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SMS Reminders for Increasing Follow-up Adherence among Diabetic Patients-an Innovative Strategy

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Abstract

Background: Introduction: Attendance rate of scheduled follow-up visits in primary health care clinic has been decreasing lately among the Malaysian population. This situation was seen in diabetic health clinic where poor compliance with follow-up visits has causes serious health complications.

Aim: This study was carried out to investigate the feasibility of Mobile SMS reminders in improving attendance rate of diabetic patients for follow-up visits.

Methodology: A non-randomised pilot study of assessing the effectiveness of SMS reminders to improve patients' attendance rate for scheduled follow-up visits was conducted among diabetic patients in the primary health care clinic. The participants were divided into 3 groups: baseline group (n=8084), control group (n=3347) and SMS reminders group (n=2258). 2 standardized SMS reminders were sent to the mobile phone of patients in the SMS reminders group the 2 weeks and 2 hours before their scheduled appointment date.

Results: SMS reminders significantly improve compliance with follow-up visits among diabetic patients.

Conclusion: SMS reminders has proved to be effective in improving follow-up adherence among diabetic patients and were cost-effective.

Keywords: Diabetes; SMS reminders; Attendance rate; Default rate

Introduction

Background

Diabetes mellitus (DM) is a common non-communicable disease in Malaysia. According to Malaysian National Health and Morbidity Survey (NHMS) 2015 [1], prevalence of diabetes in general had risen from 15.2% in 2011 to 17.5% in 2015. It was shown from NHMS 2011 [2] report that 56% of diabetic patients seek for treatment in health clinic, which is also known as "Klinik Kesihatan" in Malaysia, with mean duration for follow up of 6 years.

Diabetes is a chronic disease that is associated with other comorbidities that independently and jointly leading to disastrous complications. Latest statistics by National Diabetes Registry (NDR) 2009-2012 [3] shown that 70.1% and 55.1% of diabetic patients have concomitant hypertension and dyslipidaemia respectively. Diabetes is known to lead to macro vascular complications and microvascular disease. According to Clinical Practice Guidelines (CPG) on Management of Diabetes (5th edition) [4], diabetic patients are required to be followed-up on 3-monthly and yearly basis.

Ministry of Health (MOH) Malaysia [5] had investigated the cost of diabetes care for ambulatory patients in Malaysia. It was shown that mean direct healthcare cost was RM382.23 per patient per 6 months, with additional cost of RM398.21 if patient was hospitalised. On top of that, there would be additional direct non-healthcare and indirect cost by patient and accompanying person, with the total cost shown to add up to RM135335.45 per patient per 6 months.

Non-attendance, defined as absence of patients to scheduled appointment, is common among in primary healthcare. It was shown to range from 16.0% to 32.2 [6-14]. Non-attendance breaks the continuity of patient care, delays treatment which could cause complications of disease to arise, deprives patients of earlier appointments and increase cost of health care. A systematic review by Urganci et al. [13] has found that the most common reason for patient defaulting medical appointments was forgotten appointments. This situation could be overcome using reminder service, such as text messaging (short messaging system, SMS).

Studies have investigated the effect of SMS reminders in improving attendance rate at healthcare clinic. Urganci et al. [12] found that use of SMS was more superior than phone call reminders and phone call reminders in combination with postal reminders, with risk ratio (RR) of 1.14 versus 0.99 and 1.10. Taylor et al. [8] found that no SMS reminders have higher default rate, with odds ratio (OR) of 1.61 and number needed to treat (NNT) of 19.

A systematic review by Nuti et al. [15,16] was done to investigate the relationship between different types of intervention in getting patients to visit healthcare facilities and outcomes related to diabetic control. It was shown that SMS had led to positive outcomes of reduced HbA1c and cholesterol level by improving the attendance rate. Besides, it was shown that reminder system using phone and letter was able to increase attendance rate of patients for regular blood test and examination, reduce hospitalization rate and need for emergency care.

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Currently, no studies have been done to investigate attendance rate or default rate of patients in diabetes health clinic in Malaysia, with or without reminder system. Moreover, diabetes being a potentially disastrous disease if left without appropriate treatment and control, should be well managed from the time of diagnosis, mainly with regular follow-up. Thus, it necessitates a study to investigate if SMS reminder system would increase the attendance rate of diabetic patients for follow-up visits.

Thus, the study aimed to investigate the effectiveness of SMS reminders in improving attendance rate of patients for diabetes follow-up visits. It was hypothesised that SMS reminder will improve attendance rate of diabetes follow-up visits when compared to no reminder.

