Student Corner

Diabetes and Telecommunications: Study to Support Self-Management for People with Type 2 Diabetes A Randomized Controlled Trial in Mayo Hospital, Lahore

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Abstract

Objective: To investigate if telecommunications can improve the quality of life among type 2 diabetics, and results could then be projected to the management of other chronic illnesses as well. The alarmingly rising prevalence of diabetes mellitus and its crippling complications in Pakistan asks for modern solutions to ensure better quality of life among patients with type 2 diabetes.

Methods: This was a single centre, two arm parallel randomized controlled trial in which two groups of 133 type 2 diabetic patients presenting to the Diabetic clinic of Mayo Hospital, Lahore were randomly assorted into intervention and control groups. Motivational text messages regarding lifestyle modifications were sent to the intervention group for a period of one month. Fasting blood glucose was the primary outcome and BMI, blood pressure and physical activity score were the secondary outcomes of our study.

Results: In the intervention group, mean fasting blood glucose before and after intervention were 227.8 mg/dL and 243.71 mg/dL respectively. The FBG in the control group also increased from 238.33 mg/dL to 249.10 mg/dL during the study period. However, the DATES intervention increased the number of healthy weight patients from 42 to 55 (improvement of 10%) in the intervention group while the control group showed a worsening trend. With the 1 month DATES intervention, the number of normotensive patients increased from 21 to 32 while patients with BP greater than 120/75 mmHg decreased by 8% which was a statistically significant improvement compared to the control group. Physical activity scores also improved with sedentary life style in patients decreasing by 15% after intervention.

Conclusion: Although the fasting blood glucose levels did not improve after the intervention, the significant improvement in BMI, blood pressures and physical activity scores among the intervention group clearly suggests that if used for longer periods of time and if coupled with changes in medications and treatment regimens, intervention through mobile phone text messages can improve the glycemic control and overall quality of life in patients with type 2 diabetes.

Keywords: Type 2 diabetes, fasting blood glucose (FBG), body mass index (BMI), blood pressure (BP), physical activity, diabetes and telecommunications (DATES intervention).

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Introduction

Type 2 or non-insulin dependent Diabetes Mellitus is a chronic metabolic disease, characterized by elevated blood glucose level, insulin resistance, and relative lack of insulin. Common symptoms include polyuria, polydipsia, polyphagia, weight loss, and fatigue.

Type 2 diabetes is becoming increasingly prevalent worldwide with the total number of diabetics expected to grow from 171 million in 2000 to 366 million in 2030.[1] In 2010, there were 285 million diabetics in the world and Pakistan had the seventh largest number of diabetics in the world[2] making it particularly a huge burden on the health department.

Diabetes is associated with significant morbidity and mortality, attributed to its microvascular and macro-vascular complications.[3] Long-term complications from

elevated blood glucose include ischaemic heart disease, stroke, diabetic retinopathy, chronic kidney disease, and limb ischaemia. The onset and progression of specifically the microvascular complications can be delayed through optimal glycemic control among the diabetics.[4,5] Considering the issue, self-management has been highly recommended as the key remedy to cope up with the situation. However, many diabetics struggle to adhere to their self-care tasks which include eating a low calorie healthy diet, self-monitoring of blood glucose, engaging in physical activity and leaving sedentary lifestyle apart from administration of oral medication and insulin therapy. One modern way to make patients stick to their self-management regimen is through telecommunications.

This study aimed at finding out if the means of telecommunication like mobile phone text messages can be used to support self-management of diabetes and hence ensure better glycemic control among type 2 diabetics. Studies have shown that taking diabetes medication as directed, making lifestyle modifications and keeping more appointments with doctors is associated with substantial improvement in HbA1C levels among these diabetics[6] while patients with reduced self-care have poor glycemic control.[7] There are 4.68 billion mobile phone users in the world[8] basically 8 out of 10 people. This means that there is great scope in using mobile phones to send text messages based on principles of motivational interviewing to diabetics to change their attitude and behaviour towards diabetes and to promote adherence to self-care in them in a very easy, quick and cost-effective way.

In the west, research studies have been done on DATES and positive results have been obtained which have showed a significant decrease in HbA1c levels and a better glycemic control among type 2 diabetics who received motivational texts about improving life style and adherence to medication.[9,10,11] However no such study has been done in Pakistan partially owing to the delay in the acceptance of advancement of technology including telecommunications in the medical field.

In Pakistan, illiteracy and lack of awareness contributes to poor prognosis of chronic illnesses including diabetes and we did this study to investigate if telecommunications can improve the quality of life among type 2 diabetics, a result which can then be projected to the management of other chronic illnesses as well.

