Use of short message service (SMS) reminders to improve the attendance rate of diabetes-related multidisciplinary services in a primary care clinic a randomized controlled trial

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Research article

Keywords: Type II diabetes, attendance rate, multidisciplinary care, Short Message Service (SMS), randomized controlled trial

Posted Date: November 2nd, 2019

DOI: https://doi.org/10.21203/rs.2.16495/v1

Abstract

Background: Non-attendance of various non-physician-led multidisciplinary (NPLM) services causes wastage of health care resources. This study determined whether using mobile phone text message reminders by Short Message Service (SMS) in patients with type II diabetes attending a primary care clinic resulted in higher attendance rates of NPLM services when compared with those without SMS reminders.

Method: A single centre randomized-controlled trial included adult subjects with type II diabetes who could read Chinese or English, possessed an SMS-capable phone and booked at least NPLM service appointments in study site. The main outcomes were comparing attendance rates between the control group and the intervention group of various NPLM services including nurse complication screening, nurse individual counselling, multidisciplinary group education, dietitian counselling, physiotherapist service, retinopathy screening by optometrist and blood taking sessions

Results: 297 eligible subjects were approached, 15 were excluded and 11 refused to participate. 271 subjects were recruited (response rate 96%). Their mean (± standard deviation) age was 63.3±11.3. Their mean duration of DM was 6.9±5.3 years with mean HbA1c 7.37±1.32%. They were randomly assigned to intervention (N=135) or control (N=136) group. The Intervention groups received a standard SMS reminder included appointment name, date and time 24-72 hours prior to the scheduled appointment. The Control groups received no reminder. 733 appointments (intervention N=372, control N=361) were analysed. More subjects used smartphone (82.2%) than mobile phone without internet access (17.8%). All SMS were successfully delivered for the 372 appointments with no adverse event reported. The overall attendance rates were 92.7% in the intervention group and 83.1% in the control group (Odds ratio, OR 2.60, 95% confidence interval, CI 1.61-4.19, p<0.001). In subgroup analysis, SMS reminders were particularly useful in reminding nurse clinic (OR 3.06, 95% CI 1.22-7.66, p=0.017) and optometrist clinic (OR 2.73, 95% CI 1.07-7.01, p=0.037).

Conclusion: SMS reminder is a reliable method to increase overall attendance rates and health service utilization of NPLM DM services in outpatient setting.

Background

Evidence had shown that multidisciplinary care can improve the quality of care including process and clinical outcomes of patients with type 2 diabetes mellitus (DM) (1, 2). The American Diabetes Association recommended multidisciplinary care for patients with DM: such as participation in diabetes self-management education; receiving medical nutrition therapy, preferably by a registered dietitian; engagement in physical activity and regular eye examination by ophthalmologist or optometrist (3, 4).

However, the beneficial effects would be negated if patients failed to attend those non-physician-led multidisciplinary (NPLM) services. Non-attendance may render the complication screening and management incomplete. Non-attendance is associated with significant opportunity costs in the health

care systems, which acts as a barrier for healthcare access. Two studies in UK revealed that the non-attendance rate of diabetes care clinic was 15% (5) and 19.5% (6). One of the commonest reasons of non-attendance reported in literatures is simply forgetting the appointment (7–11). A local exploratory qualitative interview of the lower socio-economic class patients with diabetes found that they may have difficulties to read multiple appointments slips (12). Therefore, a patient reminder system before the appointment time could potentially help to improve the attendance rate.

Currently, patient reminder can be in the form of posted letters, telephone calls or electronic text messaging. All of them showed improvement in attendance rate in different clinical settings and populations (13–16). Text messaging was found to be the most cost-effective method (17). Electronic text messaging could be delivered through Short Message Service (SMS) or through mobile applications in smart phones. Almost all mobile phones can receive SMS instantly with no additional charge, and it generally does not require additional mobile data subscription plan from the network service provider or installation of mobile apps. The possession of mobile phone by Hong Kong citizen was over 99% for aged 18–59 and 89% for aged 60 or above, while possession of smart phone was 96.1% for aged 18–59 but barely around 55% for aged 60 or above (18). Therefore, unlike the messages delivered through mobile applications, SMS could cover a broader population especially in elderly, making it a suitable strategy for delivery of reminder for patients with diabetes.

In a Cochrane review in 2013, there was evidence which showed text messaging reminders increase the attendance of health care appointments, including two randomized controlled trials in primary care setting (19, 20). However, the quality of studies was only low to moderate due to heterogeneity of methodologies and study populations (21). The service types, such as allied health or nursing services, were not separately analysed. The effect of such reminder in patients receiving multiple appointments was also unknown.

To provide holistic care to patients with DM, the government-funded primary care outpatient clinic in Hong Kong had introduced a risk assessment and management programme (RAMP) since 2009 (22). It comprises of various NPLM services with input from nurse case managers and allied health professionals including dietitians, physiotherapists and optometrists in primary care clinics. All diabetes patients are invited to attend RAMP once every 1–2 years. Thus, patients enrolled in RAMP programme normally receive multiple appointments with different dates and time. The non-attendance rates of different NPLM services before study implementation were 20% to 30% in 2015.

The main objective of the study is to determine the effect of using SMS reminder on the attendance rates of various NPLM services for patients with type II diabetes, including nurse diabetes complication screening (DMCS), nurse individual counselling (DMIC) and group education (DMGE), dietitian counselling (DC), physiotherapy session (PT), retinopathy screening by optometrist (OPT) and blood taking appointment (BT). Our hypothesis for the study was that for patients with type II diabetes with more than one scheduled services, there would be an increase in attendance rates for those who received SMS reminder compared with those who did not.