Methodology

Ethical approval

Ethical clearance was obtained from Medical Research & Ethics Committee (MREC), Ministry of Health, Malaysia and Monash University Human Research Ethics Committee (MUHREC) to access the attendance list of patients appointed in the diabetes health clinic, and to send SMS reminders to those patients with their mobile phone number recorded in the medical record.

Sample size

OpenEpi software was used to calculate the sample size. Two-sided confidence level was set at 95% and the power set at 80%. Ratio of controls to cases was set at 1.5, as the ratio of patients not having their mobile phone number recorded in the medical record book to those with their mobile phone number recorded was 3:2. According to a similar study done in Malaysia investigating effectiveness of SMS reminders in improving attendance rate in 7 primary health care centers, the attendance rate of patients in the control group was 48.1%, and the SMS group was 59.0%. Thus, the hypothetical proportion of controls with exposure was set at 48.1%, with the hypothetical proportion of cases with exposure set at 59.0%. The odds ratio of SMS reminders in improving attendance rate was shown to be 1.59. The sample size calculated using Fleiss with continuity correction was shown to be 261 for cases and 391 for controls to achieve statistical significance.

Setting & Study Design

This was a non-randomized case-control study involving diabetic patients scheduled for 3 monthly follow-up visits at the diabetes clinic in tertiary primary healthcare clinic in Malaysia. The participants were divided into baseline group, control group and study group. A random 3-monthly data was collected from two separated years as the baseline group for the study to compare the baseline attendance rate, which is from April to June 2017 and April to June 2018. SMS reminders were sent to these patients for follow up in August to November 2018 to assess the improving in attendance rate.

Baseline Group (n=8084) consists of patients who were given appointments for follow-up visits to the diabetes clinic from April to June 2017 and April to June 2018. Baseline attendance rate was calculated from this group of patients which included walk in patients (patients without appointments) and some daily referrals.

Control group (n=3347) consists of participants who were given appointment for diabetes follow-up visits at diabetes clinic from August to November 2018, without receiving SMS reminders. All this participants were categorised in the control group as they did not have

their mobile phone number recorded in the medical record book in the health clinic.

Study group (n=2258) consists of participants who were given appointment for diabetes follow-up visits in diabetes clinic from August to November 2018, with SMS reminders. All these participants were categorized in the study group as they have their mobile phone number recorded in the medical record book in the health clinic.

Inclusion Criteria

1. Patients with valid local mobile phone number.

Exclusion criteria

1. Patients with only local landline phone number, overseas phone number or without mobile phone.

Mobile phone numbers of patients with appointments were collected and entered in SMS online system 3 weeks prior to appointed dates. It took about 2 hours to enter the phone numbers in the bulk SMS system every week. The SMS reminders will be sent out automatically 2 weeks before appointment day, and 2 hours before appointment time. Every patient in the SMS group received standardized SMS reminder for their appointments, with the content as shown below.

"Mr / Mrs, this is a kind reminder on your appointment with your doctor in diabetes clinic at Klinik ----------- on <date, time>"

It was assumed that patients would receive the SMS once the notifications of "messages sent out successfully" were received from the bulk SMS provider.

Outcome measure

Records of the patient's attendance to diabetes follow-up visits of the day were obtained from diabetes clinic within the study duration. Patients who turned up for the appointment on the appointed day, within the working hours, will be marked as present. Those who did not turn up will be marked as absent. Total appointments given for the month as well as number of attended and defaulted patients will be recorded. Attendance rate was calculated as number of attended patients over total appointments while default rate was calculated as number of defaulted patients over total appointments.

Statistical Analysis

Patients' name, identification number, phone number and attendance or absence were recorded in Excel and SPSS version 25. Excel was used to produce graphs of baseline attendance rate, with and without SMS reminders. Chi Square Test were used to compare characteristics of outcome across study groups, with p value < 0.05 considered as statistically significant. Odds Ratio (OR) with 95% confidence interval was used to calculate the effectiveness of SMS reminders in improving attendance rate of patients as compared to control group. Number needed to treat (NNT) were calculated using Medcalc software, with Baseline Group and Control Group being used as reference group, respectively.

Results

The participants were divided into baseline group, control group and study group.

There were 8084 patients in the Baseline Group, 3347 patients in the Control Group and 2258 patients in the SMS Group.