Methods

This study was a single centre, two arm parallel randomized controlled trial conducted at the Diabetic Clinic of Mayo Hospital, Lahore. Type 2 diabetic patients presenting to the diabetic clinic were invited to participate in this research provided that they gave informed consent and they met the inclusion criteria. This research study was authorized by the Institutional Review Board of King Edward Medical University, Lahore and due ethical considerations were taken according to the Helsinki Declaration.

Using 95% confidence interval, 10% absolute precision with expected percentage interventional group as 18% and control group as 27%[11] the sample size was calculated to be 266 type 2 diabetic patients with 133 participants each in the control and intervention group, randomly assorted by block randomization algorithm.

Patients diagnosed with type 2 diabetes mellitus, aging between 18 to 60 years and on diabetes medication or insulin therapy for a period of at least 1 month were included in this study. The participants possessed a mobile phone and were able to read and understand text messages in either Urdu or English. While patients who were totally illiterate and patients who did not give informed consent were not included. Similarly, patients having any psychiatric or mental illness like depression, psychosis and dementia and patients diagnosed with metabolic syndrome, dyslipidemias or other endocrine disorders were excluded. Patients suffering from severe diabetic complications, advanced cancer or any other terminal illness were also excluded from our study.

Data collection included socio-demographic information (age, gender, nationality, native language, education, occupation and marital status), contact information, diabetic status (duration of diabetes and fasting blood glucose level), blood pressure, body mass index and physical activity score. Body weight was measured using weighing machines, blood pressure with sphygmomanometer, physical activity score was estimated by direct questioning and patient's lab reports were checked to record the fasting blood glucose. We were able to contact all the patients on their mobile phones if not in person in the clinic to record post-intervention findings, resulting in zero participant fallout.

For a period of one month from 1st to 30th June, 2019, text messages were sent to the intervention group thrice everyday on their contact number provided and in the language of their choice to motivate them to take their diabetes medication and insulin doses regularly, to have regular checkups with their doctors, to eat a healthy, balanced diet, specifically one with less calories and to avoid sedentary life style but instead to engage themselves in exercise and physical activity. Meanwhile, the control group received no intervention.

Being a quantitative study, the primary outcome i.e. fasting blood glucose and secondary outcomes i.e. blood pressure, BMI and physical activity score were measured and compared among both groups before and after the study duration of one month.

The data was analyzed using SPSS version 26. FBG was tabulated in the form of mean and standard deviation. Proportions of participants lying in different categories of BMI, blood pressure and physical activity score were also tabulated. The z-score test and t-test of significance were run to analyze the results with p<0.05 denoting statistical significance.

Results

There were a total of 266 type 2 diabetic patients, who participated in this research with females being in the majority, 149 in number as compared to 117 males. As far as the age distribution is concerned, the mean age of the patients was 47.74 years with the largest number of patients (124 or 46.6% of the patients) lying in the range from 51-60 years of age. The participants had an average 5.9 years of diabetes duration, with 123 or around 50% patients having the duration of 4 or less than 4 years. Punjabi was the most common native language among the participants (spoken by 158 or 60% of participants) followed by Urdu, Pashto and Saraiki. 237 out of 266 patients were married. The majority of the participants of this study had an educational background only till intermediate education, with only 22 patients having had completed their university education

while 66 patients did not even complete matriculation.

The 266 participants were randomly assorted into 2 groups by block randomization algorithm, with 133 participants each in the control and intervention group. The control group had 59 males and 74 females while the intervention group had 58 males and 75 females.

The 4 outcomes of this study i.e. fasting blood glucose, blood pressure, BMI and physical activity score before and after the study period in both control and intervention group are tabulated below:

Discussion

Data analysis delineates that age and sex were two independent variables in the undertaken study. The prevalence of type 2 diabetes increased with advancing age consistent with the 2017 USA National Diabetics statistics report in which 26.3 million out of 30.2 million diabetics were aged more than 45 years.[12]

As far as the educational background of the patients is concerned, majority of them could go no further than intermediate education which might be a drawback as better educational background of the participants could have resulted in even better results of the intervention. A 2015 study in the UK found out that better diabetic

Table 1: *Comparison of Outcomes Among Control and Study Groups*

Parameter	Control group		Test of significance (p value)	Intervention group		Test of significance (p value)
	Before	**After**		**Before**	**After**	
Mean FBG (mg/dL)	238.33 ± 99.212	249.10 ± 100.264	0.38	227.80 ± 85.121	243.71 ± 85.251	0.12
BMI (kg/m²)						
16-20 (Underweight)	3	7	0.09	8	8	0.5
21-25 (Healthy)	66	65	0.45	42	55	**0.04**
26-30 (Overweight)	48	43	0.25	62	56	**0.04**
31-35 (Obese)	12	13	0.42	17	11	0.11
36-40 (Severely obese)	4	5	0.36	4	3	0.35
Blood Pressure (mmHg)						
110/70 to 120/75 (Normal)	40	29	0.06	21	32	**0.04**
120/75 to 130/85 (Elevated)	62	69	0.19	42	55	**0.04**
130/85 to 140/90 (Stage I HTN)	29	32	0.32	62	56	0.23
140/90 or greater (Stage II HTN)	2	3	0.32	17	11	0.12
Physical activity score						
Less than 10 (Sedentary)	66	75	0.13	73	58	**0.03**
10-20 (Moderately active)	54	49	0.19	47	53	0.22
Greater than 20 (Active)	13	9	0.18	13	22	**0.05**

knowledge regarding control and treatment can not only reduce the risk factors but also minimize the risk to develop diabetic complications among diabetics.[13]

