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Readiness of Diabetics to Use the Internet and Mobile Services: The Case of a Large City in a Middle-income Country

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Abstract

Objective: To determine the potential of providing health-related services on the Internet or via mobile phones to diabetic patients in a large city in Iran, a middle-income country.

Background: Diabetes mellitus (DM) is increasing worldwide, especially in developing countries, as a consequence of urbanisation, which is associated with risk factors for diabetes such as physical inactivity and high sugar and fat diets. The use of the Internet and mobile services is increasing worldwide. Independent use of the Internet and mobile technologies by patients could be a key step towards self-care management of DM.

Methods: A two-part validated questionnaire was completed by patients who attended one of two diabetic clinics for a routine check-up. The first part consisted of 16 demographic-related items. The second part contained 26 items about the specific use of the Internet and mobile services to access information.

Results: In total, 407 questionnaires were completed. The results showed that 108 (26.5%) of the respondents had routine access to the Internet, of which 95.4% had routine access to mobile services and 77.8% were positive about using an official Iranian website for medical information. However, 55% of the respondents preferred to obtain health-related information from television, radio, and educational films.

Conclusions: The data suggest that the diabetic patients who used the Internet in this study were willing to receive educational material via the Internet. However, many still preferred traditional sources of health-related information. The findings indicated that our future effort in self-care management should focus on early technology adopters to increase the penetration rate of technology in the field of health care.

Keywords: Readiness; Internet use; Mobile services; Diabetic patients; Iran

Introduction

Internet and mobile services for personal health, such as WellDoc, a mobile-based diabetes management software system 1], appeal both to patients and healthcare providers due to their potential to quickly reach a targeted population and disseminate relevant information. In addition, they offer the possibility of self-management interventions for chronic diseases, such as diabetes, with resulting marked improvements in clinical parameters, such as glycosylated haemoglobin (HbA1c) and blood glucose levels [1,2]. The use of the Internet and mobile phones for health-related purposes is increasing rapidly worldwide, as well as in Iran [3]. However, easy access to health-related information or services via the Internet and mobile phones does not ensure that patients are well prepared to receive either information or medical care in a new way other than the traditional visit to the physician or laboratory.

The prevalence of diabetes mellitus (DM) is increasing in Iran and worldwide, especially in developing countries [4,5]. Research indicates that the increased incidence of DM is a consequence of urbanisation, which is associated with increased physical inactivity and consumption of high sugar and fat diets, both strong risk factors for diabetes [6]. This study examined the readiness of diabetic patients to utilise the Internet or mobile phones to obtain health-related information. The aim of this study was to determine the potential usefulness of developing health-related Internet- and mobile phone-based services for diabetic patients in a large city of a middle-income country, such as Iran. This is the first in a series of studies aimed at bringing medicine and modern information communication technology closer together for the benefit of diabetic patients in Iran.

The World Health Organisation and International Diabetes Federation estimate that the global number of patients with type 2 DM (T2DM) today exceeds 370 million and will almost double by 2030 [7,8]. About 80% of all people with diabetes are living in low- and middle-income countries [7]. Cardiovascular diseases account for 50-80% of deaths in people with T2D, and the number is expected to rise [8]. In Iran, the incidence of T2D has been rising, and it is

estimated that 24% of Iranians over the age of 40 suffer from the disease, with an increase of 0.4% per year after the age of 20 [9]. For these reasons, T2D has become a major cause of premature illness and death in most countries, and it is predicted to become a leading cause of death by 2030 [7,8]. Thus, new tools and strategies to counteract T2D and its complications are urgently needed.

The independent use of the Internet and mobile technologies by patients is a key step towards self-care management of the disease. Self-management is an important disease-prevention strategy, which could improve the quality of life of many people [10]. Previous research has shown that patients who use self-monitoring techniques, including monitoring their food intake, physical activity, and glucose levels, have better control of their disease than those who do not use such techniques [10], although there is conflicting evidence in this area [11].

