

Original Research Article

Mobile phone usage among adults with type 2 diabetes mellitus in an urban sub-center in India: a cross sectional study

Reni Philip*, Farah Naaz Fathima, Twinkle Agarwal, Aman Andrews

Department of Community Health, St. John's Medical College, Bangalore, Karnataka, India

Received: 26 May 2019

Revised: 13 August 2019

Accepted: 16 August 2019

*Correspondence:

Dr. Reni Philip,

E-mail: roseletfrancis@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Diabetes education enables patients to be more involved in their care and helps in delaying complications. Mobile phone penetration in rural India is high and provides us with an opportunity to use mobile phones in delivering diabetes education messages. So the objective of the study is to study mobile phone usage among adults with type 2 diabetes mellitus in an urban sub-center.

Methods: A list of all the patients with type 2 diabetes mellitus was obtained from the health management information system records of the rural health and center and structured interview schedule was administered. Universal sampling method was used.

Results: Around half of the diabetic patients included in the study (55.6%) owned a personal mobile phone, 44.4% had access to a smart phone in the household and 35.4% had internet connectivity on their phone. Predominant mobile phone usages included making phone calls (54.4%), short messaging services (44.8%), listening to music (17.6%), wake up alarm (14.4%) and capturing photos/videos (12.8%). Very few participants reported using mobile phone for health-related purposes (12.8%) and usage of health-related apps (10%). A large proportion of participant reported that they would like to receive reminders for clinic visits (54.0%), set alarms as reminders to improve adherence to medication (53.6). Chi-square test was used to find associations.

Conclusions: Two-thirds of the patients with known diabetes have access to a mobile phone at the household level. Mobile phones have potential application to be used as channel for health education, reminders for clinic visits and to improve adherence to medication among patients with diabetes in urban India.

Keywords: Mobile phone, Type 2 diabetes mellitus, Urban health

INTRODUCTION

Diabetes mellitus, especially type 2, is one of the most significant public health challenges today. More than 80% of diabetes death is in developing countries.¹ The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is estimated to rise from 422 million in 2015 and 366 million in 2030 (WHO). Proper diabetes education can help the patients

themselves to better manage their disease and successfully avoid complications of the same. However, health systems cannot control all the factors that affect a person's overall health, as doctors are not able to constantly monitor what their patients eat or whether they take their medications on time as prescribed by them.² To prevent the above draw back and to attain that goal the medical professional can send SMS to remind the diabetic patients regarding the need for the adherence to medications.

Telecom Regulatory Authority of India, New Delhi, 24th April, 2018, published the data, total 1179.83 million telephone subscribers are in India; wireless are 1156.87 million, and wirelines are 22.97 million. The rural telephone subscribers are wireless 506.84, wireline 3.37, total 510.20 (data as on 28th February, 2018).³ The core component is a mobile phone-based diabetes diary that is updated both by manual user input and automatically by wireless data transfer. It also provides personalized decision support by giving feedback on users' performance related to their personal health goals.⁴ The mobile phone based interventions helped overcome barriers such as stigma, loss of privacy, limitation of transportation and problems associated with traditional interventions, and made participants feel cared for so that they were responsible for their treatment.⁵ These findings support the important role of mobile phone based interventions for promoting adherence to treatment.

Objectives

The objective of the present study was to study mobile phone usage among adult patients with type 2 diabetes mellitus in an urban sub centre and to explore the potential of using mobile phones to improve the health practices of DM patients in urban India.

METHODS

Our study population includes 250 diabetic above 18 years in our study area of Mugalur urban sub centre under Sarjapur district, which has a total of 311 diabetic people within the service area of all 10 sub-centres under its territory. It was a cross sectional study. Study period was from July 2018 to August 2018 (2 months). Universal

sampling was used. The whole 311 patients are taken in to account of my study. Administering a questionnaire comprising of social and demographic factors, like age, socio-economic status using modified B. G. Prasad classification. Health status included chronic and acute health problems and duration of diabetes, drugs consuming (medication practices) for the diabetics and latest glucose values. Mobile phone and its usage pattern including time spent on phone and using phone for health information, knowledge and practices related to diabetes using details about how many times had gone for brisk walk, number of days anti diabetic medicine missed and number of times taken sweets and junk food in a week and knowledge about most common complications of diabetics included. Ethical approval obtained from Institutional ethical committee (IEC Code No.235/2018).

