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Comparison of an SMS text messaging and phone reminder to improve attendance at a health promotion center: A randomized controlled trial*

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Abstract: Objective: To compare the efficacy of a short messaging service (SMS) text messaging and phone reminder to improve attendance rates at a health promotion center. Methods: A total of 1 859 participants who had scheduled appointments in the health promotion center of our hospital from April 2007 to May 2007 were enrolled in the study and randomly assigned into 3 groups: control (no reminder) group, SMS text messaging reminder group and telephone reminder group. Attendance rates and costs of interventions were collected. Results: A total of 1848 participants were eligible for analysis. Attendance rates of control, SMS and telephone groups were 80.5%, 87.5% and 88.3%, respectively. The attendance rates were significantly higher in SMS and telephone groups than that in the control group, with odds ratio 1.698, 95% confidence interval 1.224 to 2.316, P=0.001 in the SMS group, and odds ratio 1.829, 95% confidence interval 1.333 to 2.509, P<0.001 in the telephone group. However, there was no difference between the SMS group and the telephone group (P=0.670). The cost effectiveness analysis showed that the cost per attendance for the SMS group (0.31 Yuan) was significantly lower than that for the telephone group (0.48 Yuan). Conclusion: SMS and telephone are effective reminders for improving attendance rate at a health promotion center. SMS reminder may be more cost-effective compared with the telephone reminder.

Key words: Reminder, Short messaging service (SMS), Telephone, Failure to attend (FTA), Randomized controlled trial (RCT)
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INTRODUCTION

Absenteeism from outpatient appointments is an intractable problem. Not only does a high failure to attend (FTA) rate impact patient outcomes because of missed opportunities for diagnosis and treatment, it also reduces efficiency of health systems. The major causes of outpatient FTA are forgetfulness, practice error and a mix-up over dates and times (Martin *et al*., 2005; Murdock *et al*., 2002; Neal *et al*., 2005; Zailinawati *et al*., 2006). In previous studies various reminders have been assessed with varying degrees of success in reducing broken appointments. Such efforts have included use of letters (Can *et al*., 2003; Jibaja-Weiss *et al*., 2005; Mayer *et al*., 2000), postcards (Irigoyen *et al*., 2000; Thomas, 2004), automated phone calls (Irigoyen *et al*., 2000; Maxwell *et al*., 2001) and personalized phone calls (Reti, 2003; Roberts *et al*., 2007; Haynes and Sweeney, 2006; Shoffner *et al*., 2007). However, these methods are labor-intensive. We need cost-effective interventions that can reach a broad population to reduce FTA rates.

Short messaging service (SMS) has the potential to reach a large number of individuals at a relatively low cost. More recently, several studies have shown that use of SMS text messaging to send appointment reminders is effective in improving attendance rate (Battistotti *et al*., 2006; Downer *et al*., 2006; Geraghty

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et al., 2007; Leong *et al*., 2006; Milne *et al*., 2006). But there are no studies examining its effectiveness in China and there has been limited randomized controlled trial (RCT) comparing the efficacy of SMS-based interventions and telephone-based interventions. Therefore, we designed a RCT of an SMS-based intervention compared against a telephone-based intervention to study their effectiveness in improving attendance rate at a health promotion center and to evaluate the costs of two interventions.

MATERIALS AND METHODS

Participants

The study was carried out at the health promotion center of Sir Run Run Shaw Hospital, School of Medicine, Zhejiang University, China. The purpose of the health promotion center is to detect adult diseases at their earlier development stages through periodical check-ups. The center serves about 15000 to 20000 people annually, providing various health check-up programs specifically designed for different age groups. Medical service of this kind, known as "a human dock," is very popular in China. Most visitors are employees of local companies, owners of private enterprises and their spouses. Given their middle or higher income levels, they tend to be more attentive to their health status and to undergo health check-up more often than other people of the same age ranges.

A total of 1891 people whose scheduled appointments would fall between 72 h to 2 months from the recruitment date (from April 2007 to May 2007) were enrolled in the study. They were all requested to provide both active mobile telephone numbers and telephone numbers when they made a reservation. Thirty-two people failed to provide mobile telephone numbers or telephone numbers and thus were excluded, leaving actual 1859 participants for the trial. The ethics committee of Sir Run Run Shaw Hospital approved the study. All participants provided informed consent.

Procedures

The study is a two-month RCT conducted from April 2007 to May 2007. At study initiation, participants were assigned by computer-generated random numbers into 3 groups: SMS reminder (n=620), telephone contact (n=620), or routine medical procedure (control group) (n=619).