Comparison between baseline groups

A total of 4001 and 4083 patients were recruited to Baseline Group 1a and 1b, respectively. The baseline attendance rates of diabetes clinic from April to June 2017 and 2018 were similar, with 93.0% versus 92.7%. The attendance rate of the baseline groups combined was 92.9%.

Figure 1 visualizes the comparison of attendance between the 2 baseline groups, by months. It was seen that Baseline Group 1a had higher attendance rate than Baseline Group 1b in April and June, by about 1% respectively. However, there were no significant differences in attendance rate between the 2 baseline groups in each month.

Comparison between SMS group and control group

Ratio of patients in the SMS Group to Control Group was approximately 2:3. When comparing between SMS Group and Control Group, as shown in Table 1, it was noted that SMS Group had higher attendance rate for diabetes follow-up visits, with 97.4% versus 84.9%, and the result was statistically significant at p<0.0001. In other word, Control Group had higher default rate than the SMS Group, by around 12%.

Figure 2 depicts the attendance rate of SMS Group and Study Group from August to November 2018. From August to November 2019, attendance rate in the SMS Group peaked in August, with attendance rate of 98.8%. The attendance rate dropped to about 94% in September rose to about 98% in October and hit a plateau. In comparison to the Control Group, attendance rate was lowest in August, followed by a rise of 10% until September, where the attendance rate increased steadily in October and November. The difference in attendance rate of both groups ranged from 9-22%, and the results were statistically significant.

Comparison between SMS group with control group and baseline group

Table 2 shows the odds ratio and number needed to treat (NNT) with 95% confidence interval (CI). Results showed that when SMS reminders were sent to the patients, they have 2.5 times odds of turning up for the follow-up visits, and the result was statistically significant. NNT was high, with result of 28 (95% CI: 21.47, 39.15). However, when the SMS Group was compared with the Control Group, patients who received SMS reminders had 6.8 times odds of turning up for the follow-up visits, and the result was statistically significant. NNT was 8 (95% CI: 7.07, 9.09), which means with 8 SMS reminders sent, 1 extra patient would turn up for the follow-up visits.

Cost-effectiveness analysis

Table 3 shows the cost-effectiveness analysis of SMS reminders. There were total patients of 2258 in the SMS intervention group, where each patient received 2 SMS prior to attending diabetes follow-up visit. Time spent on entering mobile phone numbers into the SMS bulk system was 2 hours per week, with total of 32 hours spent from August to November 2018. Salary for research assistant was RM12 (USD 2.88) per hour and the cost of each SMS was RM0.08 (USD 0.02). Total cost incurred was RM745.28 (USD 178.87) to send SMS reminders to 2258 patients, which is equivalent to RM0.33 (USD 0.08) per patient. Total attendance was 2200, which resulted in slight increase in cost per attendance, which was RM0.34 (USD 0.08).
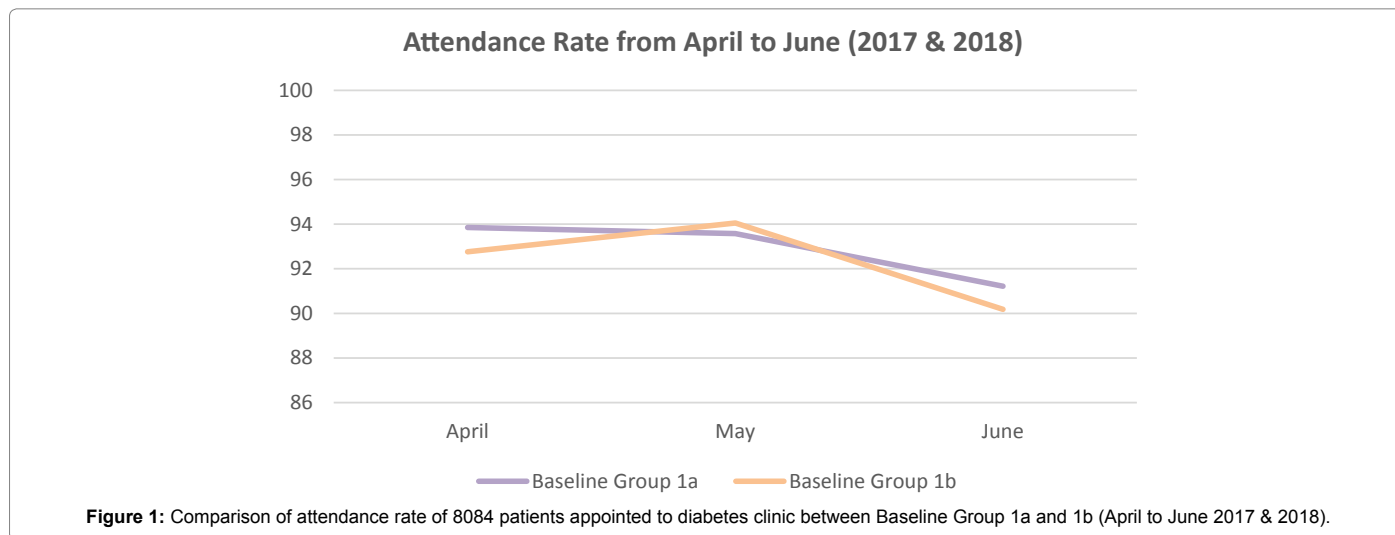

