The effectiveness of mobile message (SMS) and phone calls to improve the referral system of the diabetic patients' from diabetic retinopathy screening sites to the tertiary eye care center of Nepal.

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Abstract

Background: Diabetes mellitus is an emerging health problem worldwide and likewise in Nepal. Diabetes is growing like an epidemic in urban Nepal affecting 19% of the population above the age of 40 years. The study helps to assess if Short Message System (SMS) and phone calls can serve as effective tools for follow up of diabetic retinopathy cases from the screening sites to the tertiary eye hospitals.

Method: This study was a hospital based multi-centered, prospective comparative study. Three arms with intervention consisted of (i) Text messaging, commonly referred to as Short Message Service (SMS), (ii) Telephone reminders (iii) Dual reminders *i.e.*, both telephonic and SMS. "Counselling only" group did not get any reminder notice.

Results: A total of 1100 members were enrolled for the final analysis. Out of the 1100 study participants, 491 were females (44.6%) and 609% were males (55.4%). The failure to follow up was analyzed in different group. The follow up rate is significantly higher in SMS/phone group than in counselling only group, with 95% CI (1.60-4.46; and P=0.000). However, no significant differences were observed between the phone group and control group (P=0.831) and between the SMS group and the control group (P=0.833).

Conclusion: In this study, the percentage of follow up was found significantly higher in the intervention group that received dual reminders from both SMS as well as telephone calls as compared to the control group. In contrast, the rates of follow up with other two interventions groups (SMS group and Phone group) were not significantly different from the control group.

Introduction

Diabetes has emerged as a major public health problem [1]. The impact of rapid urbanization, industrialization and lifestyle changes has led to an increasing trend in prevalence of diabetes and its associated complications such as neuropathy, nephropathy, vascular diseases (cardiac, cerebral and peripheral) and retinopathy. By now it has been established that Diabetic Retinopathy (DR) is an important cause of avoidable blindness.

Diabetes is growing like an epidemic in urban Nepal affecting 19% of the population above the age of 40 years [2]. Health systems in most developing countries are yet to integrate effective prevention and control programs for diabetes into routine health care services and similar is the situation in Nepal. Having to deal with the inadequate human resources and under functioning health system, we need novel and innovative approaches to combat diabetes and associated retinopathy in developing country settings like that of ours. In this regard, the tremendous advances in telecommunication technology particularly cell phones can be utilized to improve diabetic eye care and follow up. With more than 6.8 billion mobile phone users and mobile phone technology penetration near 100% worldwide, mobile technology and text messages have changed communication between people and increased the use of this technology in health care services [3].

Non-attendance or loss of follow up of hospital outpatient appointments is a major burden in our patient care systems. It reduces the efficiency and effectiveness of the delivery of outpatient services. It also causes an inefficient use of clinical and administrative staff along with increased waiting time for other patients, which in turn, can result in noncompliance. Consequently, there is a delay in the presentation of patients' symptoms along with decrease monitoring of long-term chronic

conditions. This can in turn lead to increased patient morbidity. One of the main reasons for patients not attending their outpatient appointments are forgetting their appointments and confusion over the date, time and location of the appointment. Hence, to avoid or minimize the patient loss of follow up, a mobile phone and a Short Message System (SMS) could help in reaching success.

The rationale of the study

The study helps to assess how text message, also commonly referred to as Short Message System (SMS) and phone calls could serve as tool for management and follow up of diabetic retinopathy cases thus helping to bring down the rate of failure to follow up among diabetic patients for eye care and consequently minimizing the ocular morbidity in the diabetic population.

Objectives

General: To assess the effectiveness of mobile message and phone calls in improving the diabetic patient's referral system from diabetic retinopathy screening sites to the tertiary eye care center.

Research question

How effective are mobile messages and phone calls in improving follow up of diabetic patients in eye examination from DR screening sites to the tertiary/eye hospital in Nepal?

Materials and Methods

The study was a multi-centred four-armed, prospective comparative, hospital-based study. Three arms with intervention were i) Short Message Service (SMS) ii) Telephone reminders and iii) Dual reminders *i.e.*, both telephonic and SMS. Counselling only group did not get any reminder notice.

