventions more productive (12). This research provides justification for the cooperation between ICT and diabetes self-management programs. The evidence that are currently available on most of the key issues of internet-based self-management programs such as implementation and long-term results of ICT usage in diabetes control is not enough to make decision on investment on this technology in Malaysia.

Conclusion

The information from this research shows that the interest for internet-based self-management program in Malaysia is more than 50%. Furthermore, assessing the association of three groups of factors including sociodemographic and ICT and disease-related factors, we found that ICT-related factors were the strongest ones related to interest in program. This issue can be considered as the first step in providing such programs that are clearly more cost-effective and less time and money consuming for patients with diabetes, whose number is increasing dramatically as per WHO prediction (13,14).

Moving health care from hospital to the home care needs technology, equipment, and support which combine patient education and lifestyle to encourage self-care management. Future research is needed to individualize the patient-centered technology and training the doctors and nurses to work with such kind of programs (14).

Considering Malaysia's government strategies for vision 2020 and expanding E-government strategies and improvement of

internet access in the country, internet access will go up very fast in the near future; thus, internet-based health care programs can find their way accordingly. It is suggested as a federal strategy to enhance and enable internet diffusion for potential social good and value in controlling costs in health care. Subsidizing the cost of computer devices and internet connection for patients with diabetes will increase the prevalence of computer ownership among them and will create the opportunity to use a new generation of health care service delivery.

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