A reminder was sent to both SMS and telephone groups 72 h prior to the appointment. The reminder was similar in content including participant's name and appointment details, but differed in the way the content was distributed to them. In SMS group participants received text messaging delivered through a mobile telephone SMS. Participants in the telephone group were called by the office medical assistants from the health promotion center and there's no other information included in the phone conversation in order to avoid unequal intervention. In the control group, participants received no reminder. Successful contact was assumed when the mobile phone indicated 'message sent' in the SMS group or when the participants answered the phone in the telephone group. A maximum of 3 reminders were attempted in the telephone group. If the phones were unanswered, the participants would be phoned at their mobile telephone numbers.

To send SMS messages, we first placed a valid subscriber identity module (SIM) card from a wireless carrier (China Mobile) into a global system for mobile communication (GSM) modem, which was then connected to a computer through a serial cable. Information for the reminder messages was extracted from the hospital's electronic health record system database and added to the message. Then the computer used asynchronous transfer (AT) commands to instruct GSM modem to send SMS messages.

Data were collected at 1859 consecutive appointments prospectively, including participant age and sex, whether a telephone or SMS reminder was successfully made, and whether the participant showed up for the scheduled appointment. The costs of the reminders were calculated based on the staff hours expended and other charges, such as SMS and telephone service. Cost data were collected by the clinic's administrative staff.

Statistical analysis

The statistical analysis was conducted using SPSS version 13.0 statistical software. Baseline values were analyzed for differences in the three groups, by one-way analysis of variance for numerical data and chi-square for categorical data. We tested differences in attendance rates by study groups with

chi-square test and odds ratios (OR) with 95% confidence intervals (CI). For OR calculation, the control group was used as the reference group. $P \leq 0.05$ was considered statistically significant.

RESULTS

A flowchart of study participations is shown in Fig.1. A total of 1848 members were enrolled for the final analysis: SMS reminder (n=615), telephone contact (n=614), and control group (n=619). After a maximum of 3 reminders, 5 participants in the telephone group did not answer and were then contacted by their mobile telephone numbers, and remained in the analysis. In addition, 11 participants could not be reached by telephone or SMS because they changed their numbers or the medical assistants recorded the wrong numbers, and were excluded from the study because of incomplete records.

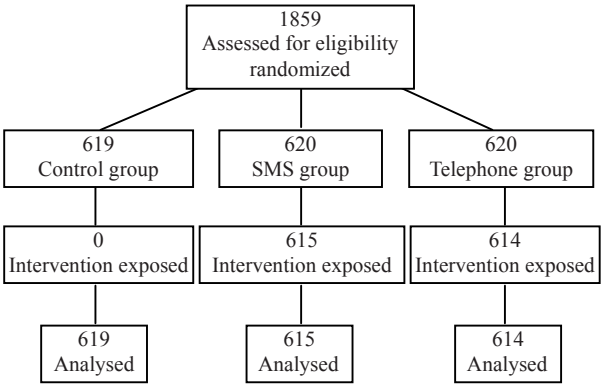

Fig.1 Study population flowchart

Table 1 shows characteristics of these 3 groups. Comparison of the intervention groups and the control group showed adequate randomization with fairly equal sex and age distributions.

Table 1 Sex and age distribution of participants

Characteristics	Male*	Age (years)Δ
Control (n=619)	356 (57.5)	51.14±11.92
SMS (n=615)	360 (58.5)	50.01±10.99
Telephone (n=614)	348 (56.7)	50.52±11.53

*The data shown as number (%); significant difference: $\chi^2=0.023$, P=0.989; ΔSignificant difference: $F=0.770$, P=0.463

Participants' attendance rates were 80.5% in the control group, 87.5% in the SMS group and 88.3% in the telephone group (Table 2). The attendance rates were significantly higher in SMS and telephone groups than that in the control group, with OR 1.698, 95% CI 1.224 to 2.316, P=0.001 in the SMS group, and OR 1.829, 95% CI 1.333 to 2.509, P<0.001 in the telephone group. However, there was no difference between the SMS group and the telephone group (P=0.670).

Table 2 Attendance rates by intervention types

Intervention	*AR* (%)	*P*-value	*OR* (95% *CI*)
SMS vs control	87.5 vs 80.5	0.001	1.698 (1.224~2.316)
Telephone vs control	88.3 vs 80.5	<0.001	1.829 (1.333~2.509)
SMS vs telephone	87.5 vs 88.3	0.670	0.928 (0.659~1.308)

AR: Attendance rate; *OR*: Odds ratio; *CI*: confidence interval

Although the attendance rate was similar, the cost-effectiveness analysis showed that the cost per attendance for SMS group (0.31 Yuan) was significantly less than that for telephone group (0.48 Yuan). The ratio of cost per attendance of SMS text messaging to that of phone was 0.65 (Table 3).

