

# Effect of Using Mobile Phone Communication on Morbidity and Health Seeking Behavior of Type 2 Diabetes Mellitus Patients at Kitui County Referral Hospital, Kenya

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**Abstract:** There is an increasing prevalence of Type 2 Diabetes Mellitus (T2DM) in Kenya. This is despite the implementations of various interventions to prevent and manage the condition. Despite increasing use of mobile phone communication in Kenya, this technology has not been utilized in management of T2DM, though it has been applied in other countries. The objective of this study was to determine the effect of using mobile phone communication on the morbidity and health seeking behavior of T2DM patients. The study was conducted among 138 patients attending the diabetes clinic at Kitui County Referral Hospital. A pretested questionnaire was used to collect data on socio economic characteristics, morbidity status and health seeking behavior at the baseline and after mobile phone based intervention. There was a greater decline in morbidity in the experimental group (35.8% to 22.4%) compared to the control group (31% to 29.6%). The difference between groups was significant (OR=0.48; 95% CI= 0.27-0.85),  $p<0.05$ ). The proportion of respondents with controlled blood pressure (BP) increased in experimental group (44.8% to 49.3%) compared to a reduction in the control group (53.5% to 47.9%). The effect of the intervention was significant ( $p<0.05$ ). Self-monitoring of blood glucose (SMBG) increased from 32.8% to 41.8% in experimental group while it reduced from 39.4% to 31% in control group. The effect of the intervention was statistically significant ( $p<0.05$ ). This study concludes that use of mobile phone communication led to significant decrease in morbidity prevalence and an increase in the proportion of T2DM patients that carried out self-monitoring of blood glucose in T2DM patients while it did not have a significant effect on glycemic control, diabetes clinic attendance and monitoring of feet health.

**Keywords:** T2DM, Morbidity Prevalence, Health Seeking Behavior, Mobile Phone Intervention

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## 1. Introduction

Diabetes incidence is increasing rapidly and it is estimated that by 2030, the number of cases will almost double the current prevalence [1]. The high prevalence of diabetes contributes to increasing burden of diseases in developing countries, Kenya being one of them [2]. Among the risk factors for the condition include lack of physical activity and unhealthy diets high in carbohydrates and fats [3, 4].

Effective glycemic control ( $HbA1c \leq 7\%$ ) is important for those with T2DM as it reduces the risk of complications. Unfortunately, glycemic control is not achieved by the majority of patients with diabetes in Kenya [5]. Interventions involving telephone messages to patients have been shown to improve knowledge and health outcomes among persons of low socioeconomic status [6]. Mobile phone communication makes it easier to contact patients, and as such offer a useful tool to deliver education and improve health seeking

behavior [7]. Despite this, use of mobile phones in management of diseases has yet to be utilized effectively in developing countries with high prevalence of diabetes, Kenya being one of them [8, 9]. In Kenya, mobile phone use has continued to soar from 88.1% in 2015 (Communications Authority of Kenya, 2016) to 94.3% of the adult population in 2017 [10, 11]. Mobile phone communication is therefore used by most of the population in the country. The objective of this study was therefore to determine the effect of a mobile phone based intervention on morbidity and health seeking behavior of adult T2DM patients attending Kitui County Referral Hospital (KCRH).

## 2. Methods

### 2.1. Study Setting

This study was conducted at Kitui County Referral Hospital (KCRH) in Kitui County which is located within the semi-arid region of Kenya [12].

### 2.2. Study Design

This was a longitudinal study where all the T2DM patients were interviewed with a pretested questionnaire on socio economic and socio demographic characteristics, morbidity and health seeking behavior at the baseline and after intervention while Focus Group Discussion (FGD) was used to collect information on perceptions about diabetes. A total of 67 subjects in the intervention group and 71 in control group completed the two phases of the study. Respondents were recruited as they attended the diabetes clinic. The dependent variables in the study were morbidity and health seeking behavior while the independent variable was receiving or not receiving diabetes management messages through mobile text messages. The intervention group received messages (SMS) five days a week on health seeking activities such as diabetes clinic attendance and self-monitoring of blood glucose for six months while the control group did not receive any messages.

### 2.3. Morbidity Status and Side Effects of Diabetes Management

Morbidity status was measured by the proportion of respondents reporting sickness in the previous month. The side effects of diabetes medicine were determined by the proportion of respondents who had suffered side effects of medicine used in diabetes management.

