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Effect of SMS Reminders on Loss to Follow up Rates among Type 2 Diabetics in an Urban Primary Care Setting

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Abstract:

Background: Non-attendance for appointments in health care results in wasted resources and disturbs the planned work-schedules. Regular diabetes follow-up allows for assessment of glycaemic control and earlier detection of, and intervention for, diabetes related complications. Various telemedicine approaches have been shown to have a positive impact on regular follow up and patient blood glucose control.

Methods: Two hundred consenting type 2 diabetics receiving care at the general outpatient department of Bingham University Teaching Hospital were recruited and randomly allocated into intervention (SMS appointment reminders) and control (regular care) study arms in blocks of 100 subjects. Socio-demographic and clinical data were obtained with standardized questionnaires from both intervention and control study arms. The data was collated and analysed using SPSS (Statistical Package for Social Sciences) software 17.0. Results were presented as chi-squares, student t-test and other statistical means.

Results: The subjects at baseline were comparable regarding age, sex, marital status, years post diabetes diagnosis, educational level, mean fasting blood glucose measurements and Body Mass Index.

In the control arm of the study, 40% of the subjects were lost to follow up whereas only 18% of the subjects in the intervention group were lost to follow up, and this difference was statistically significant ($p=0.01$).

Further comparative analysis of the sociodemographic characteristics of the subjects present at the end of the study with those lost to follow up showed a similarity of both groups except in their occupational groups, number of years post diagnosis of diabetes mellitus, BMI and blood pressure categories.

Conclusion: The findings of this study demonstrate the ability of SMS reminders to reduce the rate of loss to follow up among type 2 diabetics attending a primary care facility.

I. Introduction

There has been an explosion of mHealth activities around the world. A 2011 global survey of 114 nations undertaken by the World Health Organization found that mHealth initiatives have been established in many countries, but there is variation in adoption levels. ¹ The most common activity was the creation of health call centers, which respond to patient inquiries.

This was followed by using SMS for appointment reminders, using telemedicine, accessing patient records, measuring treatment compliance, raising health awareness and monitoring patients. According to the Cisco Visual Networking Index, global mobile data traffic has doubled for the fourth year in a row. And looking toward the future, the report estimates that "global mobile data traffic will increase 18-fold between 2011 and 2016". By the end of that time period, it is projected that there will be 10 billion mobile devices in use around the world. ²

Diabetes now constitutes the highest morbidity and mortality of all chronic NCDs in Africa. ³

The WHO suggests that Nigeria has the greatest number of people living with diabetes in Africa, with an estimated burden of about 1.7 million which will increase to 4.8 million by 2030. ⁴

In Nigeria, diabetes mellitus accounts for between 3.5% and 15% of medical admissions in most health facilities in the country. The economic burden of diabetes is enormous in terms of the direct cost of intensive monitoring and control of blood glucose and managing cardiovascular, renal, and neurological consequences. ⁵⁻⁷

Regular diabetes follow-up allows for assessment of glycaemic control and earlier detection of, and intervention for, diabetes related complications. It also creates an opportunity to regularly review and assess individual treatment plans and enable specialist support if required. Additionally, the information gained from diabetes follow-up provides up to date data for diabetes registers, which in turn drives improvements in diabetes service delivery.

Short Message Service (SMS) or Text messaging, is a communication feature among mobile, web or phone communication systems, allowing an exchange of short messages between mobile phones or fixed line devices. ⁸ Its cost effectiveness and easy accessibility has made it one of the most widely used communication

pathways in the world.⁹ Application of SMS in reminders of medical appointments and delivering medical tests is not new.

Since control of diabetes has been shown to decrease mortality and prevent long-term complications, it is critical that healthcare systems develop innovative ways to improve diabetes management, and provide timely care to patients.

We did not come across any literature that studied the effect of text message reminders on adherence to regular follow up visits among type 2 diabetics in a Nigerian primary care setting.