Methods

This study was conducted in a parallel randomized-controlled trial (RCT) design. The allocation ratio of intervention: control was 1:1. The study reporting adheres to CONSORT guidelines. The trial was approved by the Research Ethics Committee, Kowloon West Cluster, Hospital Authority (Reference number *KW/EX–16–104(100–10))*.. This study was registered in the U.S. National Library of Medicine ClinicalTrials.gov, number NCT03055702. (URL: https://clinicaltrials.gov/ct2/show/NCT03055702 'Retrospectively registered')

Study setting

The study was carried out in a community primary care clinic located in Kwai Chung, New Territories of Hong Kong from 2 Oct 2016 to 28 Feb 2017. It serves mainly the older patients, those from a lower socio-economic class and those with chronic illness. The majority of attendees are Chinese. There were 6 primary care physicians, 6 nurses, 1 physiotherapist, 1 dietitian and 1 optometrist regularly working in the study clinic. It provides around 55,000 doctors consultations and over 14,000 RAMP service attendances annually. During the study period, a total of 2,648 patients with diabetes attended for medical consultations in the study site. The cost of various NPLM DM services was the same at around USD 6.4 (HKD 50), except for blood taking which was free of charge.

Study populations

Subjects who fulfilled the following eligibility criteria were included:

[1] aged 18 or older with the diagnosis of type II DM (with International Classification of Primary Care 2nd edition coded T90),

[2] possessed an SMS-capable phone,

[3] could read Chinese or English, and

[4] had at least 2 of the 7 NPLM appointments booked in the study site (DMCS, DMIC, DMGE, DC, PT, OPT, BT) scheduled 2 days or more following the recruitment date.

Subjects were excluded if:

[1] their diabetes was managed by the internal medicine specialists or endocrinologists at the time of recruitment, or

[2] they were mentally incapacitated.

Sample size calculation

The attendance rates for the RAMP services was estimated to be approximately 70%. A study done in a Malaysia clinic showed SMS reminder can improve the attendance rate by 11.5% (20). By deploying the SMS reminder service, the attendance rate was expected to be 81.5%. In order to have 80% power and 5% false positive error, a sample size of 217 appointments were needed for both intervention and control group. Assuming all subjects had 2 appointments, the number of subjects needed in each group was 109. After consideration of the attrition rate of 15%, we aimed to recruit 126 patients in each group, making 252 subjects in total.

Study pilot

A pilot trial was conducted involving 30 patients and the data was not included for analysis. Optimization of recruitment logistics, standardization of interviewing techniques and refinement of SMS reminder wordings were done with all the co-investigators before the study began.

Subject recruitment

Subjects were approached by the clinic doctors or nurses during their clinic visits and informed consents were obtained. Trained nurses then filled in the questionnaire about their demographics and habit of using mobile phone. Subjects were then directed to registration for appointment booking and they received their printed appointment slips. Subjects in the intervention group received an additional SMS as reminder. Other clinical and laboratory parameters, such as blood pressure, body mass index, duration of DM, presence of microvascular or macrovascular complications, use of oral anti-diabetic agents, haemoglobin A1c (HbA1c) level and low-density lipoprotein (LDL) level were retrieved from the electronic health record database. *Figure 1* showed the study flow chart.

Randomization process

Each subject was assigned an anonymous identification code after recruitment. Subjects and the referring personnel were blinded from the group allocation. Simple randomization using random sequence generation with variable block length was used for assignment to either intervention or control group independently by the biostatistician, thus keeping the number of subjects approximately the same.

Intervention - SMS

Subjects randomized into intervention groups received an SMS reminder 24–72 hours prior to the scheduled appointment. A list of subjects in intervention group was prepared by the biostatistician given to the health care assistants (HCAs) who were not involved in the recruitment process. SMS was sent though a secured web-based interface provided by CSL Mobile Limited, Hong Kong by a trained HCA manually. The scheduled reminders were counter-checked with our system by another HCA 1 day before sending to avoid input error. The delivery status was also checked to see if it was successfully sent to the subject's mobile. As replying SMS may incur additional cost to them, communication through SMS was discouraged. A sample SMS reminder may read, translated in English, "Clinic Reminder: Your dietitian appointment is scheduled at 10:30am on 20/4/2017. Please call 3651 5411 if you cannot attend. Please

do not reply the message. Thank you." As a safety measure, automatic forwarding of all incoming SMS to nurse-in-charge's mailbox was done to prevent missing important messages from our subjects.

Outcome

The outcome was assessed by investigators who were blinded to the group assignment. The primary outcome of this study is the attendance of the NPLM services. Attendance is defined as the patient registered for the service as recorded by the outpatient appointment system. Those who had rescheduled their appointment and attended were also counted as attended the service. For those appointments which were being cancelled before the scheduled time were excluded from the analysis.

Statistical analysis

Descriptive statistics were used to show the distribution of socio-demographic, occupational profile, lifestyle, clinical history, and to summarize the clinical data of the SMS intervention and control patients. Differences between groups were compared using chi-square tests for categorical variables and independent t-tests for continuous variables. The effect of SMS intervention on the attendance rates of different DM services appointments of subjects was assessed. The attendance rates of each DM services appointments between intervention and control groups were tested using Chi-square test. Additionally, sensitivity analysis was also performed comparing only the attendance rate of the first visit of each subject using Chi-square test or fisher exact test. Logistic regression was performed to estimate the odds ratios (OR) of the SMS intervention on attendance rate of different DM services appointments group relative to the control group. Stepwise logistic regression was also performed to adjust for confounding factors. 95% confidence intervals of attendance rates and odds ratios were calculated. All statistical analysis was performed using SPSS Version 24.0. All significance tests were two-tailed and findings with a p-value less than 0.05 were considered statistically significant.