### 2.4. Biochemical Assessment

Glycated haemoglobin (HbA1c) was measured onsite using CERA- STAT<sup>TM</sup> 2000 HbA1C. EAG machine at the beginning and after six months. Glycated haemoglobin (HbA1c) below 7% was classified as well controlled while above 7% was classified as poorly controlled [13].

### 2.5. Blood Pressure Measurement

Blood pressure (BP) was measured by a mercury sphygmomanometer at the beginning and after six months. Systolic BP below 140mmHg was classified as well controlled while above 140mmHg was classified as poorly controlled. Diastolic BP below 90mmHg was classified as well controlled while above 90mmHg was classified as poorly controlled [14].

### 2.6. Health Seeking Behavior

Health seeking behavior was determined by daily self-monitoring of blood glucose (SMBG), diabetes clinic attendance, consulting the doctor promptly when required and daily foot care. Self-monitoring of blood glucose (SMBG) was assessed by determining whether the patients carried out daily SMBG either at home or in the nearest health facility while monitoring feet health was assessed by whether respondents checked their feet daily for cuts, sores, blisters, redness, calluses or other problems [8, 15].

### 2.7. Statistical Analysis

Data was analyzed using SPSS version 21 and statistical significance was set at  $p \leq 0.05$ . Percentages, chi square and Odds Ratio regression were performed. The Net Effect of Intervention (NEI) analysis was used to determine the impact of the intervention. The findings of the study were then presented in tables.

### 2.8. Ethical Approval

Ethical approval was obtained from Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee (KNH-UON ERC) while permission to carry out the study was obtained from Kitui County Referral Hospital and the National Commission for Science, Technology and Innovation (NACOSTI). Written and oral consent was sought from the respondents before administering the questionnaire.

## 3. Results

### 3.1. Socio Economic and Socio Demographic Characteristics

Table 1 shows the socio demographic and socio economic characteristics of the respondents. Majority of the respondents were female (65.7% in experimental group and 62% in control group), aged above 40 years (92.5% in the experimental group and 88.7% in the control group) and married.

**Table 1.** Socio demographic and socio economic characteristics.

Characteristic	Intervention group (n=67) n (%)	Control group (n=71) n (%)
Gender		
Male	23(34.3)	27(38.0)
Female	44(65.7)	44(62.0)

Characteristic	Intervention group (n=67) n (%)	Control group (n=71) n (%)
Age (Years)		
<40	5(7.5)	8(11.3)
>40	62(92.5)	63(88.7)
Marital status		
Married	50(74.6)	60(84.5)
Single/separated	7(10.4)	4(5.6)
Widow	10(14.9)	7(9.9)
Number of dependents		
<3	34(50.7)	32(45.1)
>3	33(49.3)	39(54.9)
Education level		
< Primary	44(65.7)	40(56.3)
>Primary	23(34.3)	31(43.7)

### 3.2. Morbidity Status of the Respondents

Table 2 shows morbidity status of the respondents at baseline and after six months. There was a greater decline in morbidity in the intervention group (35.8% to 22.4%) compared to the control group (31% to 29.6%) after six

months. The difference in the decrease among the two groups was statistically significant (OR=0.48; 95% CI=0.27-0.85;  $p<0.05$ ). There was a decline in proportion of respondents experiencing side effects of medication in both groups: 14.9% to 13.4% in the intervention group and 11.3% to 8.5% in the control group after six months. However, the difference in the changes between the two groups was not statistically significant (OR=1.1; 95% CI=0.53-2.49;  $p>0.05$ ). The proportion of respondents with controlled glycated haemoglobin (HbA1c) increased by 4.5% in the experimental group and decreased by 4.2% in the control group. However, the difference in the changes between the two groups was not statistically significant (OR=1.58; 95% CI=0.98-2.56;  $p>0.05$ ). The proportion of respondents with well controlled blood pressure (BP) increased by 4.5% in the intervention group while there was a decline of 5.6% in control group. The NEI (10.1%) increase was statistically significant (OR=1.63 (95% CI=1.01-2.63),  $p<0.05$ ).

Table 2. Effect of intervention on morbidity of the respondents.