Figure 1: Comparison of attendance rate of 8084 patients appointed to diabetes clinic between Baseline Group 1a and 1b (April to June 2017 & 2018).

Table 1: Comparison of attendance rate of 5605 patients appointed for diabetes follow-up visits between SMS Group and Control Group (August to November 2018).

| Characteristics	SMS Group			Control Group			p value
	Total	Attended n(%)	Defaulted n(%)	Total	Attended n(%)	Defaulted n(%)	
Attendance	2258	2200 (97.43)	58 (2.57)	3347	2840 (84.85)	507 (15.15)	< 0.001
Attendance by Months August 2018	834	824 (98.80)	10 (1.20)	755	581 (76.95)	174 (23.05)	< 0.001
September 2018	464	437 (94.18)	27 (5.82)	714	619 (86.69)	95 (13.31)	< 0.001
October 2018	690	676 (97.97)	14 (2.03)	1354	1177 (86.93)	177 (13.07)	< 0.001
November 2018	270	263 (97.41)	7 (2.59)	524	463 (88.36)	61 (11.64)	< 0.001
Chi Square test used unless specified.							
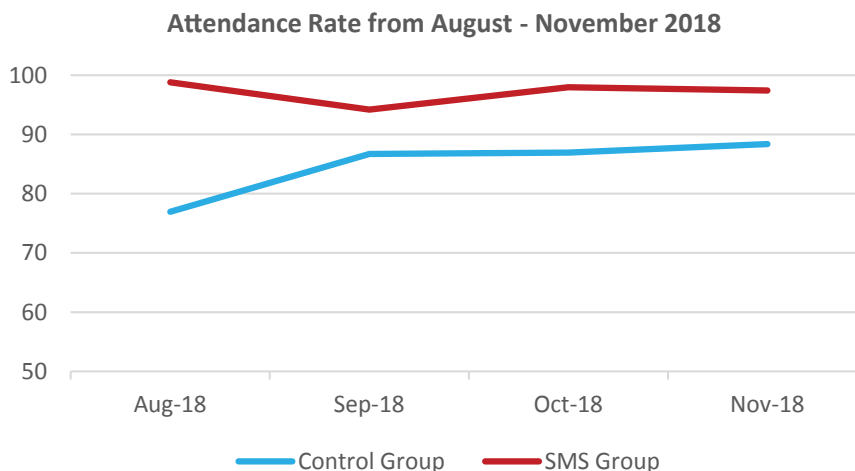
Figure 2: Comparison of attendance rate of 5605 patients appointed for diabetes follow-up visits between SMS Group and Control Group (August to November 2018).

Table 2: Results of logistic regression estimating effectiveness of SMS reminders in improving attendance rate as compared to Baseline Group and Control Group.

Groups	Odds ratio (95% CI)	p value	NNT (95% CI]
SMS Group vs Baseline Group	2.50 (95% CI: 1.89, 3.29)	**<0.0001***	28(21.47, 39.15)
SMS Group vs Control Group	6.77 (95% CI 5.13, 8.94)	**<0.0001***	8(7.07, 9.09)
Ci = confidence interval; NNT=number needed to treat			

Table 3: Cost-effectiveness analysis of SMS intervention.