Established diabetic cases at presenting to the clinic were the study population. Patients who visited diabetic clinics in Bir hospital, Patan hospital, Sahid Gangalal national heart centre, Narayani sub regional hospital, Hetauda community eye hospital, Bhaktapur community eye centre and periodic screening camps in Kathmandu valley were enrolled in the study.

All patients participated in screening through non-dilated fundus photographs. The ones with some changes of diabetic retinopathy to those having vision-threatening DR on screening were referred for further investigation and management at tertiary eye center from DR screening sites.

During the screening, all the patients underwent fundus photography by paramedics. Patients were counselled verbally on diabetic retinopathy as well as on follow up visit during which they presented to Tilganga Institute of Ophthalmology (TIO), a tertiary eye hospital. The patients were informed for the follow up according to their diabetic retinopathy status. The timing for follow up

was further established by a retina specialist of TIO after reading and grading of the fundus picture at the reading grading center.

The screened patients were randomly assigned in different follow-up reminders groups. Based on different follow-up reminder, the patients were categorized into:

Group 1: Patients without any reminder and only counselled during the screening for attending the eye center for a comprehensive eye examination

Group 2: (Referred to as SMS group): Patients who received SMS as reminder for attending a comprehensive eye examination.

Group 3: (Referred to as Phone group): Patients that received phone call as a reminder for attending comprehensive eye examination.

Group 4: (Referred to as SMS/Phone group): Patients who received both SMS and phone Call as a reminder for attending comprehensive eye examination.

The timing for the SMS reminder and/or the phone call reminder was placed at 1 week and 2 days prior to the fixed for appointment date, where a customized SMS text and phone information was given mentioning the date, day and place of follow up. In the phone call, the same text was read for the patients. No more counselling approach was applied for the referral system. Patients were considered as "failed to follow up" after 6 weeks from the time of their scheduled follow up, and were considered for a telephone conversation/interview for their cause of failing to follow up.

Sample size

Based on the formula for estimating the minimum sample size for the study;

Minimum sample size $(n) = Z^2 p^* q / d^2$

Where, P=Prevalence rate.

Z=Standard normal variate.

A total of 1100 referred cases were included in the study within the project period which was equally distributed in all 4 arms. All consecutive diabetic cases screened for diabetic retinopathy and that needed referral were included in the study. The entire referred cases were arranged in chronological order and systematically categorized in four groups. The data assistants were trained for a week before the commencement of screening.

Inclusion criteria

All diabetic patients screened at physician clinic and the public hospitals like Bir hospital, Patan hospital, Sahid Gangalal national heart centre, Narayani sub regional hospital, Hetauda community eye hospital, Bhaktapur community eye centre and periodic screening camps in Kathmandu valley conducted by TIO; and underwent fundus photography for tele-screening.

The exclusion criteria

Patients not willing to participate in the study.

Eye examination of participants: Eye examination was done at the screening site with fundus camera by trained ophthalmic personnel.

Statistical analysis

Data analysis was done in SPSS version 20. Tables were prepared for data presentation. For the association of categorical data, *chi-square*/Fisher exact test was used wherever applicable. The difference was considered significant at a 5% level of significance (p<0.05).

Results

A flowchart of study participations is shown in Figure 1. A total of 1100 members were enrolled for the final analysis: SMS+phone (n=275) SMS reminder (n=275), phone contact (n=275), and control (only counselling) group (n=275). After up-to three attempts, all 275 participants in the phone group did answer, thus all 275 remained in the analysis. Similarly, all 275 participants were reached by phone and SMS (Figure 1).
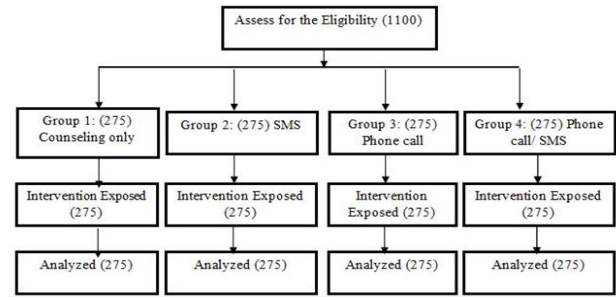

Figure 1. *Flow chart of study participants.*

Demographics

Of the 1100 study participants, 491 were females (44.6%) and 609% were males (55.4%). The only counselling group (with no reminders) had 132 females (48.0%) and 143 were males (52.0%). Similarly, in phone group (*i.e.*, with only phone call reminders, 135 were females and 140 were males, accounting for 49.1% and 50.9% respectively. In the SMS and phone group, females were 107 (38.9%) and males were 168 (61.1%). The mean age ranged from 52.38 to 53.51 yrs in different groups (Table 1).