This study was undertaken to find out the effect of text message reminders on loss to follow up rates among type 2 diabetics in an urban Nigerian primary care setting.

II. Methods

Approval to conduct the study was sought from the Bingham University Teaching Hospital Research and Ethics Committee.

The study was conducted at Bingham University Teaching Hospital Jos, the Plateau State Capital. The state has an estimated population of 3,178,712 according to the 2006 National Population Census.¹⁰ The hospital is a 200 bed centre and provides healthcare for patients from Plateau State and the neighbouring States of Kaduna, Nassarawa, Bauchi, Gombe, Adamawa and Taraba States.

The General out-patient clinic as well as the medical out-patient clinic runs daily. Unpublished Hospital data shows that an average of 500 patients are seen weekly out of which 50 are diabetic.

The inclusion criteria consisted of:

1. Adult diabetics as from 18 years of age and above as at last birthday who consent to the study.
2. Patients with confirmed diagnosis of type 2 diabetes mellitus based on hospital records of fasting blood glucose measurements.
3. Patients with access to cell phones

The exclusion criteria consisted of any of the following

1. Visually challenged patients
2. Patients without access to cell phones

From an assumed sample frame of six hundred type 2 diabetics expected to be seen for the three months duration of the study, a sample interval of every third subject was used to recruit a total of 200 subjects. These were randomly allocated by a research assistant into either the intervention or control group.

A questionnaire at the recruitment phase was administered by the investigators, using face to face interview approach for the purpose of history taking. Subjects in both groups were given a verbal reminder for their next visit. Two days before each scheduled visit, text message reminders were sent to all patients in the intervention group.

Both intervention and control groups were given appointments at the same time of the day (8am). On arrival at the hospital, patients paid consultation and fasting blood glucose fees to the hospital cashier and had their blood drawn by the laboratory scientist and tested with the Glucometer (Assure 4, Taiwan).

A trained nurse measured blood pressure in mmHg using the mercury sphygmomanometer (Dekamet MK 3, Made in England), radial pulse rate, temperature using automated clinical thermometer measuring in degrees centigrade (UNESCO, U.S.A) weight in kilograms using a standardized bathroom weighing scale (SALTON RED 307, China), and height in metres using a stadiometer (Detecto Medic, U.S.A).

Patients had their regular consultation with the physician and at the end, both groups were given another verbal reminder for their next hospital visit. Both groups were given a once in a month appointment for three consecutive months.

III. Results

Following the first hospital visit after allocation into the two study groups, 22 patients from the control group did not return for the second visit, while 12 of those allocated to the intervention group did not turn up for the second follow up visit. By the third visit, 18 more of the patients in the control group were lost to follow up while 6 patients in the intervention group were lost to follow up.

Sociodemographic Characteristics of Study Participants Who Completed The Study and Those Lost To Follow Up

Age And Sex Distribution Of All Recruited Patients

The group lost to follow up had the highest percentage (34.5%) of subjects within the 51 to 60 age group, whereas the group present at the end of the study had the highest age group (29.6% each) represented in the 41-50 and 51-60 category respectively. There was no statistically significant difference in the age group

distribution of both groups (p=0.45). Females constituted 56.5% of the subjects recruited at the beginning of the study while 43.5% were males.

The group present at the end of the study was made up of 54.2% females whereas the group lost to follow up consisted of 62% females. There was no statistically significant difference in the gender constitution of both groups (p=0.3).

Educational Qualification Of All Recruited Patients

Subjects with tertiary education made up 30.5% the subjects recruited at the beginning of the study. This was closely followed by 30% with primary school education. Those that had non-formal made up 22% of the subjects and those with secondary school education made up 17.5%. The group present at the end of the study had 31% of its members with tertiary education. Primary, non-formal and secondary education accounted for 32.4%, 18.3% and 18.3% respectively. In the group lost to follow up, 31.1% had no formal education, 29.3% had tertiary education, 24.1% had primary education while 15.5% had secondary. There was no statistically significant difference in the educational qualification of both groups (p=0.24).