RESULTS

Our study includes 250 diabetic population of Mugalur subcenter of an urban district in Karnataka, India. 155 (49.8%) of our sample population were male and 156 (50.2%) were females and the mean age of the sample was 56. Around half of diabetic patients included in the study 170 (54.7%) owned a personal mobile phone. 219 (70.4%) of diabetic people had shared access to mobile phones at home. 107 (34%) of them access the internet, 153 (49%) do not have internet access and 51 (16%) do not know about the internet facility available on their phone. Out of 311 diabetic people studied, only 32 per cent are owners of single mobile phones, while 57% have two mobile phones, 9% have three mobile phones, 1% of have four mobile phones, 1% of them have five mobile phones in the houses. Chi-square test was used to find associations.

Table 1: Sociodemographic details of study population (n=311).

Characteristics		N (%)
Sex	Male	155 (49.8)
	Female	156 (50.2)
Age (mean±SD) years	56.10±12.13	
Education	No formal education	95 (30.55)
	Primary school	93 (29.90)
	Middle school	61 (19.61)
	High school	47 (15)
	Pre-university	10 (3.21)
	Graduate	5 (1.60)
Occupation	House wife	134 (43)
	Unemployed	67 (22)
	Business	58 (19)
	Agricultural land owner	24 (8)
	Daily wage earner	19 (6)
	Salaried	6 (2)
	Business	2 (0.64)
	Retired	1 (0.32)
Socio economic status (B. G. Prasad classification)	Upper class	21 (6.75)
	Upper middle class	54 (17.36)
	Middle class	97 (31.19)

Continued.

Characteristics		N (%)
	Lower middle class	96 (30.87)
	Lower class	43 (13.87)
Religion	Hindu	299 (96.1)
	Muslim	11 (3.5)
	Christian	1 (0.3)
Language	Kannada	244 (78.5)
	Telugu	213 (68.5)
	English	13 (4.2)
	Others	19 (6.1)
Total		311 (100)

Table 2: Prevalence of common chronic disease.

Diabetes	Hypertension	Ischemic heart disease	Osteoarthritis	Stroke
N (%)	N (%)	N (%)	N (%)	N (%)
311 (100)	126 (40.5)	11 (3.5)	4 (1.3)	4 (1.3)

Table 3: Pattern of mobile phone usage.

Mobile phone usage	Frequency with help	%	Frequency independently	%
Phone calls	123/311	39	305/311+	98.1
Messages	140/311	45	121/311	38.9
Listen to music	57/311	18.3	46/311	
Alarm	82/311	26	41/311	13.2
Social media	19/311	6	12/311	3.9
Video chat	11/311	3.5	5/311	1.6
Browsing internet	17/311	5.5	4/311	1.3
Play games	4/311	1.3	1/311	0.3
Watch movies/show	5/311	1.6	6/311	1.9
Capture photos	6/311	1.9	16/311	6.1

Chronic diseases present in the sample are: 126 (40.5%) had hypertension, 11 (3.5%) had ischemic heart disease, 4 (1.3%) had osteoarthritis, 4 (1.3%) had stroke of all 311 diabetic patients. The sample has been living with diabetes for a mean duration of 9.17 years.

Acute diseases among the study sample may be summarized as follows: 91% of the people do not have any acute disease. 5% of them have cough and cold, 3% of them having normal fever, 1% of having many other diseases like head ache, body pain etc.

Women's health

Out of 156 diabetic women in our study group, 132 (84.6%) do not have any women's health problems; but 8 (5.1%) have menstrual problems and 16 (10.3%) have white discharge per vagina.

305 people use mobile independently for phone calls, and 6 people use mobile for health purposes with the help of others. 121 people who can independently use phone for messages and 140 people use mobile phone for messages with someone's help. 46 people listen to music independently and 57 people listen to music with assistance. 41 of the respondents manage wake-up alarm

independently. 82 people use mobile to keep alarm with the help of others. 12 said that they independently use mobile to access social media and another 19 use with help. 5 of the respondents themselves use mobile phones for video chat while 11 others use when helped. 4 persons use mobile without any assistance for internet browsing but another 17 people do the same with assistance. One person uses mobile phone for playing games independently and another 17 people also play games on mobile phones, but with help. 6 of the sample of respondents use mobile phone for watching movies and 5 more people can do this, but with someone's help. 16 people independently use mobile phone for capturing photo and another 6 more people do the same, but with help.