Table 3 Cost-effectiveness analysis by study groups and attendance rate

Characteristics	SMS	Telephone
Show, No.	538	542
Intervention, No.	615	649
Time spent for intervention (h)	6.05	10.82
Research assistant salary per hour (Yuan)	11.92	11.92
Telecommunication cost (Yuan)	92.25	129.80
Total costs incurred (Yuan)	164.37	258.77
Total cost per patient (Yuan)	0.27	0.42
Total cost per attendance (Yuan)	0.31	0.48
Ratio of cost per attendance (success)	0.65	1.00

DISCUSSION

In China, health promotion centers, orthodontic clinics, endoscopic clinics and many ophthalmic clinics rely on scheduled appointments, for which patient FTA is an area of concern. Indeed, the FTA rate reached 19.5% at the health promotion center of our hospital. Patient FTA wastes resources, frustrates

staff, and may result in unmet health needs. Many appointment reminder studies have found reductions in FTA rates, including postcards, letters and telephone. Recently, there are some studies using SMS text messaging that has been found to be successful in improving attendance rate in some settings (Downer *et al*., 2006; Geraghty *et al*., 2007; Leong *et al*., 2006; Milne *et al*., 2006). However, very little progress has been made in China.

To our knowledge, this is the first study to examine the effect of telephone and SMS on absenteeism at a health promotion center in China. In this study, the percentage of attendance was significantly higher in SMS and telephone intervention groups compared to the control group. Participants assigned to appointment reminders were more likely to keep their appointments than controls. The effectiveness of both interventions, telephone and SMS, is reflected by the superior attendance rate among the patients.

Similar results have also been obtained in other studies. Haynes and Sweeney (2006) studied the effect of telephone appointment reminder calls on absenteeism in a pulmonary function laboratory. The reminder calls reduced the absenteeism rate from 11.7% to 4%. Shoffner *et al*.(2007) demonstrated that phone reminders were effective for intake appointments when therapists made direct contact with patients in an Appalachian Community mental health center. Used a historical control group, Geraghty *et al*.(2007) found SMS reminder to be an effective means of improving outpatient attendance at the ear, nose and throat (ENT) outpatient clinic in Ireland, while Milne *et al*.(2006) had done the same at outpatient clinics in the UK national health service. Leong *et al*.(2006) performed a RCT of SMS reminder calls in comparison with mobile phone reminder calls to improve outpatient attendance in primary care in Malaysia. The study 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. They also found that SMS reminder was more cost-effective compared with the telephone reminder. But no articles compared SMS reminder with traditional reminder techniques, including telephone.

In the present study, although the SMS reminder and telephone reminder were equally effective, the cost-effectiveness analysis showed that the cost per attendance for SMS group was significantly lower than that for telephone group, with the ratio of cost per attendance of SMS to telephone being 0.65. This finding may have a significant influence at a health promotion center, which has a heavy patient burden and calls for an active strategy to reduce FTA. In China, due to a reasonable cost (generally 0.10~0.15 Yuan per message), people widely use the SMS text messaging on mobile phones. According to the Ministry of Information Industry (MII) of the People's Republic of China, China's cell-phone user population hit 500 million in June 2007 (http://www.mii.gov.cn/art/2007/07/25/art_166_32599.html). Chinese people sent 429.6 billion text messages through mobile phones in 2006 and the number of mobile phone users and the volume of short messages sent still show an upward trend (http://www.mii.gov.cn/art/2007/02/09/art_169_28756.html). SMS messaging software allows large batches of text messages to be delivered almost instantly, minimizing labor costs (May and Hearn, 2005). SMS messages do not require the mobile phone to be active nor necessarily within range and can be held for a number of days until the phone is active or within range (Virtanen *et al*., 2007). Furthermore, SMS is also private in a way that voice calling is often not.

This study has several limitations that need to be considered. First, it lacks information on patient beliefs or intentions, and factors as income, education and information on other barriers (e.g., work-loss time) that are of considerable interest. Such data might help explain why some patients were still not present despite these interventions. Second, in China people frequently change their mobile phone numbers as they like and we did not know whether SMS messages were received by the correct recipients. Other authors have identified outdated telephone numbers as a problem for reminder study (Lee and McCormick, 2003). Furthermore, in various countries cost-effectiveness of reminders would change in accordance with the prices of labor, telephone and text messaging costs. Finally, we also could not evaluate the effect of the time lapse between the reminder call and the appointment date on absenteeism. Further work is needed to explore the timing of patient contact, the use of SMS text messaging to other areas which include patient education, smoking cessation program and chronic disease intervention.

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