Occupational Distribution Of All Recruited Patients

Skilled artisans made up (43.5%) of the entire subjects recruited at the start of the study, 41% were unskilled artisans, 10% were retirees, 4.5% students and 1% were professionals. In the group present at the end of the intervention, 50% were unskilled artisans, 34.5% skilled artisans, 9.2% retirees, 5.6% students and 0.7% of the professional class. The group lost to follow up consisted of 65.5% of skilled artisans, 19% of unskilled artisans, 12.1% of students, 21% of retirees with 1.7% in the professional class. There was a statistically significant difference in the occupational distribution of both groups (p=0.00).

Table 1 Occupational Distribution Of All Recruited Patients

VARIABLES	COMPLETED THE STUDY	LOST TO FOLLOW UP	TOTAL	P value
OCCUPATIONAL GROUPS	N (%)	N (%)	N (%)	0.00*
PROFESSIONALS	1 (0.7)	1(1.7)	2(1)	
SKILLED ARTISANS	49(34.5)	38(65.5)	87(43.5)	
UNSKILLED ARTISANS	71(50)	11(19)	82(41)	
STUDENTS	8 (5.6)	1(1.7)	9(4.5)	
RETIRES	13(9.2)	7(12.1)	20(10)	
TOTAL	142(100)	58(100)	200(100)	

* = PEARSON’S CHI SQUARE, N=Number, () =Percentage

Marital Status Distribution Of All Recruited Patients

Married subjects made up 77.5% of the population recruited at the start of the study while the widowed, single divorced and separated formed 15%, 4%, 2% and 1.5% respectively. Seventy nine percent of the subjects in the group present at the end of the study were married while 12% were widowed, 5.6% single, while the same proportion (1.4%) were divorced and separated. The group lost to follow up had 72.4% of its members married, 22.5% widowed, 3.4% divorced, 1.7% separated with no single person. There was no statistically significant difference in the marital status of both groups (p=0.11).

Table II Marital Status Distribution Of All Recruited Patients

Variable	Completed The Study	Lost To Follow Up	Total	P Value
Marital Status	N(%)	N(%)	N(%)	0.12*
Single	8(5.6)	0(0)	8(4)	
Married	113(79.6)	42(72.4)	155(77.5)	
Divorced	2(1.4)	2(3.4)	4(2)	
Separated	2(1.4)	1(1.7)	3(1.5)	
Widow/Widower	17(12)	13(22.5)	30(15)	
Total	142(100)	58(100)	200(100)	

* = PEARSON’S CHI SQUARE, N=Number, () =Percentage

Number Of Years Post Diabetic Diagnosis And Diabetes Family History Of All Recruited Patients

The percentage of diabetics in the recruited population that had been diagnosed diabetic for not more than 5 years was 38%, 21.5% had been diabetic for up to ten years, 11.5% for 15 years, 9.5% for up to 20 years, 8.5% for up to 30 years, another 7.5% for up to 40 years and 4% for less than a year. In the group present at the end of the intervention, 26.8% of subjects had been diagnosed diabetic for not more than 5 years, 25.4% had been diagnosed diabetic for up to 10 years, 15.5% for 15 years, 12% for 20 years, 8.5% for 30 years, 8.5% for 40 years and 3.5% for less than a year. In contrast, the group lost to follow up had 12.1% of its members diagnosed diabetic for up to 10 years, 65.5% for not more than 5 years, 1.7% diagnosed diabetic for up to 15

years, 3.4% for 20 years, 8.7% for 30 years, 3.4% for 40 years and 5.2% for less than a year. There was statistically significant difference in the number of years post diagnosis in both groups (p=0.00).

There was a positive family history of diabetes mellitus in 35.5% of the group recruited for the study, while in the group present at the end of the study, 35.9% had an immediate family member that had been diagnosed diabetic. Similarly, 34.5% of the group lost to follow up had a family member that was a known diabetic and there was no statistically significant difference in the number of subjects with a positive family history of diabetes in both groups (p=0.84).