For technology to be effective in changing the quality of life of T2D patients, it should follow a rigorous patient education regimen. Patient education enables patients to make informed decisions about health-related behaviours. Behavioural change is a complex process, in which the patient has to relearn specific health-related activities, such as food intake and physical activity [12]. Patients obtain information about their illness from different sources [13]. With the ready availability of new technologies, access to such information has increased [14]. However, mere knowledge or access to health-related information does not bring about changes in health-related behaviours. Patients need to have access to trustworthy educational material to learn effective self-care management skills [15].

Today, the patient is widely accepted as an active partner in improving health care, and not just a passive receiver of diagnostic testing and medical treatment [16]. Given that patients are seen as active partners in their health care, the accuracy of health-related information on the Internet is important [16]. According to statistics collated by the Internet World State in January 2012, about 42-million Iranians (53.3% of the whole population) used the Internet, whereas there were only 250,000 Internet users in 2000. This shows the rapid growth in the use of the Internet in the Iranian population [17]. However, there is a digital divide in access to technology in Iran. A digital divide defines the gap between individuals who have and those who do not have access to modern information and communication technologies (e.g. television, computers and the Internet). It is of national and general interest to examine, through this study, the potential impact of the Internet on self-care management patterns of T2D patients in the future. To the best of our knowledge, this topic has not been the focus of former studies in Iran. The present study also examined the readiness of T2D patients in Iran to use the Internet and mobile services to obtain access to health-related services and evaluated what technologies they most commonly used to access this information.

Materials and Methods

This study used a validated questionnaire that was previously employed to collect similar data on patients with gastrointestinal diseases [3]. The contextual information was changed to suit T2D. To check the validity of the questionnaire, 10 experts in the field of medical education and training programs and an endocrinologist checked the questionnaire and made small changes to it. The questionnaire was tested and adjusted in a pilot study using a sample of 30 patients. The interpretation and comprehensiveness of the instrument were tested. The content validity and reliability were also calculated. Based on a report by the Internet National Development Management Centre in Iran (www.matma.ir/en), at the time of the study, the largest group of Internet users were those aged 20-60 years. Therefore, this questionnaire was piloted using diabetic patients within this age group.

The questionnaires were completed between March and September 2014 by patients who were admitted to two outpatient diabetic clinics as referrals or for routine check-ups. One diabetic clinic was located in a university-affiliated hospital, which admits referral patients from different health centres. The other was a private outpatient diabetic clinic, with about 7000 patients. The patients were briefed about the study and its ethical implications. All the patients who consented to volunteer for this study received information about the objectives of the study and of the questionnaire. The ethical committee of Mashhad University of Medical Science approved the study (No: 94/89960).

Mashhad has a population of 2.7 million and a prevalence of T2D of 5% [9]. Thus, it was estimated that there are 170,000 T2D patients in Mashhad. The sample size for the study was calculated as follows: sample size n=[DEFF*Np (1-p)]/[(d2/Z21-α/2*(N-1)+p*(1-p)], with a margin of error of 0.05, t=1/96 and p ≤ 0.05%. The resulting sample size was 376 patients [18]. A final sample size of 450 was selected by foreseeing a dropout rate of 20%.

Diabetic patients who were within the studied age group and had the ability to answer the questions were recruited while waiting to see their physician in the clinic. Trained nurses administered and completed the questionnaires for the patients. The questionnaire had two parts. The first part consisted of 16 items, which covered demographic-related information, such as gender, age, place of residence for the past 6 months, education level, occupation, type of diabetes and its duration and information gathering on the disease. The items in the questionnaire were scored using a 4-point Likert scale, as follows: 1=very little, 2=little, 3=to some extent and 4=to a large extent.

How much do you know about diabetes? What level of information would you like to have about diabetes? Would you like to have access to information about diabetes-related complications?

Have you ever received any information about diabetes other than from your doctor? Which information resources did you use? Which resources would you prefer to use?