Results

Throughout the 5-month recruitment period, 297 subjects were approached. 12 subjects did not fulfil the inclusion criteria (10 of them had only 1 appointment on booking and 2 did not have DM) and 3 were excluded as being followed up in medical specialists. 11 subjects refused to participate, making the overall response rate 96%. A total of 271 subjects were recruited and randomized. 135 were in the intervention group and 136 were in the control group. The Consolidated Standards of Reporting Trials CONSORT diagram is presented in **Figure 2** (23).

The details of the socio-demographic variables, clinical characteristics and laboratory data for both groups were listed in Table 1. There were no statistically significant differences of all the variables between the intervention and control groups. The mean (± Standard deviation, *SD)* age of the subjects was 63.3±11.3 and male to female ratio was 0.99. All of them are Chinese and 62% of them had no full-time employment. 41.3% had their highest education attained at primary school or below. More than

three-quarters (77.5%) of them had been using mobile phone for more than 5 years, and 82.2% of them possessed a smart phone.

Majority of them (88.6%) were on at least one anti-diabetic medication. Their mean duration of DM was 6.9±5.3 years. Their mean HbA1c was 7.4±1.3% and LDL level was 2.4±0.7 mmol/L. More than half (51.3%) had at least one macrovascular or microvascular complications of diabetes.

Most of the subjects (86%) had either 2 or 3 scheduled DM-related services in our clinic. The mean time to appointment of various services were 48.6±28.7 days. The overall appointment rescheduling rate was 1.6%. The cancellation rate was 2.4%, accounting for some subjects only had one appointment for analysis (Table 2).

The SMS delivery rate for the appointment in the intervention group was 100%. 733 appointments (intervention N=372, control N=361) were analysed. The attendance rates of various services in both groups are presented in Table 3. BT, DMCS and OPT were the three most frequently scheduled appointments in our study, constituting more than 80% of the total. The overall attendance rates were 88.0% (92.7% in the intervention group and 83.1% in the control group). The appointment with highest attendance rate was blood taking (overall 96.8% attended, 98.1% in intervention group and 95.5% in control group), while dietitian appointment was the lowest (overall 70% attended, 78.8% in intervention group and 59.3% in control group). DMCS, DMIC, OPT and overall appointment attendances reached statistical significance in univariate analysis by Chi-square test.

Sensitivity analysis was also performed by comparing only the attendance rate of the first visit of each subject (Table 4). 271 appointments (intervention N=135, control N=136) were analysed which showed there were significantly higher overall attendance rates in intervention group (96.3%) when compared with the control group (84.6%).

To determine the effect of the socio-demographic (age, sex, occupation, education level, smoking and drinking status, marital status and use of smart phone), clinical variables (presence of diabetes complications, use of oral anti-diabetes medications, use of insulin, HbA1c level, systolic and diastolic blood pressure, low-density lipoprotein level, body-mass index and duration of diabetes) and days to appointment on the appointment attendances, stepwise logistic regression was performed. HbA1c level, days to appointment and SMS intervention showed significant effect on appointment attendance (Table 5).

The effects of SMS intervention on the appointment attendances by logistic regression is shown in Table 6. The overall appointment attendance was significantly higher in intervention group with adjusted odds ratio (aOR) 2.55 (95% confidence interval, *CI* 1.57-4.12, p <0.001). The absolute difference of the attendance rates is 9.6% (92.7% in intervention group and 83.1% in control group). For analysis of individual services, DMCS (aOR 3.17, 95% CI 1.25-8.03, p=0.015) and optometrist appointments (aOR 2.58, 95% CI 1.00-6.69, p=0.05) had significantly higher attendance rates in intervention group. The effect of SMS on other services did not show statistically significant difference.

Adverse events during study

There were no reported adverse events during the study period, including wrong numbers sent, data misinterpretation, loss of privacy or message delivery failure. Two incoming messages were received, both were acknowledging the service with appreciation.

Discussion

The conduction of this study was based on current evidence that one of the major reasons for non-attendance was forgetfulness. This was the first RCT focused in patients with DM demonstrated positive effect of SMS on attendance rate of multiple NPLM services in a government-funded primary care clinic. The characteristics of the study population was similar to those patients with DM who were being followed up in primary care clinics in Hong Kong (24), and it could be generalized to other primary care clinics with similar patient profile. The observed high response rate and absence of adverse events indicated SMS is a useful technology for primary care patients with DM.

Effect of SMS on appointment attendance

The study showed that SMS reminder improved the overall attendance rate of NPLM services as compared with no reminder. Further analysis of each individual service showed the attendance rates of DMCS and OPT appointments had significant improvement by using SMS reminder. Although the attendance rates of other services did not reach statistical significance, they were consistently higher in the intervention group. The frequency of DMCS, OPT and BT were higher than others because these were the components for annual diabetes assessment according to the prevailing service protocol. Other allied health services were provided to patients if they were newly diagnosed diabetes, or referred on discretion by the primary care physicians and patients' preference. The results from this study are in keeping with the phenomenon that forgetfulness is one of major reasons for non-attendance.

The baseline non-attendance rate of NPLM services, excluding BT, ranged from 16.9–40.7% in the control group, which was consistent with our baseline and other studies(5, 6). One interesting observation was the high attendance rate of blood taking appointment. Previous studies reported besides forgetfulness, negative attitude, perceived ineffectiveness, personal commitments and transportation costs may also contribute to the appointment non-attendance (7–12). In our study, 95.5% of patients attended blood taking even though no reminder was given to them in the control group. We postulated this phenomenon was due to the perceived usefulness or effectiveness of the service to the patients with diabetes. Subjects may find blood taking is more important to them as it is an accurate reflection of the disease control and may influence the decision of medication adjustment by the physician. In addition, blood taking service is free of charge and this may also contribute to high attendance rate. On the contrary, dietitian counselling had the highest non-attendance rate, despite all other NPLM services charged the same. In Chinese culture, food is not solely served as a source of nutrition, but it also plays an important role in social function. Chinese usually eat together to maintain relationship and for information exchange. They like to eat in Chinese restaurants with relatives, neighbours and friends in the morning. Some patients may have

anticipated difficulty in following the advice by dietitians, so they would choose not to attend the counselling service as a way of avoidance. In order to sustain the improved attendance, patient education on the importance of diabetic services is equally important in addition to the reminder services. As there was no subject interview conducted during the study, the exact reason remains to be elucidated.

