

# Investigating readiness to using Internet and mobile services of diabetic patients of a middle-income country

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## ABSTRACT

**Background:** Diabetes mellitus is increasing worldwide, especially in developing countries, as a consequence of urbanization. The use of the Internet and mobile service are increasing as well. The independent use of the Internet and mobile technologies by the patients could be a key step towards self-care management of the disease.

**Methods:** A validated questionnaire with two parts was used and was completed by patients who came to two diabetic clinics for routine checkup. The first part consisted of 16 items collecting demographics information. The second part contained 26 items about the specific use of the Internet and mobile services to access information.

**Results:** 407 questionnaires were completed. 108 (26,5 %) had routine access to Internet, of which 95,4 % had routine access to mobile services and 77,8 % were positive to the use of a Persian website for medical information. Yet, 55 % of respondents preferred to get information from TV, radio and educational courses.

**Conclusions:** Data suggest that most diabetic patients who use the Internet in this study were willing to receive educational material by the Internet. However, many still prefer traditional means of information. Our future research is going to focus on early adopters.

**Key words:** readiness, internet use, mobile services, diabetic patients, Iran

## 1. Introduction

Internet and mobile services for personal health, e.g. WellDoc, a mobile-based diabetes management software system (Quinn et al., 2008), appeal to patients and healthcare providers for the potential to quickly reach and spread targeted patient information. Besides, they offer the possibility to self-management interventions of chronic diseases like diabetes. They can have also significant improvement effects on patient's clinical parameters such as on glycosylated hemoglobin (HbA1c) and blood glucose (Kim & Kim, 2008). Internet and mobile phone use for health-related purposes therefore is increasing quickly worldwide as well as in Iran (Roshandel et al., 2005). Unfortunately, the prevalence of diabetes mellitus (DM) in Iran is also raising (Lotfi, Saadati & Afzali, 2014), as it is worldwide especially among developing countries (Ginter & Simko, 2012). Research indicates that this is a consequence of urbanization and its commodities (Cheema et al., 2014). Easy access to health-related information or services by the Internet and mobile phones does not however guarantee 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. This study reports on a survey study about readiness and access to Internet and mobile phones of diabetic patients. The scope is to understand whether it would be of any benefit to develop health-related services on the Internet or mobile phones for diabetic patients in a large city of a middle-income country like Iran. This is the first of a series of studies in which we want to understand how to bring closer medicine and modern information communication technology for the benefit of the diabetic patients in Iran.

The World Health Organisation and International Diabetes Federation estimate that the global number of patients with type 2 diabetes mellitus (T2D) today exceeds 370 million and will

almost double by 2030 (International Diabetes Federation),(World Health Organization). About 80% of all people with diabetes are living in low and middle-income countries. Cardiovascular diseases account for 50-80% of deaths in people with T2D and the number is expected to rise (World Health Organization). Also in Iran, the incidence of T2D has been rising, and it is estimated that 24% of Iranians over 40-year of age suffers from the disease, with an increase of 0.4% per year after the age of 20 (Azimi-Nezhad et al., 2008). For these reasons, T2D has become a major cause of premature illness and death in most countries and is predicted to become a leading cause of death by 2030. Thus, new tools and strategies to counteract T2D and its complications are highly needed.

The independent use of Internet and mobile technologies by the patients is a key step towards self-care management of the disease. This strategy retains a very high potential to fundamentally initiate prevention and change the quality of life of many people. Previous research has shown that patients who use self-monitoring techniques, including monitoring food intake, physical activity, and glucose levels, have better control of their disease (Jones et al., 2003). Even though contrasting evidence also exists (Pal et al., 2014).

For technology to be effective in changing the quality of life of T2D patients, it should follow a rigorous patient education regimen. Patient education is a process that enables patients to make informed treatment on health-related behaviors. Behavioral change for patients is a complex process, where the patient has to relearn the way to do certain health-related activities such as food intake and physical activity (Bellamy, 2004). Patients obtain information about their illness from different sources (Salo et al., 2004), and with the growing availability of new technologies, access to care has increased (Nahm et al., 2008). However, the mere knowledge or access to health-related information does not bring changes in health-related behaviors.

Patients should be made available access to trustworthy educational material to learn effective self-care management skills (McIlhenny et al., 2011). The accuracy of health-related information on the Internet is important as well (Pellisé & Sell, 2009). These days, the role of 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 (Pellisé & Sell, 2009).