Do you have access to the Internet through others (e.g. work, friends or family? Do you have access to the Internet at home?

In the first part of the questionnaire, if the patients answered that they routinely obtained information from the Internet, they were asked to complete the second part of the questionnaire. The second part contained 26 items about their specific use of the Internet and mobile services to access information. It also contained an open question: Do you have any further comments? The data were analysed using SPSS software version 22.

Results

General patient information

The nurses administered 450 questionnaires during the interviews. Forty-three questionnaires were dropped because the patients' age was outside the selected age range or because they were incomplete. Of the remaining 407 questionnaires, 93 (23%) valid questionnaires were

completed by patients at the outpatient diabetic clinic of a large educational hospital, and 314 (77%) were completed by patients at the private outpatient diabetic clinic.

The age range of the patients was 20-60 years. The mean was 47 years, and the median was 50 years. Most of the patients were aged 51-60 years (46.7%, n=190) years, and fewer patients were in the 20-29-year-old age group (6.1%, n=25). Among the participants, there were 254 (62%) women and 153 (38%) men. In the last 6 months, 372 (91%) lived in the central province, and the others came from other cities or rural areas around the province. In the study group, 158 (39%) had less than a high-school education, 145 (36%) had finished high school, 40 (10%) had a 2-year university education, and 63 (15%) had a university degree.

Half (50%) of the patients were homemakers, 62 (15%) were employed but did not specify what job they had, 59 (14%) were retired, 40 (10%) were freelance workers, 37 (9%) did not clearly specify any employment, and 5 (1%) did not reply to this question. Three hundred and six (75%) suffered from T2DM, 33 (8%) had type 1 diabetes, 11 (3%) had pregnancy-related diabetes, 47 (11%) did not know which type of diabetes they had, and 9 (2%) did not reply to this question. The duration of the disease was less than 1 year in 35 (9%) patients, 1-3 years in 86 (21%) patients, 3-5 years in 75 (18%) patients, 5-10 years in 107 (26%) patients and more than 10 years in103 (25%) patients.

Responses to diabetes-related questions

A number of questions related to patients' knowledge of diabetes and their perceptions of the disease. Four hundred and one (99%) patients responded to these questions. Among those, 223 (55%) stated that they had very little or little knowledge about diabetes, and 140 (34%) reported that they were informed (Figure 1).