Comparison with existing literature

The findings from our study were accordant with four similar RCTs comparing SMS effect on primary care clinics attendance rate (19, 20, 25, 26). Their attendance rate in control group ranged from 48.1% to 80.5%, which was lower than that of our control group (83.1%). The effect of SMS ranged from increase of 3.7% to 11.5%, which is similar to overall increase of 9.6% attendance rate in our study. The subjects in previous studies did not focus on patients with specific disease. The analysis of different types of multidisciplinary service was not performed. Our study added value in showing there is a significant effect of SMS reminders for improving appointment attendance rates in patients with DM. They need long-term and multidisciplinary care, which patients may receive multiple appointments from different service providers. The study result also provided some insight in application of SMS reminders for patients with other chronic diseases who need multidisciplinary services.

Two other factors, HbA1c and days to appointment, were found to have significant negative effect on appointment attendance. A recently published systematic review showed that the poor disease control with high HbA1c level was associated with follow-up non-attendance, which was consistent with our findings (27). It was also observed in our study that longer days to appointment was associated with lower attendance rate, and similar finding was also reported in a cross-sectional study in a ophthalmology clinic (28).

Limitation of study

As limited by manpower and available facility, the RCT was carried out in one clinic. This study included subjects who had DM and followed up in public sector, the effectiveness of SMS in other settings (e.g. those who had follow up in private sector) may require further evaluation. As the subjects were recruited based on the number of appointments but not the service types, some services may not have enough power to perform subgroup analysis. Also, we did not require the subject to acknowledge our SMS message after reading. Some of the subjects may have received but not read the reminder. It may underestimate the effect of SMS on the attendance rate. Lastly, health outcomes such as HbA1c, blood pressures and lipid profile were not assessed after the intervention.

Implication for clinical practice and future research

This study found that SMS is an effective strategy to improve the attendance rates of various NPLM DM services, particularly for DMCS and OPT appointment. With further development of this reminder system, for example with automatic transmission of reminder by connecting to the appointment system, the labour cost and the data input could be further reduced. The cost for each SMS is HKD 0.6 (equivalent to

USD 0.08). It can reduce the wastage of scarce medical resources by patients' non-attendance. Since the process involves handling of sensitive personal data, health care providers need to consider possible concerns for patients' confidentiality and privacy issues when launching it as a long-term routine service model.

Future research could be done to evaluate the cost-effectiveness of using SMS reminder and whether there is any difference in long term health outcome. Qualitative interview with patients who received SMS but still did not attend the services would have given insight into other reasons of non-attendance. The effectiveness of the SMS with variation on the timing, frequency and the content of the reminder message could also be studied. Under the current scheme, the SMS reminder is unidirectional (i.e. from clinic to subject). It is useful to explore the feasibility of a bidirectional communication using the same platform.

Conclusion

SMS reminder is an effective way to improve overall attendance rates of non-physician-led DM-related services, particularly for diabetes complication screening clinic by nurse and retinopathy screening by optometrist. To reduce resource wastage, policy-maker could consider implementation in a larger scale in outpatient setting.

Abbreviations

BT—blood test

CI—confidence interval

DM—diabetes mellitus

DMCS—diabetes mellitus complication screening

DMIC—diabetes mellitus individual counselling

DMGE—diabetes mellitus group education

DC—dietitian counselling

HbA1c—Haemoglobulin A1c

HCA—Healthcare assistant

LDL—low density lipoprotein

NPLM appointment—Non-physician-led multidisciplinary appointment

OPT—optometrist

PT—physiotherapy

RCT—randomized controlled trial

SMS—Short message system

USD—United State Dollar

Declarations

Ethics Approval and Consent to Participate:

The study was approved by Research Ethics Committee, Kowloon West Cluster, Hospital Authority of Hong Kong S.A.R. approval number: KW/EX-16-104(100-10).

Consent For Publication:

Written informed consents were sought before study participation.

Availability of Data and Materials:

All data generated or analysed during this study are included in this published article

Competing Interests

The Authors declare that they have no competing interests

Funding

This is a self-funding study

Authors' Contributions:

MD, SF, WL and CW participated in the study design and analyses. SF and MD conducted the study, MD and CW performed statistical Analysis. MD wrote the first draft of the manuscript. SF, CW and WL

commented on this draft and performed critical revisions. All authors have read and approved the manuscript.

Acknowledgement

We would like to thank our medical colleagues, nursing and supporting staff in Ha Kwai Chung General Outpatient Clinic for their assistance in this research project. We would like to thank our consultants Dr. Yuk-Kwan YIU for the approval and overall supervision of this study.

References

1.Ridge T. Shared Medical Appointments in Diabetes Care: A Literature Review. Diabetes Spectrum. 2012;25(2):72–5.

2.Powell PW, Corathers SD, Raymond J, Streisand R. New approaches to providing individualized diabetes care in the 21st century. Curr Diabetes Rev. 2015;11(4):222–30.

3.American Diabetes Association. 4. Lifestyle Management. Diabetes Care. 2017;40(Suppl 1):S33-S43.

4.American Diabetes Association. 10. Microvascular Complications and Foot Care. Diabetes Care. 2017;40(Suppl 1):S88-S98.

5.Hardy KJ, O'Brien SV, Furlong NJ. Information given to patients before appointments and its effect on non-attendance rate. BMJ. 2001;323(7324):1298–300.