	Intervention group			Control group			NEI*	Odds (95% CI)	P value
	Baseline n (%)	Six months n (%)	% change	Baseline n (%)	Six months n (%)	% change			
Morbidity status	24(35.8)	15(22.4)	-13.4	22(31.0)	21(29.6)	-1.4	-12.0	0.48 (0.27-0.85)	0.012
Side effects of diabetes management	10(14.9)	9(13.4)	1.5	8(11.3)	6(8.5)	2.8	-1.3	1.10(0.53-2.49)	0.718
Glycated haemoglobin	39(58.2)	42(62.7)	4.5	37(52.1)	34(47.9)	-4.2	8.7	1.58(0.98-2.56)	0.061
Blood pressure	30(44.8)	33(49.3)	4.5	38(53.5)	34(47.9)	-5.6	10.1	1.63(1.01-2.63)	0.046

\*NEI: Net Effect of Intervention

### 3.3. Health Seeking Behavior

Table 3 shows that respondents who contacted a health worker when unwell increased from 37.3% to 50.7% in the intervention group and 36.6% to 40.8% in the control group. The NEI (9.2%) was not statistically significant (OR=1.24(95% CI=0.77-2.01),  $p>0.05$ ). After six months, there was an increase in diabetes clinic attendance from 61.2% to 79.1% in the experimental group and from 60.6% to 69% in the control group. The NEI (9.5%) increase was not statistically significant (OR=1.52; 95% CI=0.93-2.50;  $p>0.05$ ). The most cited barriers to regular clinic attendance in both groups were lack of bus fare, forgetting the clinic day

and being unwell. Respondents who conducted self-monitoring of blood glucose (SMBG) increased from 32.8% to 41.8% after six months in the experimental group while in the control group, they decreased from 39.4% to 31% after six months. The NEI (17.4%) increase was statistically significant (OR=1.65; 95% CI=1.01-2.73;  $p<0.05$ ). There was an increase of respondents who monitored their feet condition from 61.2% to 71.6% in the intervention group and 57.7% to 60.6% in the control group. The NEI increase of 7.5% was not statistically significant (OR=1.41(95% CI =0.88-2.28),  $p>0.05$ ) (Table 3).

Table 3. Effect of intervention on health seeking behavior of respondents.

	Intervention group			Control group			NEI*	Odds (95% CI)	P value
	Baseline n (%)	Six months n (%)	% change	Baseline n (%)	Six months n (%)	% change			
Contacted health worker when unwell	25(37.3)	34(50.7)	13.4	26(36.6)	29(40.8)	4.2	9.2	1.24 (0.77-2.01)	0.372
Diabetes clinic attendance	41(61.2)	53(79.1)	17.9	43(60.6)	49(69.0)	8.4	9.5	1.52(0.93-2.50)	0.099
Self-monitoring of blood glucose	22(32.8)	28(41.8)	9.0	28(39.4)	22(31.0)	-8.4	17.4	1.65(1.01-2.73)	0.047
Feet health monitoring	41(61.2)	48(71.6)	10.4	41(57.7)	43(60.6)	2.9	7.5	1.41(0.88-2.28)	0.158

\*NEI: Net Effect of Intervention

## 4. Discussion

Good health seeking behavior is important as it helps to prevent serious long term complications associated with diseases such as diabetes [16, 17]. Epidemiological studies have repeatedly confirmed an inverse association between diabetes and socio economic status [18]. In this study, there were more women (66% in intervention and 62% in control group) than men. These results are similar to those of other studies in Kenya: in a study carried out in Murang'a District on T2DM patients, female were 64% while another study involving Kenyatta National Hospital (KNH) and Thika District Hospital (TDH) found 67% of respondents were female [1, 19]. Fewer studies have reported lower number of females compared to men [20, 21]. A higher percent (72%) of women compared to men in a diabetes study was also observed in Ghana [22]. However, some studies have reported an equal number of males and females) in the diabetes clinics [23]. The reason for the higher female than men in our study could be that women tend to have better health seeking behavior than men [24-26].

Most respondents in this study were aged above forty years (91% in intervention and 89% in control groups). This is expected as the risk for Type 2 Diabetes Mellitus (T2DM) increases with age [27]. Given the fact that older patients with diabetes are at increased risk of having diabetes-related complications and to present with co morbid conditions such as hypertension [28], this makes it more probable that it is the older rather than the younger who seek medical attention. It is therefore important to educate the population on need for T2DM screening. Most of respondents in this study were married. This is consistent with another study in Coastal Kenya where 77% of the respondents were married and another in Tripoli, Libya where 76.9% were married [29, 30]. However the results are lower than a study in India on T2DM where 98.7% of the respondents were married while another study in Ethiopia on T2DM patients showed 65.1% as married [31, 32]. Marital status has been suggested to be a significant factor in mental and physical health [25]. Increased risk of diabetes has also been associated with low socio-economic status and low education status [33].