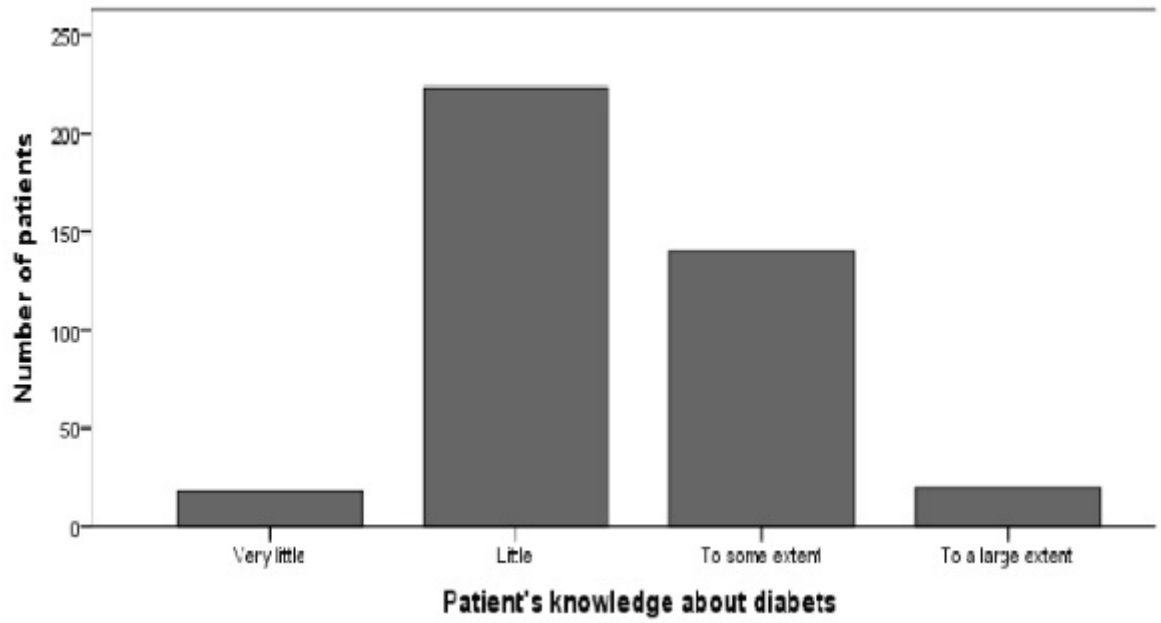

Figure1: Bar graph showing patient's knowledge about diabetes.

Of the 407 responders, 373 (92%) were willing to obtain information about the disease and to learn more about nutrition (n=218, 54%), diabetes treatment (n=188, 46%), side effects of medications (n=142, 35%) and genetic links to the disease (n=118, 29%) (Table 1).

Subjects No. (%)	Cause of diabetes	Treatment	Diet	Physical activity	Complication	Prevalence	Drugs Complication	Genetic links
To a large extent	159 (39)	188 (46)	218 (54)	183 (45)	158(39)	128 (31)	142(35)	118 (29)
To some extent	188 (46)	179(44)	160(39)	182 (45)	198 (49)	208 (51)	209 (51)	205 (50)
Little	30 (8)	15 (4)	11(3)	16(4)	19(5)	36(9)	23(6)	50 (13)
Very little	-	-	-	1(0.2)	2(0.5)	3(0.7)	2(0.5)	-

No response	30(7)	24(6)	17(4)	25(6)	30(7)	36(9)	31(8)	34(8)

Table 1: Patients' preferences about diabetes-related information.

Three hundred and one (74%) patients mentioned that they used sources other than their doctor sfor obtaining information about the disease. With regard to the patients preferred methods of obtaining additional information about their disease, the majority of the patients stated that they would like to have access to more information via face-to-face courses and the Internet (Table 2).

	Sources of information	Preferred sources of information
TV, radio and educational films	225 (55%)	225 (55%)
Books, magazines and pamphlet	149 (37%)	98 (24%)
Information in physical courses	97 (24%)	179 (44%)
Internet	67 (16%)	94 (23%)
Others	63 (15%)	36(9%)

Table 2: Actual and preferred sources of diabetes-related information.

Responses related to internet use

In this study, just 108 (26%) patients responded that they had personal access to the Internet, and 130 (32%) had access to the Internet through family members. Of those with personal access to the Internet, 44 (41%) were female, and 64 (59%) were male. The male patients had greater access to the Internet than the female patients, and younger patients had more access to the Internet than older ones. The self-estimated level of knowledge about diabetes increased according to the duration of the disease and the patient's education level ($p<0.05$). There was no statistically significant relationship between the self-estimated level of knowledge about diabetes and gender. There was also no statistically significant difference between the two different clinics in terms of access to the Internet. Eighty of the 108 patients who used the Internet stated that they had been using the Internet for an average of 6 years. Ninety-nine (92%) had access to the Internet from home, 35 (32%) had access from the workplace, and only 6 (6%) had access through a mobile phone. One hundred and one (94%) were aware that they could use the Internet to obtain information about their disease. With regard to the level and type of Internet usage, 45 (42%) reported daily use, 40 (37%) reported weekly use, and 11 (10%) reported monthly use. Fifty-eight (54%) of the respondents had a personal email address. Of those, 23(21%) checked it daily, 20 (19%) checked it weekly, and 12 (11%) checked it monthly. Twenty-seven (25%) had experience of using chatrooms. One hundred (92%) of the Internet users had access to mobile phones and sent and received SMS messages. The majority (91%) of the respondents stated that they would like to receive educational materials through a mobile phone.