6.Forster AS, Forbes A, Dodhia H, Connor C, Du Chemin A, Sivaprasad S, et al. Non-attendance at diabetic eye screening and risk of sight-threatening diabetic retinopathy: a population-based cohort study. Diabetologia. 2013;56(10):2187–93.

7.Hogan AM, McCormack O, Traynor O, Winter DC. Potential impact of text message reminders on non-attendance at outpatient clinics. Ir J Med Sci. 2008;177(4):355–8.

8.Tesa P, Le Lievre C, Lawrenson R. Why don't patients with diagnosed diabetes attend a free 'Get Checked' annual review? J Prim Health Care. 2009;1(3):222–5.

9.Zailinawati AH, Ng CJ, Nik-Sherina H. Why do patients with chronic illnesses fail to keep their appointments? A telephone interview. Asia-Pac J Public He. 2006;18(1):10–5.

10.Schwennesen N, Henriksen JE, Willaing I. Patient explanations for non-attendance at type 2 diabetes self-management education: a qualitative study. Scand J Caring Sci. 2016;30(1):187–92.

11.Wong VMY, Lai TYY, Lee GKY, Wong AL, Leung GM, Lam PTH, et al. Non-attendance behavior at a general ophthalmic outpatient clinic in Hong Kong - the patient's perspective. Hong Kong J Ophthalmol. 2006;10(1):15–21.

12.Hung SL, Fu SN, Lau PS, Wong SY. A qualitative study on why did the poorly-educated Chinese elderly fail to attend nurse-led case manager clinic and how to facilitate their attendance. Int J Equity Health. 2015;14:10.

13.Jeppesen MH, Ainsworth MA. Telephone reminders reduced the non-attendance rate in a gastroenterology outpatient clinic. Dan Med J. 2015;62(6).

14.Jayaram M, Rattehalli RD, Kader I. Prompt letters to reduce non-attendance: applying evidence based practice. BMC Psychiatry. 2008;8:90.

15.Geraghty M, Glynn F, Amin M, Kinsella J. Patient mobile telephone 'text' reminder: a novel way to reduce non-attendance at the ENT out-patient clinic. J Laryngol Otol. 2008;122(3):296–8.

16.da Costa TM, Salomao PL, Martha AS, Pisa IT, Sigulem D. The impact of short message service text messages sent as appointment reminders to patients' cell phones at outpatient clinics in Sao Paulo, Brazil. Int J Med Inform. 2010;79(1):65–70.

17.Stubbs ND, Geraci SA, Stephenson PL, Jones DB, Sanders S. Methods to reduce outpatient non-attendance. Am J Med Sci. 2012;344(3):211–9.

18.Women and Men in Hong Kong - Key Statistics [Internet]. Census and Statistics Department, HKSAR Government. 2017 [cited 14/12/2017]. Available from: https://www.censtatd.gov.hk/fd.jsp?file = B11303032017AN17B0100.pdf&product_id = B1130303&lang = 1.

19.Liew SM, Tong SF, Lee VK, Ng CJ, Leong KC, Teng CL. Text messaging reminders to reduce non-attendance in chronic disease follow-up: a clinical trial. Br J Gen Pract. 2009;59(569):916–20.

20.Leong KC, Chen WS, Leong KW, Mastura I, Mimi O, Sheikh MA, et al. The use of text messaging to improve attendance in primary care: a randomized controlled trial. Fam Pract. 2006;23(6):699–705.

21.Gurol-Urganci I, de Jongh T, Vodopivec-Jamsek V, Atun R, Car J. Mobile phone messaging reminders for attendance at healthcare appointments. Cochrane Database Syst Rev. 2013;12:CD007458.

22.Jiao F, Fung CS, Wan YF, McGhee SM, Wong CK, Dai D, et al. Long-term effects of the multidisciplinary risk assessment and management program for patients with diabetes mellitus (RAMP-DM): a population-based cohort study. Cardiovasc Diabetol. 2015;14:105.

23.Boutron I, Moher D, Altman DG, Schulz KF, Ravaud P, Group C. Methods and processes of the CONSORT Group: example of an extension for trials assessing nonpharmacologic treatments. Ann Intern Med. 2008;148(4):W60–6.

24.Lau IT. A Clinical Practice Guideline to Guide a System Approach to Diabetes Care in Hong Kong. Diabetes Metab J. 2017;41(2):81–8.

25.Cho SJ, Kim YS, Shin HC, Sung EJ, Kim DH, Lee S, et al. A Randomized Controlled Trial of SMS Text Messaging versus Postal Reminder to Improve Attendance after Lipid Lowering Therapy in Primary Care. Korean Journal of Family Medicine. 2010;31(4):284.

26.Chen ZW, Fang LZ, Chen LY, Dai HL. Comparison of an SMS text messaging and phone reminder to improve attendance at a health promotion center: a randomized controlled trial. J Zhejiang Univ Sci B. 2008;9(1):34–8.

27.Lee RRS, Samsudin MI, Thirumoorthy T, Low LL, Kwan YH. Factors affecting follow-up non-attendance in patients with Type 2 diabetes mellitus and hypertension: a systematic review. Singapore Med J. 2019;60(5):216–23.

28.McMullen MJ, Netland PA. Lead time for appointment and the no-show rate in an ophthalmology clinic. Clin Ophthalmol. 2015;9:513–6.

Tables

Table 1. Demographic and baseline characteristics of subjects in intervention and control groups.