Table 1. *Age and sex distribution of the participants.*

	Age (in years)		Male
	Mean	SD	
Group 1 (counseling only) (n=275)	53.51	12.38	143 (52.0%)
SMS group (n=275)	52.99	11.63	158 (57.5%)
Phone group (n=275)	52.99	11.96	140 (49.1%)
SMS/phone group (n=275)	52.38	13.3	168 (61.1%)

In group 1, follow up accounted for 79.6% while loss of follow up accounted for 20.4%.

Table 2 for the phone group, the follow up was 80.4% and loss of follow up was 19.6%. The SMS group had the follow up of 78.9% and loss of follow up of 21.1%. Among the SMS and phone group, the follow up was 91.3% and loss of follow up 8.7%.

Table 2. *Follow up rates by groups.*

Control group	Follow up rate (%) in comparison with Control group 1	P value	Exp (B)	95% CI for Exp(B)	
				Lower	Upper
Phone group	80.4% *vs.* 79.6%	0.831	1.05	0.69	1.59
SMS group	78.9% *vs.* 79.6%	0.833	0.96	0.63	1.45
SMS/Phone group	91.3% *vs.* 79.6%	0.001	2.67	1.6	4.46

Note: (Where Significance is P Value, CI is Confidence Interval; Exp (B) denotes the Exponentiation of the B coefficient).

On comparing the reference and control groups, Table 3 depicts that the follow up rate is significantly higher in SMS/phone group than that in group 1, with EXP (B) 2.67, 95% CI 1.60 to 4.46; and P=0.000). However, no significant differences were observed between phone group and control group (P= 0.831) as well as between SMS group and control group (P=0.833).

Table 3. Comparison of follow up rates with group 1.

	Follow up rate (%) in comparison with Control group 1	P value	Exp (B)	95% CI for Exp (B)	
				Lower	Upper
Control group			Reference		
Phone group	80.4% *vs.* 79.6%	0.831	1.05	0.69	1.59
SMS group	78.9% *vs.* 79.6%	0.833	0.96	0.63	1.45
SMS/Phone group	91.3% *vs.* 79.6%	0.001	2.67	1.6	4.46
Note: (Where Significance is P Value, CI is Confidence Interval; Exp (B) denotes the Exponentiation of the B coefficient).					

Failure to follow up was analysed in different groups (Table 4). It was seen that in the control group, out of 56 patients who did not come to follow up 58.9% responded to as having no time for the follow up, and another 33.9% were unaware of their follow up time. Reasons for failing to follow up are outlined the following table for other group.

Table 4. Reasons for failing to follow up by groups.

Types	If no, why?	Count	%
Control group	Asymptomatic	4	7.10%
	Missing follow up date	0	0.00%
	Not aware	19	33.90%
	Time not available	33	58.90%
	Total	56	100.00%
Phone group	Asymptomatic	3	5.60%
	Missing follow up date	1	1.90%
	Not aware	6	11.10%
	Time not available	44	81.50%
	Total	54	100.00%
SMS group	Asymptomatic	8	13.80%
	Missing follow up date	0	0.00%
	Not aware	16	27.60%
	Time not available	34	58.60%
	Total	58	100.00%
SMS/phone group (n=24)	Asymptomatic	0	0.00%
	Missing follow up date	0	0.00%
	Not aware	8	33.30%

	Time not available	16	66.70%
	Total	24	100.00%
Total	Asymptomatic	15	7.80%
	Missing follow up date	1	0.50%
	Not aware	49	25.50%
	Time not available	127	66.10%
	Total	192	100.00%

Discussion

Many appointment reminder studies have found reductions in failure to follow up rates by including postcards, letters and telephone. To our knowledge, this study that assesses effectiveness of telecommunication tools in encouraging follow up rates among health care patients is a first of its kind in Nepal.