Issues related to internet use

Of the 108 Internet users, 103 (95%) had experience of searching the Internet, and 20 (18%) reported difficulty in searching the Internet. Patients with a higher level of education accessed the Internet more often than those with a lower level of education ($p<0.000$). Among the respondents who used the Internet, 92 (85%) used it to find general information, and 77 (71%) had searched specifically about diabetes.

Eighty (74%) of the Internet users perceived that the information on the Internet was reliable, and 28 (26%) thought it was unreliable. Fifteen (14%) reported that their doctor had referred them to the Internet to obtain further information about their disease. Among the Internet users, 87 (81%) obtained new information about diabetes on the Internet and then asked their physician more questions about the disease.

About one-half (n=56, 52%) of the Internet users mentioned that they asked their doctor to recommend a specific health-related website. Only 24 (22%) respondents used the Internet for medical consultation. Ninety (83%) of the Internet users were willing to receive educational materials via the Internet, and nearly all of those patients said they would find an educational website about diabetes useful.

At the end of the questionnaire, the patients were invited to add any comments they had about using the Internet and/or mobile phones to obtain diabetes-related information. Forty-nine (45%) of the participants responded to this question and provided short comments. Nineteen patients stated that a reliable Iranian site for diabetes-related information in Farsi would be beneficial. Eight patients stated that such information would only be helpful if it came from a trusted source. Seven patients mentioned that they could access information faster and easier using their mobile phones. Four patients stated that they would prefer that the information from the Internet was directly transmitted to their personal email. Four patients mentioned that it would be better to receive information by SMS or email to a specific mailbox. Three patients stated that their Internet connection was too slow. One patient mentioned that he would be willing to pay a premium for a reliable, fast Internet service, and another stated that Internet and mobile services are not reliable in Iran.

Discussion

In this study, the majority of diabetic patients who used the Internet on a regular basis were aware that they could obtain general information and medical information by using the Internet, and most considered that the information was reliable. These patients were also willing to access educational materials on the Internet. An earlier study

found that patients were unaware how to best use educational materials that were available on the Internet [13]. However, the present study did not investigate this issue. A previous study conducted in Iran reported that diabetic patients were not fully aware of potential diabetes-related complications [19]. The findings of the present study and those of earlier studies [19] suggest that utilising the educational materials that are available on the Internet is not easy and not without risks and that patients should be wary about using medical information without suitable medical guidance.

Much remains to be done in the area of patient education, which is an important part of the overall care of diabetes patients. According to previous research, to be beneficial to patients, patient-directed medical websites should contain good-quality educational material, which is easy to understand and pedagogically design [13]. As the Internet can easily be accessed today via computers or mobile phones, patients should be able to utilise the technology to contact experts for reliable information or better self-care management [20].

In the present study, Internet access varied between the genders, with the male participants having higher Internet access than the female participants. A similar difference was found in an earlier study in Iran [3]. This may be explained by males having a greater interest in the Internet or by them having greater access to the Internet in the workplace. In contrast to men, most married women in Iran do not work outside the home. Recent qualitative research on diabetic patients in Iran also demonstrated that, in addition to gender, other factors, such as a family history of diabetes and the level of education, can both act as facilitators and barriers to healthcare-seeking behaviour [21].

In the current study, the rate of Internet access increased as the educational level rose. This confirms the results obtained in another study performed in Iran [3]. The present study also showed that the duration of the disease (i.e., the longer the patients had the disease) was associated with the likelihood of a patient seeking diabetes-related information from a source other than their doctor. The results suggest that patients with a higher level of education find it easier to access the Internet to obtain health-related information. They also suggest that such patients, in addition to those with longer disease duration, have a greater desire to utilise the Internet to access information from a non-traditional source (e.g. doctors/newspapers). The results also show that the awareness of diabetes among Iranian patients is moderate and mainly determined by their level of education and the duration of the disease.