According to statistics provided by the Internet World State in January 2012, about 42 millions of Iranians (53.3% of the whole population) used the Internet, while in 2000 only 250 thousand used the Internet. This shows the rapid grow of the use of the Internet in the Iranian population (Internet World Stats, 2014). However, the issue of a possible digital divide still remains. Digital divide defines the gap between individuals who have and those who do not have access to modern information and communication technologies. These technologies can include television, computers and the Internet. It becomes of national and general interest then to determine in the future what impact the Internet can have on self-care management patterns of T2D patients. To the best of our knowledge this has not been studied in Iran. However, to date it remains yet to determine if T2D patients in Iran are actually ready to use Internet and mobile services to get access to health-related services and evaluate how they access knowledge about their disease and in what proportion.

## **2. Materials & Methods**

The researchers used a validated questionnaire that has previously been used to collect similar data from patients with gastrointestinal diseases (Roshandel et al., 2005). The contextual information was changed to suite T2D. In order to check the validity, 10 persons, experts in the field of medical education and training programs as well as an endocrinologist, checked the questionnaire and small changes were made. The questionnaire was tested and adjusted in a pilot study by using a sample of 30 patients. We tested the interpretation and

comprehensiveness of the instrument. We also calculated face and content validity and reliability. Based on the report issued the Internet National Development Management Center in Iran ([www.matma.ir/en](http://www.matma.ir/en)), at the time of the study, the largest age group of Internet users were between 20 to 60 years of age; therefore, this questionnaire was piloted by 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 referral or for routine checkup. One diabetic clinic was located in a university-affiliated hospital which admits referral patients from different health centers. The other was a private outpatient diabetic clinic with about 7000 patients. Patients were briefed about the study and its ethical implications. All patients who consented to volunteer their participation in this study received also information about the objectives and questionnaire. The ethical committee of Mashhad University of Medical Science approved the study and issued ethical permission (No: 94/89960).

The prevalence of T2D in Mashhad was 5%, and the study population was 2.7 million people, so it has been estimated that 170,000 cases living with T2D in Mashhad (5). The sample size for our study was calculated as follows:  $Sample\ size\ n = [DEFF * Np(1-p)] / [(d^2 / Z_{1-\alpha/2}^2 * (N-1) + p*(1-p)]$ , with a margin of error of 0.05,  $t = 1/96$  and  $p \leq 0.05\%$ , the resulting sample size was 376 patients (Sullivan, 2015). The final sample size of 450 was considered by foreseeing a drop-out rate of 20%.

Diabetic patients who were within the study age group and had the ability to answer the questions were recruited while waiting to see their physician in the clinic. Trained nurses completed the questionnaires. The questionnaire had two parts. The first part consisted of 16 items which collected demographics information, such as gender, age, place of living during the past 6 months, education level, occupation, type of diabetes and its duration, and the

gathering information patterns around the disease. These last questions were based on a Likert scale of 4 (1=very little, 2=little, 3=to some extent and 4=to a large extent) and were as follows:

1. How much do you know about diabetes? How much do you actually want to know about diabetes? And how much do you want to know about complications from diabetes?
2. Do you have ever received any information about diabetes others than from your doctor? Which resources do you use? And which resources do you prefer to use?
3. Do you have access to Internet through others? Do you have personal access to Internet?

If during the first part of the questionnaire the patients answered that they routinely used to get information from the Internet, they then were asked to complete the second part. The second part of the questionnaire contained 26 items about the specific use of the Internet and mobile services to access information and also an open question for any possible comment. Data were entered and analyzed using SPSS software version 22.

### **3. Results**

#### **3.1. General information about the patients**

450 questionnaires were filled by nurses during the interviews. 43 questionnaires were dropped because the patients' age was outside the determined age range or because left incomplete. With 407 remaining questionnaires, 93 (23%) valid questionnaires were completed at the outpatient diabetic clinic of the large educational hospital and 314 (77%) 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. The largest proportion of patients was in the age group 51-60 (46.7%, n=190) years and the least in the age group 20-29 (6.1%, n=25) years. Among the participants, there were 254 (62%) women and 153 (38%) men. In the last 6 months, 372 (91%) lived in the central province, while the others came from other cities or rural areas around the province. 158 (39%) had less than high school education, 145 (36%) finished high school, 40 (10%) had two-year university education and 63 (15%) had a university degree.