Average time spent by 23% of the respondents on browsing internet for health related affairs is 45 minutes, 57% have an average use of internet for 30 minutes, 11% uses for 15 minutes 9% of uses for 10 minutes. Problems faced while using mobile phone are: difficulty in using phone (39.5%), bad internet connectivity (27.7%), bad signal (13.2%) and 80 (25.7%). Mobile phone was said to be of help for 52.1% to be reminded of clinical visits. 34.1 % said that mobile phone is being used to improve physical activity, while 22.5% found it useful to improve

dietary practices. Reminder for lab tests was another use found among 60 (19.3%) of the sample. to improve

knowledge about the mobile phone knowledge 65 (20.9%).

Table 4: Questions regarding knowledge.

Questions	Number	%
People using mobile phone for health	38	12.2
People having health related apps	31	10
People using mobile to share health related information(forwards)	64	20.6
People receiving health related information(forwards) on mobile	85	27.3
People who browse internet for health-related queries	35 (N)	11.3
Immediate answers	16	45.7
Good information	12	34.3
Don't want to ask others	3	8.6
More convenient	8	22.9
People who do not browse internet for health-related queries	276 (N)	88.7
Not aware of sites	66	23.9
Don't know how to use	196	71
Don't think it's useful	30	10.9

The types of reminder the patients would like to receive are: phone calls 206 (66.2%), SMS 138 (44.4%), MMS 22 (7%), WhatsApp messages 9 (4.2%), and alarm 13 (4.2%). Facility for sharing the information if we send SMS to a person who own mobile phone is 296 (95.2%).

Table 5: Use of mobile phone.

	Frequency	%
To improve physical activity	106	34.1
To improve dietary practices	70	22.5
Reminder for clinic visit	162	52.1
Reminder for lab test	60	19.3
To improve knowledge about diabetes	65	20.9

According to patient knowledge of diabetic complications 259 (83.3%) have eye problems, 66 (21.2%) have renal

problems, 110 (35.4%) have neuro problems and 38 (12.2%) have cardiac problems.

Knowledge of patients about diabetic foot care was studied. It is found that 203 (65%) wear comfortable footwear, 155 (49%) wash and dry foot every day, 117 (37.6%) treat injuries immediately, 8 (2.6%) cut toe nails straight, and 15 (4.8%) examine foot every day. Chi-square test about the association of the knowledge of patients about component of diabetic foot care and use of mobile phones for health practices was found significant (at $p < 0.05$). It means the person who uses mobile phone apps will have more knowledge about the need to keep the hygiene of nail by cutting it. The people who use health related apps have more knowledge about the need for brisk walk for thirty minutes than the people who are not using.

Table 6: Knowledge about brisk walk and mobile phone usage pattern.

Variable	In the last 7 days how many days patient go for a brisk walk for at least 30 minutes			P value
		Good N (%)	Poor N (%)	
Do you use mobile phone for health	Yes	31 (81.6)	7 (18.4)	0
	No	139 (50.9)	134 (49.1)	
Do you have health related apps in phone	Yes	26 (83.9)	5 (16.1)	0.001
	No	144 (51.4)	136 (48.6)	
Do you browse internet for health related queries?	Yes	29 (82.9)	6 (17.1)	0
	No	141 (51.45)	135 (48.9)	
Do you share health related information on phone	Yes	46 (71.9)	18 (28.1)	0.002
	No	124 (50.2)	123 (49.8)	
Do you get health related information on phone	Yes	56 (65.9)	29 (34.1)	0.015
	No	114 (50.4)	112 (49.6)	

Chi-square test used here.

Table 7: Knowledge about diabetic foot care.