	Intervention (N=135)		Control (N=136)		Total (N=271)		p-value
	N	%	N	%	N	%	
Demographic							
Age, mean±SD	135	63.5±11.2	136	63.1±11.4	271	63.3±11.3	0.775
Sex							0.761
Male	66	48.9%	69	50.7%	135	49.8%	
Female	69	51.1%	67	49.3%	136	50.2%	
Occupation							0.358
Housewife	14	10.4%	23	16.9%	37	13.7%	
Manual non-skilled	11	8.1%	10	7.4%	21	7.7%	
Manual skilled	6	4.4%	4	2.9%	10	3.7%	
Non-manual	28	20.7%	31	22.8%	59	21.8%	
Professional/Managerial	9	6.7%	8	5.9%	17	6.3%	
Retired	62	45.9%	49	36.0%	111	41.0%	
Unemployed	5	3.7%	11	8.1%	16	5.9%	
Educational level							0.661
Primary or below	54	40.0%	58	42.6%	112	41.3%	
Secondary	61	45.2%	63	46.3%	124	45.8%	
Tertiary or above	20	14.8%	15	11.0%	35	12.9%	
Smoking							0.581
No	100	74.1%	93	68.4%	193	71.2%	
Yes	15	11.1%	19	14.0%	34	12.5%	
Ex-smoker	20	14.8%	24	17.6%	44	16.2%	
Drinking							0.292
No	105	77.8%	96	70.6%	201	74.2%	
Yes	28	20.7%	35	25.7%	63	23.2%	
Ex-drinker	2	1.5%	5	3.7%	7	2.6%	
Marital status							0.292
Married	112	83.0%	119	87.5%	231	85.2%	
Single/Divorced/Widowed	23	17.0%	17	12.5%	40	14.8%	
	Intervention (N=135)		Control (N=136)		Total (N=271)		p-value
	N	%	N	%	N	%	
Use of smartphone^							0.237
No	20	15.0%	27	20.6%	47	17.8%	
Yes	113	85.0%	104	79.4%	217	82.2%	
Experience of using mobile phone							0.235
0-5 years	25	18.5%	36	26.5%	61	22.5%	
6-10 years	17	12.6%	21	15.4%	38	14.0%	
11-15 years	16	11.9%	16	11.8%	32	11.8%	
16 years or above	77	57.0%	63	46.3%	140	51.7%	
Clinical Parameters							
Presence of Diabetes Complications							0.854
No	65	48.1%	67	49.3%	132	48.7%	
Yes	70	51.9%	69	50.7%	139	51.3%	
Cardiovascular disease	8	5.9%	7	5.1%	15	5.5%	0.779
Peripheral vascular disease	1	0.7%	1	0.7%	2	0.7%	0.996
Ischemic heart disease / Myocardial infarction	9	6.7%	9	6.6%	18	6.6%	0.987

Nephropathy	32	23.7%	41	30.1%	73	26.9%	0.232
Retinopathy	35	25.9%	27	19.9%	62	22.9%	0.234
Neuropathy	1	0.7%	0	0.0%	1	0.4%	0.315
Use of anti-diabetes medications							0.552
No	17	12.6%	14	10.3%	31	11.4%	
Yes	118	87.4%	122	89.7%	240	88.6%	
Metformin	116	85.9%	114	83.8%	230	84.9%	0.629
Sulphonylurea	71	52.6%	69	50.7%	140	51.7%	0.760
Dipeptidyl peptidase-4 inhibitor	24	17.8%	16	11.8%	40	14.8%	0.163
Insulin	9	6.7%	4	2.9%	13	4.8%	0.151
Hemoglobin A1c level, HbA1c (%), mean±SD	135	7.34±1.21	136	7.39±1.43	271	7.37±1.32	0.744
Systolic blood pressure (mmHg), mean±SD	135	129.3±11.2	136	127.5±11.9	271	128.4±11.6	0.186
Diastolic blood pressure (mmHg), mean±SD	135	73.4±10.0	136	74.0±9.8	271	73.7±9.9	0.632
Low-density lipoprotein (mmol/L) , mean±SD	135	2.43±0.65	135[#]	2.37±0.70	270[#]	2.40±0.68	0.436
Body mass index (kg/m^2), mean±SD	135	26.7±4.2	136	26.3±4.5	271	26.5±4.4	0.529
Duration of Diabetes (year), mean±SD	135	7.4±5.5	136	6.3±5.0	271	6.9±5.3	0.099

[^]There were 2 subjects in intervention group and 5 subjects in control group with undetermined mobile phone model.

[#]Low-density lipoprotein level was not calculated in 1 control group subject as his triglyceride level is high.

Table 2. Appointment variables in intervention and control groups.

	Intervention (N=135)		Control (N=136)		Total (N=271)		p-value
	N	%	N	%	N	%	
Number of appointments							0.935
1	3	2.2%	4	2.9%	7	2.6%	
2	56	41.5%	60	44.1%	116	42.8%	
3	58	43.0%	59	43.4%	117	43.2%	
4	9	6.7%	6	4.4%	15	5.5%	
5	7	5.2%	6	4.4%	13	4.8%	
6	2	1.5%	1	0.7%	3	1.1%	
Days to appointment, mean±SD	372	48.2±27.3	361	49.0±30.1	733	48.6±28.7	0.713
Rescheduled appointment	9	2.4%	3	0.8%	12	1.6%	0.090
Cancelled appointment	10	2.6%	8	2.2%	18	2.4%	0.687

Table 3. Attendance rate of <u>all</u> DM services appointments of subjects in intervention and control groups by Chi-Square Test.