Half (50%) of the patients were housekeeper, 62 (15%) were employed but did not specify what job they had, 59 (14%) were retired, 40 (10%) freelanced, 37 (9%) did not clearly specify any employment, while 5 (1%) did not reply to this question. 306 (75%) suffered from diabetes type 2, 33 (8%) had diabetes type 1, 11 (3%) had pregnancy diabetes, 47 (11%) did not know which type of diabetes they had, while 9 patients (2%) did not reply to this question. 35 (9%) of the patients have been suffering from diabetes for less than 1 year, 86 (21%) between 1-3 years, 75 (18%) between 3-5 years, 107 (26%) between 5-10 years, while 103 (25%) have been having the disease for more than 10 years.

### **3.2. Diabetes-related responses**

A number of questions were related to patients' knowledge and own perceptions of diabetes. 401 patients (99%) responded to these questions. 223 (55%) stated that they had very little or little knowledge about diabetes, while 140 (34%) reported that they were informed (Figure 1).

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Figure 1  
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Between the 407 responders, 373 (92%) were willing to get information about the disease by knowing more on nutrition, 218 (54%), diabetes treatment, 188 (46%), the side effects of medications, 142 (35%) and also about genetics, 118 (29%) (Table1).

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Table 1

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301 patients (74%) mentioned that they used sources other than their doctor for getting information about the disease. In terms of how patients would prefer to receive more information about their disease, the greatest increase was in patients who stated that they would like to get it through courses and Internet (Table 2).

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Table 2

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### **3.3. Internet users-related responses**

In this study, just 108 (26%) patients responded that they had personal access to the Internet, while 130 (32%) had access to the Internet through family members. 44 (41%) of Internet users were female and 64 (59%) male. Male patients had more access to the Internet in comparison with female patients, and younger patients had more access to the Internet than older ones. The self-estimated level of knowledge about diabetes increased by the duration of the disease and education level ( $p < 0.05$ ), that is, the longer a patient had been suffering from diabetes and the higher his/her education level, the higher the self-estimated knowledge about diabetes. Self-estimated level of knowledge about diabetes did not have any statistical relation

to gender. No statistical significant difference was found between the two different clinics in terms of access to Internet by the patients. 80 out of the 108 patients who used the Internet stated that they had been using the Internet for an average of 6 years. 99 (92%) had access to the Internet from home and 35 (32%) from the workplace, while only 6 (6%) had accessed to the Internet through the mobile phone. 101 (94%) were aware that they could use the Internet to acquire information about their disease. On how often they were connected to the Internet and used it, 45 (42%) reported daily, 40 (37%) reported weekly and 11 (10%) reported monthly. 58 (54%) had personal email, of which 23 (21%) checked it daily, 20 (19%) checked it weekly and 12 (11%) checked it monthly. 27 (25%) had experience of using chatrooms. 100 (92%) of Internet users had access to mobile phones and sent and received SMS. The majority (91%) liked to receive educational materials through a mobile phone.

#### **3.4. Issues in using the Internet**

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

80 (74%) Internet users among the participants reported that the information on the Internet is perceived as reliable, while 28 (26%) perceived it as unreliable. 15 (14%) reported that their doctor had referred them to use the Internet to get further information about their disease. 87 (81%) of Internet users obtained new information about diabetes on the Internet and had questions about it to their physician.

About half of the patients who were Internet users, 56 (52%) mentioned that they asked for recommendation to their doctor when wanting to search the Internet for diabetes-related information. Only 24 (22%) used it for medical consultation. 90 (83%) of Internet users were willing to receive educational materials through the Internet, and nearly all of those patients found an educational website about diabetes useful.

At the end of the questionnaire there was an open question for any comments that patients had about using the Internet and/or mobile phone in relation to their disease. 49 participants (45%) responded to this question and gave short comments. 19 patients stated that a reliable Persian site for diabetes-related information would be beneficial. 8 patients stated that only if the information comes from trusted source than it would be very helpful. 7 patients mentioned that by using the mobile phone they could reach information faster and easier. 4 patients stated that it would be better if the information comes from the Internet directly to individual's emails. 4 patients mentioned it would be better to receive information by SMS or email to a specific mailbox. 3 patients stated that the Internet connection is too slow. One patient mentioned that he was willing to make a donation to help this cause, while another one mentioned that in the Iranian society the Internet or mobile services are not effective.