Variable		Knowledge on diabetic foot care: cut toe nails straight		
		Good	Poor	P value
		N (%)	N (%)	
Do you use mobile phone for health	Yes	5 (13.2)	33 (86.8)	0.001
	No	3 (1.1)	270 (98.9)	
Do you have health related apps in phone	Yes	6 (19.4)	25 (80.6)	0
	No	2 (0.7)	278 (99.3)	
Do you browse internet for health related queries?	Yes	5 (14.3)	30 (85.7)	0.001
	No	3 (14.3)	273 (98.6)	
Do you share health related information on phone	Yes	7 (10.9)	57 (89.1)	0
	No	1 (0.4)	246 (99.6)	
Do you get health related information on phone	Yes	8 (9.4)	77 (90.6)	0
	No	0 (0)	226 (100)	

Chi-square test used here.

DISCUSSION

There are many trials using mobile phone as a tool for improving the adherence to diabetic medications around the world. Diabetes education was offered by some organizations via lectures, workshops, or pamphlets, but not through mobile text messages. Very limited number of private hospitals had the possibility of sending their patients a text message, yet only in cases of appointment booking and cancellations. The idea of SMS messages with educational content was regarded as promising, especially that it could aid hospitals meet the standard of patient education, one that is required by quality systems in Egypt.² But there is not many studies showing the effectiveness of SMS to the diabetic patients to improve their knowledge about diabetes and adherence to medications, especially for the good of rural people.

Information and communication technologies (ICTs) have the power to influence the quality of life of people. They have been a key driver for many improvements in modern society including in health care, transport, education as well as public safety.⁶ A lot of research have been conducted to analyse how technology has been leveraged to enhance aspects such as productivity, efficiency and speed.⁶ Diabetes does demand life-long medical care and self-management, it is difficult for the patients to be motivated to take medicine regularly. Mobile technologies might help patients withstand the common reasons for dropping out. Recently, mobile technologies, such as smartphone applications (mHealth) have been shown to be effective in supporting the self-management of diabetes patients.⁷ A smartphone-based self-management support system provides real-time advice on diet and lifestyle managements to maintain optimum sugar levels.⁷ The system significantly improved and introduced to the patients by their physicians, it might help strengthen the physician-patient relationship, thereby enhancing the patient motivation that is especially necessary for continuous care of patients with mild glycaemic status.⁷ Mobile phones can be a solution without any additional cost to provide health

education and increase adherence to health practices among people with chronic diseases like diabetes.¹ Poorly controlled diabetes leads to devastating complications at a significant cost to health systems. Text messaging is an ideal platform for the delivery of self-management interventions to patients with poorly controlled diabetes due to the ubiquity of mobile phones; the ability of text messaging to reach people in their everyday lives when self-management of the condition is vital.⁸

The SMS intervention for diabetic patients really made a change in HbA1c level, reportedly more in developed country than in developing countries.⁹ Usage of tailored SMS reminders to increase adherence in treatment programs among sick individuals has suggested an interventional role for SMS in self-care management of diabetes mellitus (DM).¹⁰ Findings from a 6-month field study showed that good system usability and user acceptance. The diary also challenges patients to decide about how they can improve their situation, because it helps them a way to capture and analyze relevant personal information about their disease.⁴ Increasing availability and openness of embedded sensors in mobile devices will gradually help in more accurate and adaptive apps that are aware of their context of use, e.g., the Ring Dimmer app.⁴ A study conducted in the US shows that SMS messages send to a group of patients showed improvements in their self-management behavior, foot checking, blood glucose monitoring and above all medication adherence.² Text-message reminders have been found to be effective amplifiers of adherence in their medical needs.⁸ Study done in United States of America demonstrates that good effective interventions like SMS for increasing activity in patients with pre-diabetes and diabetes remain as an urgent need and it will increase the compliance level to medication and other activity.⁸ Each person's behaviours play an important role in diabetes control including blood glucose monitoring, medication adherence, physical activity and healthy eating, and therefore diabetes self-management education and support is a fundamental part of diabetes care through medias. There is a wide range of interventions designed

to support people to self-manage their diabetes-from passive interventions (e.g., provision of information like SMS) to more active interventions (e.g., interventions to change behaviour or increase self-efficacy).¹¹ The idea of SMS messages with educational content was regarded as promising, especially that it could aid hospitals meet the standard of patient education, one that is required by quality systems in Egypt.² But there are not many studies showing the effectiveness of SMS to the diabetic patients to improve their knowledge about diabetes and adherence to medications, especially among the rural people.