Description	Intervention (N=372)		Attended		Control (N=361)		Attended		Total (N=733)		Attended		p-value
	N	%	N	%	N	%	N	%	N	%	N	%	
Nurse Diabetes Complication Screening (DMCS)	108	29.0%	101	93.5%	103	28.5%	85	82.5%	211	28.8%	186	88.2%	***0.014****
Nurse Diabetes Individual Counselling (DMIC)	21	5.6%	20	95.2%	18	5.0%	13	72.2%	39	5.3%	33	84.6%	***0.047****
Diabetes Group Education (DMGE)	11	3.0%	9	81.8%	12	3.3%	9	75.0%	23	3.1%	18	78.3%	0.692
Dietitian Counselling (DC)	33	8.9%	26	78.8%	27	7.5%	16	59.3%	60	8.2%	42	70.0%	0.101
Physiotherapy Session (PT)	12	3.2%	11	91.7%	9	2.5%	7	77.8%	21	2.9%	18	85.7%	0.368
Retinopathy Screening by Optometrist (OPT)	79	21.2%	72	91.1%	81	22.4%	64	79.0%	160	21.8%	136	85.0%	***0.032****
Blood taking appointment (BT)	108	29.0%	106	98.1%	111	30.7%	106	95.5%	219	29.9%	212	96.8%	0.265
Overall	372	100%	345	92.7%	361	100%	300	83.1%	733	100%	645	88.0%	***<0.001****

* Significant at p<0.05

Table 4. Attendance rate of first DM services appointments of subjects in intervention and control groups.

Description	Intervention (N=135)		Attended		Control (N=136)		Attended		Total (N=271)		Attended		p-value
	N	%	N	%	N	%	N	%	N	%	N	%	
Nurse Diabetes Complication Screening (DMCS)	17	12.6%	16	94.1%	14	10.3%	9	64.3%	31	11.4%	25	80.6%	***0.036****
Nurse Diabetes Individual Counselling (DMIC)	4	3.0%	4	100%	6	4.4%	4	66.7%	10	3.7%	8	80.0%	0.467
Diabetes Group Education (DMGE)	3	2.2%	3	100%	2	1.5%	2	100%	5	1.8%	5	100%	1
Dietitian Counselling (DC)	12	8.9%	9	75.0%	7	5.1%	3	42.9%	19	7.0%	12	63.2%	0.326
Physiotherapy Session (PT)	3	2.2%	3	100%	3	2.2%	1	33.3%	6	2.2%	4	66.7%	0.4
Retinopathy Screening by Optometrist (OPT)	23	17.0%	22	95.7%	18	13.2%	13	72.2%	41	15.1%	35	85.4%	***0.035****
Blood taking appointment (BT)	73	54.1%	73	100%	86	63.2%	83	96.5%	159	58.7%	156	98.1%	0.250
Overall	135	100%	130	96.3%	136	100%	115	84.6%	271	100%	245	90.4%	***0.001****

* Significant at p<0.05

Table 5. Stepwise logistic regression on overall appointment attendances

	OR	95%CI		p-value
		Lower	Upper	
Hemoglobin A1c level (%)	0.85	0.74	0.98	***0.018****
Days to Appointment	0.99	0.98	1.00	***0.035****
Intervention Group (SMS)	2.46	1.51	4.01	***<0.001****

* Significant at p<0.05

Table 6. Effects of SMS intervention on the appointment attendances.

	OR	95%CI		p-value	**Adjusted OR^**	95%CI		p-value
		Lower	Upper			Lower	Upper	
Nurse Diabetes Complication Screening (DMCS)	3.06	1.22	7.66	***0.017****	3.17	1.25	8.03	***0.015****
Nurse Diabetes Individual Counselling (DMIC)	7.69	0.81	73.55	0.077	6.78	0.68	67.99	0.104
Diabetes Group Education (DMGE)	1.50	0.20	11.24	0.693	1.40	0.15	13.13	0.766
Dietitian Counselling (DC)	2.55	0.82	7.94	0.105	1.85	0.53	6.43	0.332
Physiotherapy Session (PT)	3.14	0.24	41.51	0.384	3.06	0.21	44.12	0.411
Retinopathy Screening by Optometrist (OPT)	2.73	1.07	7.01	***0.037****	2.58	1.00	6.69	***0.050****
Blood taking appointment (BT)	2.50	0.48	13.17	0.280	2.49	0.47	13.23	0.285
Overall	2.60	1.61	4.19	***<0.001****	2.46	1.51	4.01	***<0.001****

*Significant at p<0.05. ^Adjusted OR with HbA1c level and number of days to appointment.