## **4. Discussion and Conclusion**

### **4.1. Discussion**

In this study the majority of diabetic patients who used the Internet on a regular basis were aware that they can get general and medical information by using the Internet, and most of them deemed that information to be reliable. These patients are also willing to receive educational material through the Internet. In an earlier study, however, researchers state that it is not clear for all patients how to make best use of educational material that is available on

the Internet (Salo et al., 2004), and this could also be the case in our study although we have not collected this information. Moreover, in a study conducted in Iran the authors show that diabetic patients are not fully aware of the possible complications that can arise from diabetes (Jamshidi, 2012). This demonstrates that making proper use of educational material that is available on the Internet is far from easy and without risks, and patients should be cautious about using medical information without suitable guidance.

Patient education becomes therefore an important part of overall care, but much remains to be done. Patient-directed medical websites should uphold good quality educational material and pedagogical design in order to be beneficial to patients (Salo et al., 2004). Internet is nowadays a communication media that is easily available both on computers and mobile phones, and by using this technology appropriately patients can contact experts for reliable information (Lewis, 1998) or use it for better self-care management.

In our study, Internet access was distributed differently between the genders, meaning that male participants had higher Internet access than female. A similar difference is also found in an earlier study in Iran (Roshandel et al., 2005). This can indicate a larger interest about the Internet from the male population or simply that the male population has easier access to the Internet at the workplace, while women in Iran are more inclined to stay at home. On the same note, a new qualitative research in diabetic patients in Iran also demonstrated that factors such as gender, history of diabetes in the family and the level of education can act both as facilitators and barriers to healthcare-seeking behavior (Karimi Moonaghi et al., 2014).

In our study, the rate of Internet access increased as the educational level rose. This confirms the results obtained in another study performed in Iran (Roshandel et al., 2005). Our study also showed that the longer the patients have been suffering from the disease, the likely they

were to seek information about diabetes off the traditional pathway. Our results can suggest that patients with a higher education level and/or a longer history of treatment have greater desire or possibility to access the Internet to reach information beyond of what is available in traditional media, either at home or workplace. Nonetheless, the results show that awareness of diabetes among Iranian patients is moderate and mainly determined by their level of education, and duration of the disease.

It is broadly accepted in industrialized countries nowadays to manage a chronic disease by using Internet and/or mobile services as access to the Internet has changed the way we communicate. Internet has become one of the most important resources for health and medical information, and the use of the Internet or mobile services have made a great impact on communications with patients (Wang et al., 2012),(Schnall et al., 2013). A study performed in an Asian country show that the majority of participants who received Web-based intervention reported satisfaction with the intervention programs, and they appreciated the speed of feedback, information and follow up on their trends of physical activity (Kim & Kang, 2006).

According to research, 42 million (47%) Iranians have access to the Internet (Internet World Stats, 2014), and the Internet National Development Management Center in Iran reports the penetration of the Internet in 2012 to be about 60% ([www.matmas.ir/en](http://www.matmas.ir/en)). We expected that a similar percentage of Internet users could extrapolate to the diabetic population. However, even though this study was conducted in Mashhad, one of the largest cities of Iran, the average Internet access in diabetic patients between the ages of 20-60 was only a marginal 26%. Recent research shows instead that in Europe 150 million people (only 30%) have never used the Internet and adults not online felt less able to learn new skills. The Digital Agenda for Europe (DAE) aims to enhance digital literacy among these people (Carretero et al., 2012). Most of the patients in the study preferred to get general and diabetes-related

information by TV, radio and educational films. The majority of the patients in this study who had access to the Internet knew they can get medical information by using the Internet, and many of them perceived the information on the Internet as reliable. Yet, the Internet is not a preferred source of information by the participants in this research.

A study conducted in the United States shows that patients with lower socioeconomic status were less likely to engage with a number of communication technologies compared to their counterparts (Kontos et al., 2014), demonstrating the digital divide occurrence even in a high-income and industrialized country. While a European report states that 78% of older people who uses the Internet felt the Internet had improved their lives, 42% felt the world will not be the same without the Internet and also 23% felt it enhanced relationships (Carretero et al., 2012). The Internet is pushed forward as a means of democracy, communication and socialization in the western world as well as in Iran. As stated, our findings show that technology like TV or traditional education are preferred before the Internet, and maybe it would be satisfactory to focus on finding solutions for patient information that use the traditional media, knowing that a larger number of patients can be reached. It becomes legitimate then to use a more realistic approach such as the Radio Health and educational TV Life Channel supported by the Iranian government to amplify patient education by suggesting the 'off-line' patients to use these technologies.

