



Impact of Digital Health Education among Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Background: Effective delivery of health education is critical to achieving the goal of controlled diabetes. The objective was to assess the impact of health education among patients with Type 2 Diabetes mellitus.

Materials and Methods: This study was quasi-experimental done with type 2 diabetes mellitus of tertiary care hospital. 100 diabetes patients were included and randomized into two groups to receive health education material and standard care. The intervention consisted of health education intervention via text messages and images. The glycemic parameters were assessed before and at the end of 3 months of intervention. Paired t-tests were applied.

Results: Mean (SD) of HbA1c before the start of the intervention among the patients with intervention and control arm were 10.1(±0.9) and 10.6 (±0.3) respectively. There was a significant difference in FBS, PPBS and HbA1c- (198(±14) vs 112(±6), 277(±50) vs 151(±16) and 10.1(±0.9) vs 7.2(±0.9) in the intervention group before and after the intervention (p-value <0.05). No significant difference was found in the control arm.

Conclusion: There was a significant difference in the group that received health education intervention compared to the standard therapy group. Thus, well-designed health education delivery could maintain better glycemic control in patients with uncomplicated type 2 diabetes mellitus.

Keywords: Short message services, health education, type 2 Diabetes Mellitus

BACKGROUND

Diabetes, one of the most common non-communicable diseases, poses a serious threat due to its increasing incidence, prevalence, and mortality. The prevalence of diabetes globally was estimated to be 9.3% (463 million people), and one in every two people with diabetes are not aware of their condition.¹ The prevalence of diabetes in India has a wide regional variation and varies from state to state from 4.3% in Bihar to 13.6% in Chandigarh.²

A study conducted in India revealed that the preva-

lence of diabetes in India is at 11.8% (12% in males and 11.6% in females), with the highest prevalence observed in the 70+ age group. Deaths due to diabetes rose from 0.98% of all deaths in 1990 to 3.1% of all deaths in India in 2016. Diabetes and hyperglycemia accounted for about 2.75 crores disability-adjusted life years.³ The significant growth in the number of cases is more likely due to India's unprecedented rates of urbanization resulting in rapid environmental and lifestyle changes.⁴ The average annual direct and indirect cost of diabetes treatment was found to be Rs 8,822 and Rs 3,949, respectively, and

How to cite this article: Chellaiyan VG, Jenniferbritto J, Alfred J. Impact of Digital Health Education among Patients with Type 2 Diabetes Mellitus. Natl J Community Med 2022;13(3):171-174. DOI: 10.55489/njcm.1332022394

Financial Support: None declared

Conflict of Interest: None declared

Date of Submission: 17-12-2021

Date of Acceptance: 08-02-2022

Date of Publication: 31-03-2022

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for the lower middle class, the average expenditure was found to be 23.7%.⁵

Uncontrolled Diabetes makes the disease progress rapidly and development of complications such as heart diseases, kidney diseases, nerve damage, foot ulcers, vision and hearing loss, and even mental health problems. To prevent such complications, multi-interventional therapies are necessary along with maintenance of healthy blood sugar levels.⁶

An effective strategy to help prevent the complication of diabetes or, even better, diabetes itself is health promotion activities. A regular reminder and motivation of patients towards healthy lifestyle practices plays a key role in the control and management. Diet and physical activity promotion programs, intensive lifestyle interventions and newly shown effective intervention of digital reminders.⁷ Digital reminders for health are most effective in improving patient outcomes especially if it is in synchronous with the patient's attitudes and motivations. The reminders could be in the form of texts, social media apps messages, emails. At present, it is very well possible to cover a large group of people as the majority of us own a Smartphone/ smart device now.⁸ Health care delivery for non-communicable diseases was disrupted since the COVID-19 pandemic. Strategies have been promulgated and followed in some countries for incessant service delivery to these patients.⁹

In the present study, short messaging services (SMS) text messages and health awareness images were sent to patients, and their impact on glycemic status was assessed. The objective was to study the impact of digital health education intervention among patients with Type 2 Diabetes Mellitus.

MATERIAL AND METHODS

Study design: The present study was a pilot study of a bigger ongoing trial-TECARE being conducted in India. This quasi-experimental study was done with two groups of patients – each consisting of 50 patients at a tertiary care teaching hospital, Chennai, Tamil Nadu.