Table III Number of Years Post Diabetic Diagnosis and diabetes Family History Of All Recruited Patients

VARIABLE	COMPLETED THE STUDY	LOST TO FOLLOW UP	TOTAL	P VALUE
DURATION	N(%)	N(%)	N (%)	
LESS THAN 1 YEAR	5(3.5)	3(5.2)	8(4)	0.00*
1-5	38(26.8)	38(65.5)	76(38)	
6-10	36(25.4)	7(12.1)	43(21.5)	
11-15	22(15.5)	1(1.7)	23(11.5)	
16-20	17(12)	2(3.4)	19(9.5)	
21-30	12(8.5)	5(8.7)	17(8.5)	
31-40	12(8.5)	2(3.4)	14(7)	
TOTAL	142(100)	58(100)	200(100)	
FAMILY HISTORY				
YES	51(35.9)	20(34.5)	71(35.5)	0.84
NO	91(64.1)	38(65.5)	129(64.5)	
TOTAL	142(100)	58(100)	200(100)	

* = PEARSON'S CHI SQUARE, N=Number, () =Percentage

Baseline Clinical Parameters Of Study Participants Who Completed The Study And Those Lost To Follow Up

Baseline Body Mass Index Of All Recruited Patients

Of all the subjects recruited at the beginning of the study, 36% had normal body mass index, 32% were overweight, 22% were in obese class I, 3% in obese class II and 7 % were morbidly obese. The group present at the end of the intervention was made up of 43.6% of subjects with a normal body mass index, 29.6% overweight, 23.2% were in obese class I category, 1.4% were in obese class II and 2.4% were morbidly obese. The group lost to follow up consisted of 19% subjects with a normal body mass index, 38% overweight, 19% were in obese class I category, 6.8% were in obese class II and 17.2% were morbidly obese. There was a statistically significant difference in the body mass index of subjects in both groups (p=0.00).

Table IV Baseline Body Mass Index Of All Recruited Patients

BMI	COMPLETED THE STUDY N (%)	LOST TO FOLLOW UP N (%)	TOTAL N (%)	P VALUE
18-24.9(normal)	61(43.6)	11(19)	72(36)	0.00 *
25-29.9 (overweight)	42(29.6)	22(38)	64(32)	
30-34.9(obese class 1)	33(23.2)	11(19)	44(22)	
35-39.9(obese class 2)	2(1.4)	4(6.8)	6(3)	
>40(morbid obesity)	4(2.8)	10(17.2)	14(7)	
TOTAL	142(100)	58(100)	200(100)	

* = PEARSON'S CHI SQUARE, N=Number, () =Percentage

Baseline Blood Pressure Recording Of All Recruited Patients

At the beginning of the study, 24.5% of the subjects recruited for the study had normal blood pressure, 19.5% were in the pre-hypertensive phase, 18.5% had stage I hypertension, while 37.5% were in the stage II hypertension category. The study group present at the end of the intervention had 23.9% of its subjects with normal blood pressure recordings, 13.4% were pre-hypertensives, 10.6% had stage I hypertension stage while 52.1% had blood pressure recordings in the stage II hypertension category. However, the group lost to follow up had 25.8% of its subjects with normal blood pressure recordings, 34.6% were pre-hypertensives, 37.9% had stage I hypertension stage while 1.7% had blood pressure recordings in the stage II hypertension category and there was a statistically significant difference in the blood pressure categories of subjects in both groups (p=0.00)

Table V Baseline Blood Pressure Recording Of All Recruited Patients

BLOOD PRESSURE (mmHg)	COMPLETED THE STUDY N (%)	LOST TO FOLLOW UP N (%)	TOTAL N (%)	P VALUE
normal (<120/80)	34(23.9)	15(25.8)	49(24.5)	0.00*
Prehypertension (120-139/80-90)	19(13.4)	20(34.6)	39(19.5)	
stage I hypertension (140-159/90-99)	15(10.6)	22(37.9)	37(18.5)	
stage ii hypertension (>160/100)	74(52.1)	1(1.7)	75(37.5)	
TOTAL	142(100)	58(100)	200(100)	