Figures

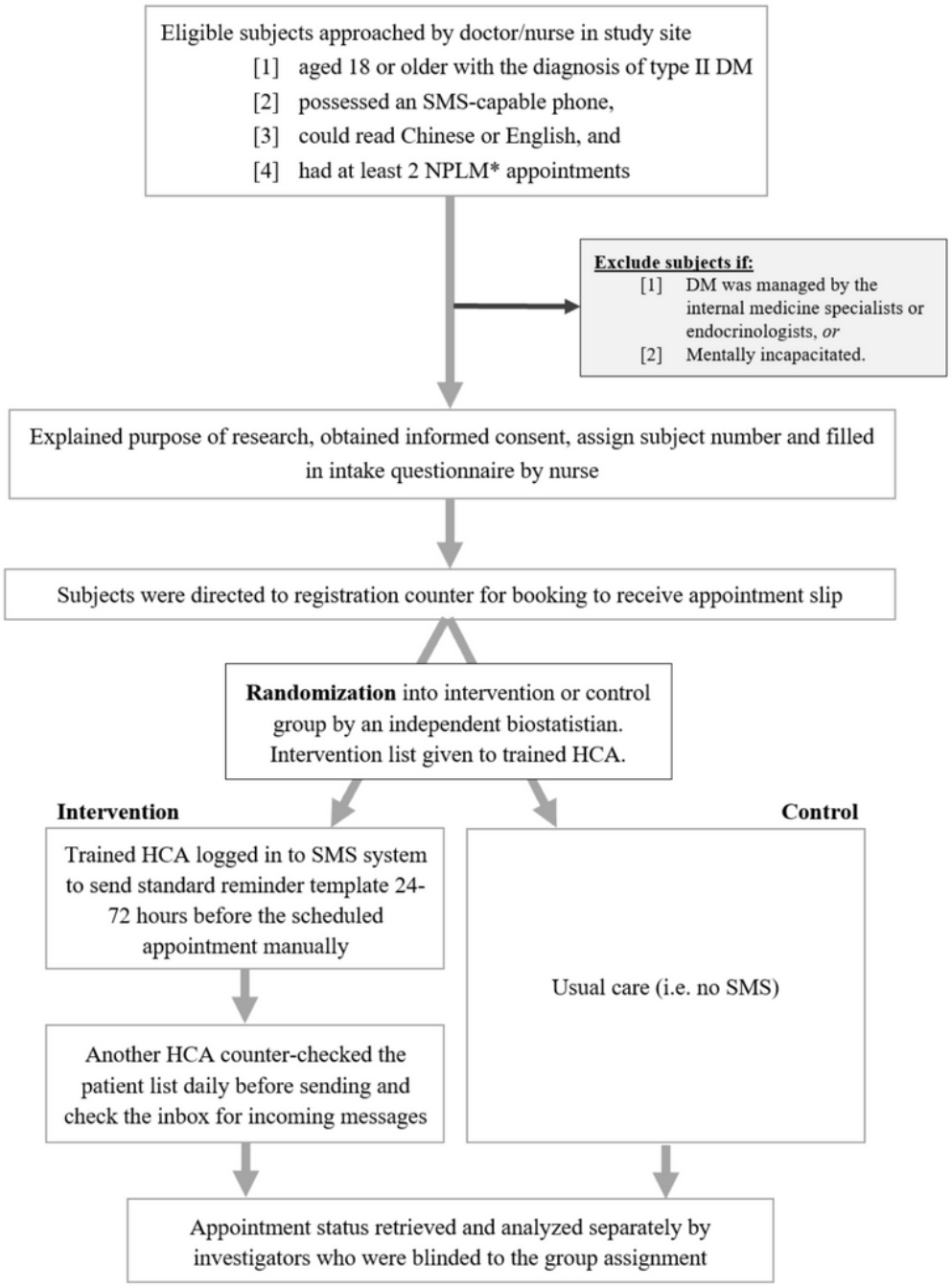

Figure 1

Study Flow Chart. *NPLM appointments include nurse diabetes complication screening, nurse individual counselling and group education, dietitian counselling, physiotherapy session, retinopathy screening by optometrist and blood taking appointment

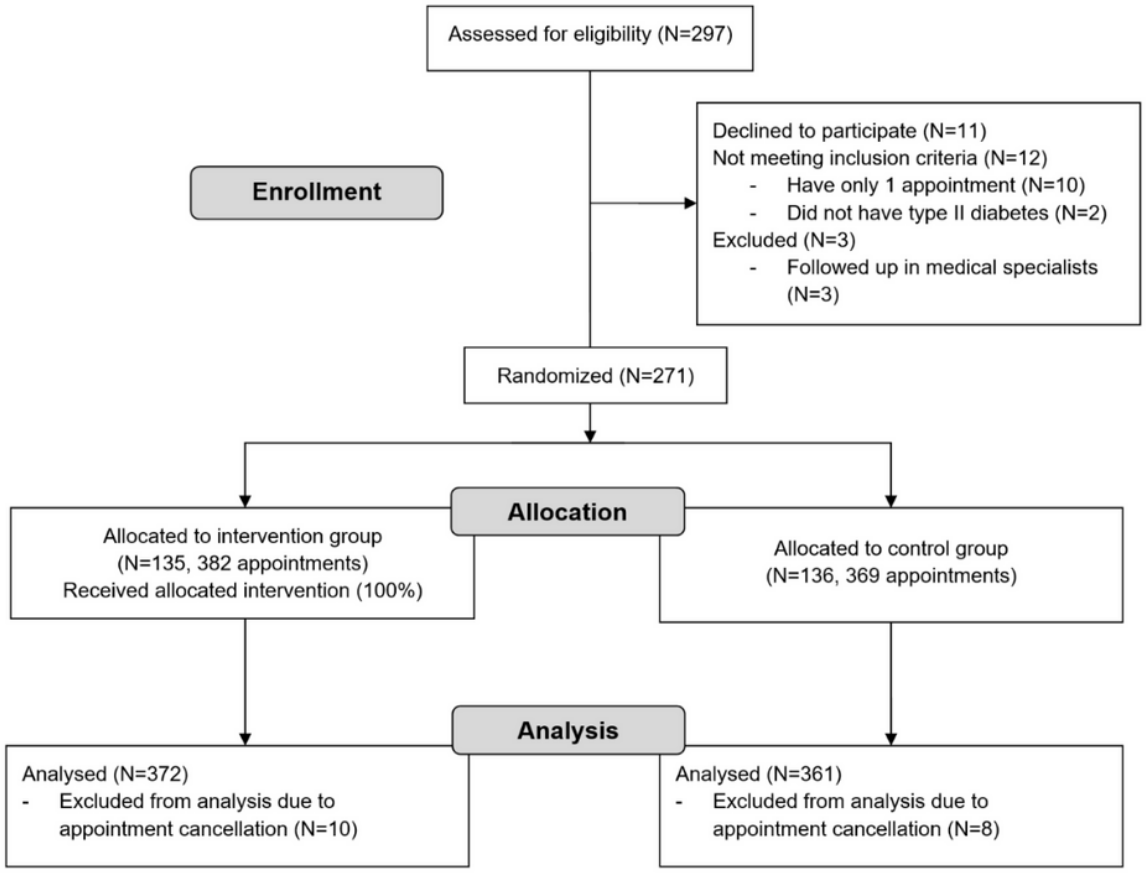

Figure 2

Consolidated Standards of Reporting Trials (CONSORT) Diagram.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- CONSORT2010Checklistdmc.doc