Study population: The study population was those who with 18 years and above and patients with type 2 diabetes mellitus. The patients who were newly diagnosed with type 2 diabetes and with complications such as diabetic neuropathy, diabetic kidney disease and retinopathy were excluded. A total of 100 patients were included in the study- 50 in Group1 and 50 in Group 2. Group 1 received health education intervention and follow up; Group 2 received standard care and follow up.

Intervention arm: The intervention consisted of health education - text messages via short message services (SMS) and WhatsApp application images. The patients received text messages via SMS and motivational images via WhatsApp mode. Text messages were sent in the morning and images in the evening

daily. The content of the messages included the importance of regular physical activity, maintaining the ideal body weight and waist circumference, nutritional/diet tips for diabetes and insisting compliance towards diabetic medications. The text messages and images were sent in two languages- both English and regional language. The duration of such intervention was 3 months.

Control arm: The control group received regular standard care and follow up every 3 months.

Randomization: The participants were randomized into two groups using the block randomization technique. The participants had an equal chance of being allocated to any of the two arms.

Data Collection: The participants who gave informed written consent were recruited in the study. Basic socio-demographic profiles such as age, sex, residence, dietary habits were collected. Other information such as alcohol consumption, smoking history, physical activity, medication adherence and comorbid statuses such as obesity, hypertension, dyslipidemia, ischemic cardiomyopathy and acute myocardial infarction were also collected. Blood investigations were measured before and after 3 months of this health education intervention, and HbA1c, FBS, PPBS and average blood glucose values were measured. Compliance with drug intake was also assessed before and after the intervention, and missing two doses of medications in any month was considered poor compliance.

Data Analysis: The collected data were entered and analyzed with statistical software-SPSS-IBM version 21.0 Significant differences in the mean values of HbA1c, blood sugar values were assessed with paired t-tests, and independent t-tests were applied to find any difference between the groups. P-value of <0.05 was considered to be significant.

RESULTS

Baseline characteristics of both the group study participants were comparable. (Table 1) Analysis of the mean values of HbA1c, fasting blood glucose and postprandial blood glucose before and after the intervention revealed a statistically significant reduction. (p value=0.032,0.002,0.009) The intervention was able to reduce the mean values significantly. (Table 2)

An Independent t-test was applied to find any significant difference between the two groups after the intervention. A significant difference in the mean values of HbA1c, FBS and PPBS values were between the groups at the end of the intervention. (P-value =0.012, 0.041, 0.032) (Table 3)

Also, compliance of drug intake was 100% in patients with group 1, and in group 2, the compliance was 86% at the end of the intervention.

Table 1: Baseline characteristics of participants

Variables	Group1 (N=50) (%)	Group 2 (N=50) (%)	P-value
Sex			
Male	32(64)	30(60)	0.12
Female	18(36)	20(40)	
Age group			
18-30	1(2)	2(4)	0.32
31-45	13(26)	9(18)	
46-60	28(56)	32(64)	
>60	8(16)	7(14)	
Family history of diabetes			
Yes	3(6)	5(10)	0.49
No	47(94)	45(90)	
Co morbidities			
Obesity	4(8)	8(16)	0.66
Hypertension	2(4)	4(8)	
IHD	0	0	
Dyslipidemia	13(26)	11(22)	
Duration of diabetes			
≤ 5 years	23(46)	20(40)	0.87
>5 years	27(54)	30(60)	
Tobacco history			
Yes	2(4)	3(6)	0.39
No	48(96)	47(94)	
Alcohol history			
Yes	3(6)	1(2)	0.19
No	47(94)	49(98)	
Drug compliance			
Yes	43(86)	42(84)	0.34
No	7(14)	8(16)	
Mean HbA1c levels	10.1(±0.9)	10.6 (±0.3)	0.23

Table 2: Glycemic parameters in intervention group before and after the intervention (n=50)