Today, access to the Internet has changed the way we communicate, and the use of the Internet and/or mobile services in the management of chronic diseases is broadly accepted in industrialised countries. The Internet has become one of the most important resources for health and medical information, and the use of the Internet or mobile services has made a great impact on communications with patients [22,23]. A study performed in an Asian population showed that the majority of participants who received web-based interventions reported satisfaction with these intervention programs [24]. The same study found that they appreciated the speed of feedback, information and follow up on their trends of physical activity [24].

A report by the Internet National Development Management Centre found that the penetration of the Internet in Iran in 2012 was about 60% (www.matmas.ir/en). We expected to find a similar percentage of Internet users among the diabetic population in Iran. However, although this study was conducted in Mashhad, one of the largest cities of Iran, the average Internet access of diabetic patients aged 20-60 was low (26%). In contrast, recent research conducted under the auspices of the Digital Agenda for Europe showed that only 150-million (30%) people have never used the Internet and that adults not online felt less able to learn new skills [25]. The Digital Agenda for Europe aims to enhance digital literacy among these non-Internet users. In the present study, most of the patients preferred to obtain general and diabetes-related information from the television, radio and educational films. In this study, the majority of those who had access to the Internet were aware that they could obtain medical information using this medium, and many of those with Internet access perceived that this information was reliable. However, the Internet was not a preferred source of information by the participants in this research.

A study conducted in the U.S. showed that patients with a lower socioeconomic status were less likely than those with a higher socioeconomic status to engage with a number of communication technologies [26], demonstrating that a digital divide can occur even in a high-income, industrialised country. In another European study, 78% of older people who used the Internet felt that it improved their lives, 42% felt that the world would not be the same without the Internet, and 23% felt that it enhanced relationships [25]. The Internet allows for greater freedom of expression and brings democracy about in the Western world, as well as in Iran. As stated earlier, the findings of the present study showed that media, such as television or traditional face-to-face courses are preferred to the Internet. As larger numbers of people can be reaching via traditional media, it may be sensible to focus first on these media when aiming to promote patients' access to healthcare information. For example, radio programs, such as Radio Health, and the educational TV Life Channel, which is supported by the Iranian government, could be used to amplify patient education by directing non-Internet users to these media.

Although access to the Internet has increased in recent years in Iran, the results of this study showed that there was insufficient information available in Farsi. The lack of medical sites in Farsi may be a contributing factor to the low use of the Internet by diabetic patients. Similar to the findings of an earlier study [27], the present study found that the Internet was not a major medical resource for T2DM patients in Iran.

A local approach to the provision of patient information seems to be required in Iran. Research on the use of the Internet or mobile services in high-income countries, although useful, may be skewed and not applicable to low- or middle-income countries. To achieve the maximum benefits for patients, contextualised research would be preferable. Concentrating on early adopters could be another way of stimulating technology use in T2DM patients [28]. In this study, only a small percentage of the participating patients used the Internet to obtain medical information about diabetes or wished to use mobile phones to receive prompt health-related information. Focusing on creating health-related information for early adopters might enhance their self-care management. In turn, this group could motivate others to shift to a self-management approach through the use of the Internet. A small group of early adopter could function as a good example of empowerment.

Conclusions

In conclusion, most diabetic patients in this study were willing to receive educational material via the Internet. However, they preferred to use a Farsi website, and they favoured more traditional media, such as the television, radio and face-to-face courses. The penetration rate of

the Internet among diabetic patients was low, demonstrating that the Internet does not currently serve as a significant source of diabetes-related information. A different strategy to spread health-related information and encourage self-management care of diabetes could be to focus on 'off-line' media. However, technology advances quickly and is likely to supplant many traditional means of healthcare provision. Thus, in subsequent studies, we will focus on early technology adopters.

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