Language did not prove to be a barrier to providing intervention. Text messages were sent in Urdu to all the participants in the intervention group as they had made clear that they were able to read and understand Urdu.

Through the mobile phone text messages, we tried to motivate the participants in the intervention group to eat a balanced diet, one with low calories, to quit sedentary lifestyle and to engage in different sorts of physical exercises. BMI, blood pressure, physical activity score and fasting blood glucose were the 4 dependent variables in our study which we used to compare the effect of DATES intervention on self-management of diabetes in the control and intervention group.

A 2007 USA research study found that increased BMI is associated with increased prevalence of diabetes mellitus, hypertension and dyslipidemia.[14] Similarly according to another research study, motivational interviewing was found to be a beneficial adjunct to behavioral obesity treatment for women with type 2 diabetes.[15] We also found a reduction in BMI after 1 month of DATES intervention. As compared to no change in the control group, there was a significant decrease in overweight and obese patients (p=0.04) in the intervention group. Prolonging the duration of mobile phone text message intervention can no doubt lead to even more significant improvement in BMI.

Sending text messages regarding the benefits of regular blood pressure monitoring and low salt diet also proved beneficial to control blood pressure among the diabetics in the intervention group leading to significant improvement in number of patients with BP less than 120/75 (p<0.05) while the control group on the other hand showed a worsening trend in blood pressures. These results go along with a 2017 study, which found that compared with usual care home blood pressure telemonitoring (HBPT) improved systolic and diastolic blood pressure and HBPT combined with counseling, education and behavioral management resulted in even more significant improvement in blood pressures.[16]

The third parameter which we used to study the efficacy of DATES intervention was the physical activity score, based on which we classified participants as having active, moderately active or sedentary lifestyle. In the control group during the study, the number of participants having sedentary life style increased although this was statistically insignificant (p=0.13) but in the intervention group we found a greater than 10% reduction in people with sedentary life style and this came out statistically significant. (p=0.03). Interestingly in China automated telephone counselor is available to motivate

people to engage in active lifestyle and so far it has shown promising results.[17]

The primary objective of our study was to study the effect of motivational mobile phone text messages on the glycemic control of type 2 diabetics (measured in terms of fasting blood glucose).

Literature is full of studies that have demonstrated the beneficial effect of intervention through telecommunications on the glycemic control of diabetic patients. It has shown to improve adherence to diabetes therapy and improve clinical outcome in patients with type 2 diabetes in Saudi Arabia.[18] While another study in 2018 also showed that tailored text message based self-management support program for 9 months resulted in modest improvements in HbA1C levels in patients with poorly controlled diabetes.[19]

However in our study, DATES intervention failed to improve the fasting blood glucose levels or the glycemic control in the intervention group. Although results were statistically insignificant (p>0.05), it was found out that fasting blood glucose levels worsened in both the control and intervention groups.

HbA1C is the gold standard to comment on the glycemic control in diabetic patients but due to lack of funding, we were not able to measure HbA1C levels of 266 participants. The element of spontaneity in fasting blood glucose does not make it a good parameter to comment on the glycemic control in diabetic patients because there is always this chance that fasting blood glucose was not essentially measured in fasting state by the patient. This was one of the limitations of our study as was the short duration of providing DATES intervention. Plus another contributing factor might be the low educational background of the participants.

DATES intervention indeed has showed promise in improving life quality of diabetic patients. Mobile phone text messages regarding life style modifications sent for longer periods of time (at least 6 months) coupled with regular health care visits and any changes in treatment regimens accordingly by the treating physician can improve glycemic control and prevent diabetic complications among type 2 diabetics.

Conclusion

Our research study brought us to the conclusion that diabetes and telecommunications i.e. DATES intervention has huge potential to be a fructuous tool in motivating patients with type 2 diabetes to adhere strictly to their medication regimen and to adopt a healthy lifestyle which in the long run can certainly improve their BMI, blood pressure and physical activity score. DATES intervention in the long run coupled with regular medical checkups and any necessary modifications

in treatment regimen can improve glycemic index, reduce the incidence of diabetic complications and hence improve the overall quality of life of diabetic patients in a very easy and cost-effective way.

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