Parameters	Mean (SD)	Mean difference (95% CI)	P-value
HbA1c			
Before	10.1(±0.9)	2.4 (2.17-2.67)	0.032
After	7.2(±0.9)		
Fasting blood glucose			
Before	198(±14)	86.8(80.3-93.2)	0.002
After	112(±6)		
Postprandial Blood glucose			
Before	277(±50)	125.7(105.8-145.6)	0.009
After	151(±16)		

Paired t-test applied, p-value of <0.05 is considered significant

Table 3: Comparison of Glycemic parameters between the two groups after intervention (n=100)

Parameters	Mean (SD)	Mean difference (95% CI)	P-value
HbA1c			
Group 1	7.2(±0.9)	-3.0(-3.8--2.4)	0.012
Group 2	9.4(±1.3)		
Fasting blood glucose			
Group 1	112(±6)	-1.6(-4.6—0.9)	0.041
Group 2	163(±18)		
Postprandial Blood glucose			
Group 1	151(±16)	-70.6(-88.9—52.4)	0.032
Group 2	202(±47)		

Independent t-test applied, a p-value of <0.05 is considered significant

DISCUSSION

Diabetes a chronic lifestyle disease is a burden on health and the economy. However, the disease can go into partial remission without any surgical interventions on management along with intensive lifestyle interventions, thereby not only reducing the cost of the medication but also mortality and the serious complications of diabetes.¹⁰

During COVID-19 Pandemic, the overwhelming need for resources for COVID-19 services, the health personnel were reassigned to COVID-19 care and non-communicable disease services were severely disrupted.^{11,12}

Motivation and continuing health education have proven to be effective in controlling diabetes and maintaining better compliance. Health education becomes an absolute necessity for diseases like diabetes where lifestyle modifications are as important as drug management. It gives us the knowledge and skills for improvement and creates a positive attitude towards health and maintaining that health. The difference in glycemic parameters before and after the health intervention has shown a significant improvement in this study.¹³

Hawthorne K et al¹⁴ showed improvement in glycemic control after health education intervention and stated that the intervention significantly had short term effects on the health. Chawla SS et al¹⁵ reported in their study that effective health education improved the glycemic control of the patients and slowed down the disease progression. M.M Ahmed et al¹⁶ also reported that educational intervention had effectively helped in glycemic control. Additionally, their study showed a strong negative correlation score between patients' glycemic levels and knowledge/ attitude of the patients. Furthermore, with health education intervention the drug compliance also has shown an increase in this study, the compliance of drug intake was 100% in patients in the intervention group and was 86% in the control group at the end of the intervention. Adherence to medical advice plays a vital role in the management of many chronic diseases including diabetes.^{17,18} The health intervention through smart phones, smart devices, therefore, prove to be beneficial, similar to previous studies.^{19,20}

There are existing reminder systems already set up and in use for several treatment strategies for some diseases, and immunization. The reminder systems notify the patients about their appointments, and the recall system contacts those who have missed their appointments and encourage them to reschedule. This system improves the treatment outcome, reduces morbidity and mortality, help reduce treatment costs too in the long run and improve drug compliance.^{17,18} The reminder system intervention that currently is being used and found to be effective are automated personalized text messages, automated two way messaging, multi-component reminders, auto-

mated health information texts, automated emails, manually entered texts, automated or manually made phone calls, tailored automated motivational messages, leaflet reminders and more for medication adherence, vaccine reminders, appointment reminders, post-op follow-ups, behavioral changes, lifestyle changes.²¹⁻²³

Knowing the benefits and outcome of the health education intervention system, we recommend that it be made as part of the treatment strategy for diabetes patients to improve their health outcomes from their original treatment procedures as it shows it is significantly effective. Text messages and health education images could be used as a model of self-management of diabetes accompanied by multi-modal health system strengthening and other forms of self-management support. More research is needed to study the long-term effects on health outcomes, including its complications. The study had a few limitations. The study did not include patients with diabetes-related complications or type 1 diabetes patients.

CONCLUSION

It is evident from the study that there was a significant difference in the group that received health education intervention compared to the standard therapy group. Thus, well-designed text messages with images lead to a change in glycemic control in patients with uncomplicated type 2 diabetes mellitus. Text messages and health education images could be used as a model of self-management of diabetes accompanied by multi-modal health system strengthening and other forms of self-management support.

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