* = PEARSON'S CHI SQUARE, N=Number, () =Percentage

Baseline Glycaemic Level Of All Recruited Patients

At the beginning of the study, glycaemic control was good in 50.5% of the population, 11% had fair glycaemic control while 38.5% had poor glycaemic control. In the group present at the end of the intervention, 41.5% had poor glycaemic control, 47.9% had good glycaemic control and 10.6% had fair glycaemic control. The group lost to follow up had 56.9% of its population with good glycaemic control, 31% with poor glycaemic control and 12.1% with fair glycaemic control. There was no statistically significant difference in the glycaemic control of subjects in both groups (p=0.38).

IV. Discussion

Seventy one percent of the study group completed the study.

Comparative analysis of the socio demographic and clinical characteristics of the patients who completed the study (n=142) and those lost to follow up (n=58) was done (Tables 1, II, III, IV, V). Those who completed the study (n=142) and those lost to follow up (n=58) were comparable regarding age, sex, marital status, medication type, family history of diabetes and educational level. Significantly more of those who had been diagnosed diabetic for less than 5 years were lost to follow up as well as more skilled than unskilled artisans (Tables 1 and III). Those that had been diagnosed diabetic for less than five years, were less likely to have come to terms about their condition and the need for routine follow up. Some of these patients may also be at different stages of denial about their condition, hence their tendency to be lost to follow up. Significantly more of the patients lost to follow up had either normal blood pressures or belonged to the pre hypertensive category (Table V). This could have given them the impression that their health condition was relatively better than their peers who were hypertensive and on anti-hypertensive, and hence they were more likely to adhere less to routine hospital visits. Both groups also differed statistically in terms of the body mass index of its members. Significantly more of the patients lost to follow up belonged to the obese class II and III categories (Table IV). Such patients are likely to have made several unsuccessful attempts at sustained weight loss and more likely to be discouraged at keeping routine hospital visits.

The group lost to follow up consisted of statistically significant more skilled artisans. It is difficult to explain the differences in the study population. There was no available comparable literature that considered occupation and family history of diabetes in the socio demographic characteristics of their study population. However, the location of the study site allows it to be accessed by both skilled and unskilled artisans, but there have been no studies to survey the occupational characteristics of patients presenting at the study facility. . Skilled artisans are more likely to operate business enterprises that require their physical presence and hence less likely to follow routine hospital appointments strictly, moreover their type of business is likely to fluctuate from day to day with regard to expected income, and this also may predispose them to being lost to follow up

The use of information systems and communication technologies to support the achievement of health objectives (eHealth) is an area currently being developed worldwide, and has minimal initiatives in our country.¹¹ The growth of mobile phone subscriptions and the new technologies into phones enable the use of these devices for health services.

There is evidence in the literature that reminder systems have reduced the non-attendance in various practice settings.¹²⁻¹⁴ In our study, overall, 29 % of the study group was lost to follow up . Of these, 9 % were from the intervention group that had SMS reminders whereas 20 % of those lost to follow up were from the control group. Even though the setting of our study is different from that of other researchers who had similar studies, our findings agree with those of other researchers like Sims et al who in a controlled study demonstrated a relative risk reduction of 28 and 25 % in terms of non-attendance, in the two years studied when comparing the attendances with the year prior to no reminders being sent.¹⁴ Prasad and Anand using a broader outcome measure i.e. attending on the day and on time, noted that it occurred overall in 79% of those who

received reminders and only 34% who did not receive the reminder.¹² Stubbs in their review noted that all reminder systems improved attendance rates but SMS reminders were the most cost effective.¹⁵

Further research

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