We have found that individuals using mobile phones for health affairs are regular in making brisk walks and also cut toe nails straight. 57% of the study population was found to have two phones in their household. 98% of the diabetics use mobiles independently for phone calls, 45% use messages on their phones with the help of others, 10% of the individuals use health related apps, 11.3% of the individuals browse the internet for health-related queries. Only 39.5% of the individuals found it difficult to use their mobile phones.

When asked about how mobile phones would be of help for enhancing health practices, the responses showed that reminders for clinic visits will be of most help and that phone calls will be of most help. Individuals who use their mobile phone for health, health related apps and also browse the internet for health-related queries were found to consume lesser junk food when compared to those who do not use their phones for health. Individuals who use health related apps were found to have a better knowledge about heart problems as a complication of diabetes. Those who get health related information on their phones had a better knowledge about nerve problems as a complication of diabetes. Those who share and receive health related information on mobile phones were found to inspect their feet every day with a mirror and also higher knowledge of the need to wash and dry their feet every day. On the whole having a better knowledge about diabetic foot-care.

CONCLUSION

Mobile phone usage among patients with DM is significantly sizeable in India. With and without assistance, most of the patients use many features of the mobile phones, predominantly the SMS facility. The users welcome the use of mobile phones to improve their health practices and it requires no significant additional costs. Mobile phones have potential application to be used to send reminders for clinic visits and to improve adherence to medication among patients with diabetes in urban India.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Islam SMS, Lechner A, Ferrari U, Froeschl G, Alam DS, Holle R, et al. Mobile phone intervention for increasing adherence to treatment for type 2 diabetes in an urban area of Bangladesh: Protocol for a randomized controlled trial. *BMC Health Serv Res.* 2014;14(1):1-9.
2. Abaza H, Marschollek M. SMS education for the promotion of diabetes self-management in low & middle income countries: A pilot randomized controlled trial in Egypt. *BMC Public Health.* 2017;17(1):1-19.
3. Telecom Regulatory Authority of India, 20 glorious years. 1997 Available at www.trai.gov.in. Accessed 15 July 2018.
4. Chomutare T, Tatara N, Hartvigsen G, Arsand E, Froisland DH, Skrovseth SO, et al. Mobile Health Applications to Assist Patients with Diabetes: Lessons Learned and Design Implications. *J Diabetes Sci Technol.* 2012;6(5):1197-206.
5. Chen S, Pan Y, Qu Y, Liu Z, Yao L, Xiang L. Mobile phone based interventions for promoting adherence to tuberculosis treatment: a systematic review and meta-analysis. *Lancet.* 2015;386:S29.
6. Mealor B, Van Belle JP. The impact of mobile phones on quality of life of the elderly. 8th Int Dev Informatics Assoc Conf ICTs Incl communities Dev Soc (IDIA2014), Port Elizab South Africa. 2014;(2014):223-40.
7. Yamaguchi S, Waki K, Tomizawa N, Waki H, Nannya Y, Nangaku M, et al. Previous dropout from diabetic care as a predictor of patients' willingness to use mobile applications for self-management: A cross-sectional study. *J Diabetes Investig.* 2017;8(4):542-9.
8. Polgreen LA, Anthony C, Carr L, Simmering JE, Evans NJ, Foster ED, et al. The effect of automated text messaging and goal setting on pedometer adherence and physical activity in patients with diabetes: A randomized controlled trial. *PLoS One.* 2018;13(5):1-12.
9. Defronzo RA, Simonson DC. Oral sulfonylurea agents suppress hepatic glucose production in non-insulin-dependent diabetic individuals. *Diabetes Care.* 1984;7(S1):72-80.
10. Riaz T, Riaz H, Hussain SA, Kherani D. SMS reminders-future in self-care management of diabetes mellitus? *Diabetol Metab Syndr.* 2012;4(1):3-4.
11. Dobson R, Whittaker R, Pfaeffli Dale L, Maddison R. The effectiveness of text message-based self-management interventions for poorly-controlled diabetes: A systematic review. *Digit Heal* 2017;3:205520761774031.

Cite this article as: Philip R, Fathima FN, Agarwal T, Andrews A. Mobile phone usage among adults with type 2 diabetes mellitus in an urban sub-center in India: a cross sectional study. *Int J Community Med Public Health* 2019;6:3829-34.