Characteristics	SMS Intervention, RM (USD)
Total patients in SMS Group, n	2258
Total SMS sent, n	4516
Time spent for intervention, hours	32
Research assistant salary per hour	12 (2.88)
Total human resource cost	384 (92.16)
Cost of each SMS	0.08 (0.02)
Total SMS cost	361.28 (86.71)
Total cost incurred	745.28 (178.87)
Total cost per patient	0.33 (0.08)
Total cost per attendance	0.34 (0.08)
RM = Ringgit Malaysia; USD = United States Dolar RM1 = 0.24 USD	

Discussion

Main findings

Baseline attendance rate of diabetes clinic from April to June 2017 and 2018 was 93.0% and 92.73%, respectively. With SMS reminders, attendance rate of patients presented for diabetes follow-up visits was significantly higher than without SMS reminders. With p value <0.0001. NNT of SMS reminders was 8, which means with every 8 SMS sent, 1 extra patient presented for diabetes follow-up visit.

Study design

The study was non-randomized due to the nature of collecting patients' information. As approximately 60% of patients' medical records did not contain their mobile phone number, they were recruited to the Control Group.

Baseline attendance rate

Baseline attendance rates of diabetes clinic from April to June 2017 and 2018 were similar, which were 93.0% and 92.73%, with a combined overall baseline rate of 92.9%. This baseline rate did not reflect the

true attendance rate of patients presented for diabetes follow-up visits. The baseline attendance rate was overestimated as it included patients who did not have follow-up on that day but had presented as walk-in patients.

Attendance rate of diabetes follow-up visits

The attendance rate of the Control Group, 84.9%, reflects the actual attendance rate for diabetes follow-up visits. The attendance included only patients who had appointments on the specific dates, and had presented on the same day, within working hours, as appointed. With SMS reminders, it was shown that attendance rate improved to 97.4%. However, there may be potential confounders that have resulted in the higher attendance rate in the SMS Group.

Comparison between SMS group with control group and baseline group

When SMS reminders were sent, there were 6.8 times odds of the patients presenting for follow-up visits, as compared to no reminders (Control Group), and the result was statistically significant. The odds ratio (OR) was higher than what was shown by Leong et al. [16], who investigated the OR of patients presenting to the primary care, which was only 1.59. In other words, SMS reminders intervention was shown to be more effective in our study as compared to Leong et al. [16]. The huge difference may be due to the low baseline attendance rate of the primary care investigated, which was 48.1%. NNT of SMS reminders was 8, which signified that with 8 SMS sent, 1 extra patient would present for follow-up visits. The NNT was similar with the same study by Leong et al. [16], with NNT of 9.

When comparing between SMS Group and Baseline Group, the attendance rate with SMS reminders was higher, with 97.4% *versus* 92.9%. The differences in attendance rate between these 2 groups were lower than that of SMS Group and Baseline Group. The difference in attendance rate, which was 8%, potentially signifies the attendance rate of walk-in patients in the Baseline Group. Patients who received SMS reminders were shown to have 2.5 times odds of presenting for follow-

up visits, and the result was statistically significant. NNT was 28, which means 28 SMS needed to be sent out in order to have 1 extra patient attending diabetes follow-up visits.

Cost-effectiveness Analysis

The cost incurred per patient was shown to be RM0.33 (USD 0.08). The cost was slightly higher than another study done in Malaysia by Leong et al. [16], which was shown to be RM0.27 per patient. However, the cost per attendance in our study was lower, with RM0.34, as compared to RM0.45 by Leong et al. [16]. The difference between the cost per attendance was due to the better effectiveness of SMS reminders in our study, as discussed earlier. Moreover, this cost of sending SMS reminders per patient were much lower than the cost of treating one patient with diabetes-related complication, as shown from a cost analysis by Mustapha et al. [l6]. By spending RM0.33 to send out SMS reminders for every patient, it could help to save RM135335.45 spent on patient who developed complications from poor diabetes control.

Limitation

Baseline characteristics such as age, gender, income of patients and appointment time of the participants were not recorded in the study, as have been done in other studies. These may be the confounding factors of patients defaulting their diabetes follow-up visits. Secondly, reasons for defaulting follow-up visits were not recorded. Thus, it was unable to prove if "forgetting appointments" was the main reason for defaulting follow-up, which could have explained the significant improvement in attendance rate after SMS reminders were sent. Moreover, other reminder methods were not investigated in the study, thus it was unable to compare the effectiveness between different reminder methods.

Future prospects

Baseline characteristics of patients should be included in future studies to detect potential confounding factors of defaulting follow-up visits. Besides, reasons for defaulting follow-up should be recorded with the aim of improving reminder system and healthcare system in general. Other reminder method such as phone call to landline or mobile phone numbers can be included in future studies to identify the most effective reminder method.

Conclusion

SMS reminder system was shown to be statistically significant in improving attendance rate of diabetic patients presenting for follow-up visits, with NNT of 8.

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