In this study, the percentage of follow up was significantly higher in the intervention group that received dual reminders both from SMS as well as telephone compared to the control group. In contrast, the rates of follow up with other two interventions groups (SMS group or Phone group) were not significantly different from the control group. This finding of our study is not analogous with similar studies conducted in different parts of the world. Haynes and Sweeney studied the effect of telephone appointment reminder calls on absenteeism in a pulmonary function laboratory and found that the reminder calls reduced the absenteeism rate from 11.7% to 4% [4]. Similarly, Shoffner, et al., demonstrated that phone reminders were effective for intake appointments when therapists made direct contact with patients in an Appalachian community mental health [5]. In our study, however, appointment reminder made singularly through telephone did not show an equivalent result.

Recently, there were some studies where using SMS text messaging was found to be successful in improving attendance rate in some settings. Likewise, Geraghty, et al., using a historical control group, found SMS reminder to be an effective means of improving outpatient attendance at the Ear, Nose and Throat (ENT) outpatient clinic in Ireland [6]. Leong, et al., performed a RCT of SMS reminder calls in comparison with mobile phone reminder calls to improve outpatient attendance in primary care in Malaysia and showed that the attendance rate of the SMS group was significantly higher than that of the control group, but there was no difference between SMS group and the telephone group [7]. They also found that SMS reminder was more cost effective compared with the telephone reminder [8].

In our study we see a significant increase in the patient response to follow up in group receiving the phone call and the SMS text compared to the response with the SMS texting only, which gives us a new aspect for further research as it could be due to the literacy status of the phone users, hearing impairment and also unavailable data to the ownership of the phone number provided. It could also be confounded by patients' habits of not checking SMS received in their mobile phones.

Similarly, when we analysed the failure to follow up group, we see that the majority of the people in that group claim lack of time for the failed follow up which shows us the impact that the chronic disease makes on the day to day life of the patient including the day loss at the job and the financial burden. The second major reason in that group for the failed follow up involved being unaware about the follow up, which directs us to the ownership of the provided phone number and also to the literacy rates of the targeted population.

Conclusion

This study has shown us that in comparison to the only being counselled group, the ones reminded through phone call and SMS texting, follow up is increased to 91.3%. So it is a good approach to decrease the failure to follow up thus avoiding the loss of vision by the chronicity and advancement of the diabetic pathophysiologic process. Similarly, only text messaging though does not have statistically significant value, has a numerically greater response than the only counselling group. So using mobile telephones which has become an essential part of life in every part of the country could be a novel technique in the health care system and eye care essentially.

Limitation

This study has several limitations that need to be considered. First, it lacks information on predisposing factors such as patient beliefs or intentions, and other enabling factors such as income, education and information on other barriers (e.g., work-loss time) that are of considerable interest.

Cost and accessibility have been cited as the major barriers associated to eye care adherence by patients with diabetes in many surveys. Cost factors including examination costs, lost wage on the day of examinations, travel costs and its relation to failing to attend eye care in the context of Nepal have not been included in this study. The cost factors have significant bearing on the uptake as well as utilization of eye care that should be included in other similar king of studies.

Other factor that to need to be considered while analysing the rate of failure to follow up is that many patients in the context

of Nepal of this kind of the screening program may not have been aware of their high-risk status for vision loss and of the preventive importance of dilated eye care at regular intervals.

Recommendation

After the conclusion of this study we would like to recommend a randomized controlled trial with a larger population where education status and ownership of phone has been documented. We would also like to recommend the assessment of other essential aspect for the use of phone as the vision status and the hearing impairment. If the evaluation of loss of work time in days with loss to the monetary values during the attendance to the clinics or hospital could be done that would give the impact of chronic disease condition to the quality of life and loss of finances leading to failure to follow up.

Ethical Consideration

The proposal was submitted to the institutional review committee of TIO to review the ethical aspects of research. Patient confidentially was maintained.

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