This study noted that there was a significant effect of the mobile phone intervention on morbidity prevalence among respondents. This reduction in morbidity prevalence in the intervention group could be because the mobile phone intervention led to improvement in self-care practices that led to better management of the T2DM patient hence decreased morbidity. Use of the mobile phone may lead to early identification of complications and enhance patient adoption of healthy lifestyles that in the long run leads to reduced morbidity [34].

The study also noted that there was no significant effect of the mobile phone intervention on side effects of diabetes medicine. Medication side effects among T2DM patients have been reported in other studies [17, 35]. Such side effects can have a negative impact on patient adherence to treatment, resulting in

uncontrolled diabetes and increased hospitalization and mortality [36]. Therefore, it is important to adhere to prescribed drugs to minimize possible side effects. Mobile phone communication has been used to monitor medication side effects following treatment in cancer patients [37].

The proportion of subjects with well-controlled HbA1c was relatively low in both the intervention and control groups, and mobile phone communication did not have a significant effect in the control. This raises concern as poorly controlled diabetes puts the patients at risk of complications [38]. Other studies on T2DM patients have reported even a lower proportion of patients with controlled HbA1c [38- 40]. The results on the effect of mobile phone communication in this study are similar to those made in other studies [41-43] where the communication did not have a significant effect. However, significant difference in HbA1c between the intervention and control group after mobile phone intervention has been reported by [44].

Blood pressure control in T2DM patients is important as it also prevents cardio vascular complications [45]. In this study, it was observed that there was a significant effect of mobile phone intervention on blood pressure control. Significant improvement in blood pressure after mobile phone intervention have been reported while no significant effect on BP after mobile phone intervention have also been reported by [46-48].

There was no significant effect of the mobile phone intervention on the proportion of patients who attended the hospital when unwell in this study. Diabetes should be aggressively managed by regular clinic attendance [49]. The study also observed that there was no significant effect of the mobile phone intervention on clinic attendance. Other studies on T2DM patients reported a higher adherence to clinic attendance at 85% and 87% [1, 19]. However, a study carried out in United Kingdom (UK) reported a very low adherence to doctor's appointment of 35% [50]. Mobile phone have been shown to have an increase in rate of diabetes clinic attendance in other studies where the rate of attending health check visits increased in the intervention group [51]. Use of mobile phone significantly increased ( $p<0.05$ ) rate of clinic attendance in epileptic patients in Malaysia [52].

Self-monitoring of blood glucose (SMBG) is important as it promotes better awareness of glucose levels, leading to improvements in diet and lifestyle [53]. There was a significant effect of the mobile phone intervention on SMBG in this study. Low rates of SMBG of 34% and 19% have been shown in other studies [19, 54]. However, higher rates of SMBG (49%) have been reported in other studies [5, 55]. Other studies have also reported an increase in SMBG in experimental group compared to control group [56] after mobile phone messaging. However, there are also studies where no significant difference in SMBG was observed between intervention and control group after mobile phone intervention [57].

Feet health is an important component in diabetes as it prevents diabetes foot ulcers (DFUs) that are associated with

foot amputations [58]. Our study noted that there was no significant effect of the mobile phone intervention on respondents monitoring their feet health. This is similar to results of another study that showed only 37% of diabetes patients monitored their feet [29]. Another study reported an even lower proportion of 20% of diabetes patients that monitored their feet while a study in Lamu, Kenya, showed that 37% checked their feet regularly. However, another study reported that over half (58%) of respondents checked their feet [58, 59]. The reason for poor feet checks could be because of poor knowledge on its importance indicating the need for more education on importance of daily feet check. A previous study reported a significant difference in feet health ( $p < 0.05$ ) after mobile phone messaging [15].

## 5. Conclusion

This study found that a large percent in this population is non-adherent to diabetes clinic attendance, self-monitoring of blood glucose (SMBG) and feet health. Having explored the consequences of non-adherence in T2DM patients, this then calls for an urgent action aimed at improving morbidity and health seeking behavior of T2DM patients. This will play a significant role in managing diabetes and prevent co-morbidities that are associated with poor diabetes management. Mobile phone communication significantly decreased the morbidity prevalence and increased the proportion of respondents that carried out SMBG. This technology should be promoted in blood pressure control and self-monitoring of blood glucose (SMBG). In aspects such as glycemic control and diabetes clinic attendance, other methods ought to be used in combination. This technology can also be used in other low income countries.

## Conflict of Interest

The authors declare that they have no competing interests. This study was self-funded.

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