Even though Internet access in Iran has increased in the past few years, the results show that there is not enough available information in Farsi. The authors argue that the lack of medical sites in Farsi may be a contributing factor to the low use of Internet by the participating diabetic patients. Similar to a study by Zargari and Kinyai-Asadi (2006) we observe that the Internet is not yet a major medical resource for patients in Iran.

This calls also for a local research approach. Research on the use of the Internet or mobile services coming from high-income countries, even though useful, may be skewed for middle-income countries, and for the benefits of patients a contextualized research could be preferred. Another approach is to concentrate on early adopters (Rogers, 2003). In this study, only a small percentage of the participating patients used the Internet to get medical information about diabetes or wanted to use the mobile phones to receive prompt health-related information. A possible strategy would be to create health opportunities for just that small group, hoping they can show improvements in self-care management. In their turn, this group could motivate others into shifting to a self-management approach through technology. The small group of early adopter could function as a good example of empowerment.

#### **4.2. Conclusion**

In conclusion our data suggest that most diabetic patients in this study although they were willing to receive educational material by the Internet and that they preferred to use a Farsi website, they are still fond of more traditional media. They preferred to get information from TV, radio and courses. The penetration rate of the Internet in diabetic patients is low, and it shows that Internet does not currently serve as a significant source of information related to diabetes. A different strategy for spreading health-related information that can lead to self-management care of diabetes could be to focus on 'off-line' media. However, since technology advances quickly and substitutes many of the more traditional health-related preventive functions such as communication between patients and care providers and self-care management, our next studies are going to focus on early technology adopters.

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## Author disclosure statement

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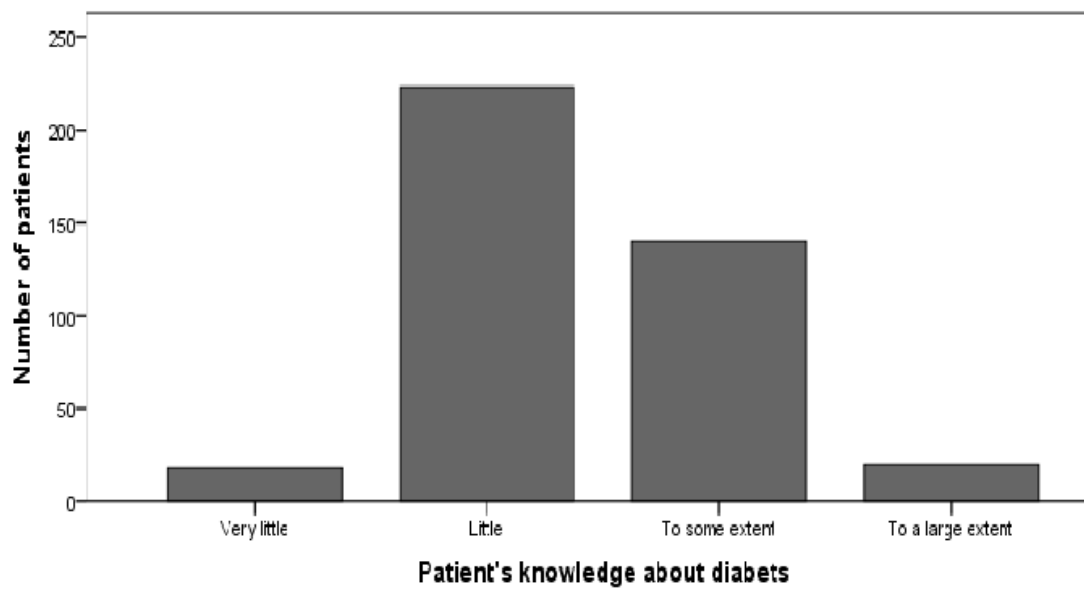
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Subjects No. (%)	Cause of diabetes	Treatment	Diet	Physical activity	Complicati on	Prevalence	Drugs Complication	Genetic
To a large extent	159(39)	188(46)	218(54)	183(45)	158(39)	128(31)	142(35)	118(29)
To some extent	188(46)	179(44)	160(39)	182(45)	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)

**Table1. Patient's Preferences for information about diabetes.**

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

**Table 2 : Actual and preferred sources of information.**



**Figure 1. Bar graph showing patient's knowledge about diabetes.**