SMS text messaging improves outpatient attendance

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Abstract

Objective: To evaluate the operational and financial efficacy of sending short message service (SMS) text message reminders to the mobile telephones of patients with scheduled outpatient clinic appointments.

Design: Cohort study with historical control.

Setting: Royal Children's Hospital, Melbourne, Victoria.

Patients: Patients who gave a mobile telephone contact number and were scheduled to attend an outpatient clinic at the Royal Children's Hospital, Melbourne in October, November and December 2004 (trial group) or in October, November and December 2003 (historical control group).

Main outcome measures: Failure-to-attend (FTA) rate compared between the trial group, whose members were sent a reminder, and the historical control group, whose members were not sent a reminder. Financial benefits versus cost of sending reminders.

Results: 22 658 patients with a mobile telephone contact number scheduled to attend an outpatient clinic appointment in October, November and December 2004 were sent an SMS reminder; 20 448 (90.2%) of these patients attended their appointment. The control group included 22 452 patients with a mobile telephone contact number scheduled to attend an appointment, with 18 073 (80.5%) patients attending. The FTA rate was significantly lower in the trial group than in the historical control group (9.8% v 19.5%; $P < 0.001$). The cost of sending the SMS reminders was small compared with the increase in patient revenue and associated benefits generated as a result of improved attendance.

Conclusions: The observed reduction in FTA rate was in line with that found using traditional reminder methods and a prior pilot study using SMS. The FTA reduction coupled with the increase in patient revenue suggests that reminding patients using SMS is a very cost effective approach for improving patient attendance.

What is known about the topic?

Patients failing to attend their scheduled outpatient appointments is a significant problem, impacting on access to outpatient care and on the efficiency of the clinics. Reminder systems improve attendance but can be costly to operate.

What does this study add?

This study confirms that sending text messages to patients' mobile phone numbers three days before their scheduled appointments reduces failure to attend (FTA) rates at relatively low cost.

What are the implications?

Hospitals and other clinic operators could reduce waiting times for patients in need of specialist care, and the efficiency of clinics, by providing timely SMS reminders to patients. ◆

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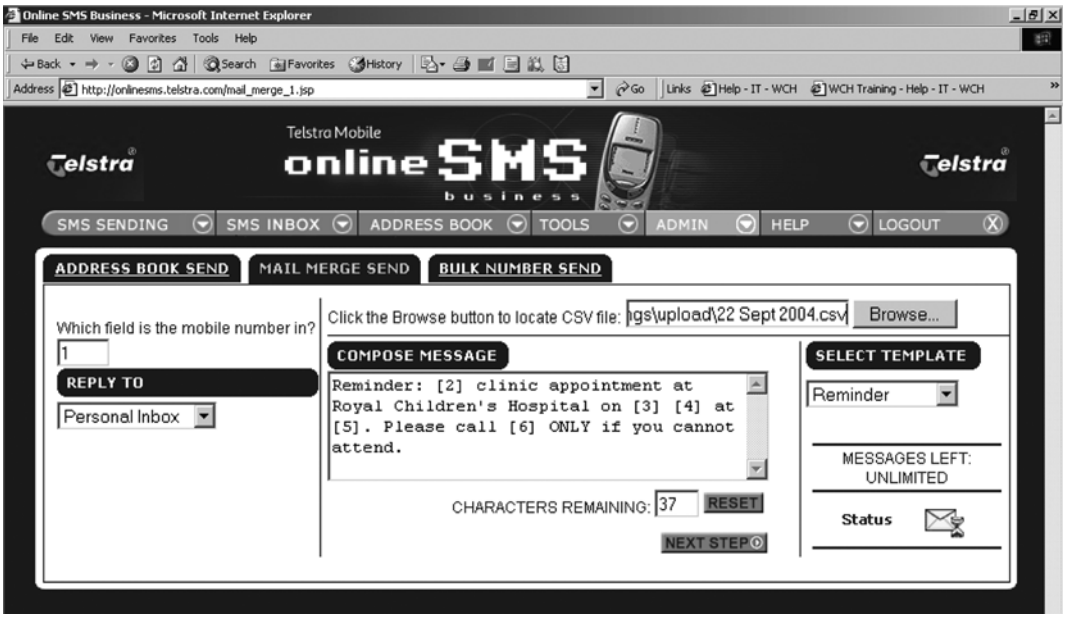
FAILURE TO ATTEND outpatient appointments is a significant and widespread problem in public hospitals that severely reduces the ability to provide an efficient and effective outpatient service. Not only does a high failure to attend (FTA) rate waste clinical and administrative resources, it also reduces revenue opportunities, increases waiting times for outpatient appoint-

1 Telstra Mobile Online SMS Business system screen image



ments and lengthens treatment times. Traditional reminder methods such as telephone calls and posted letters have high unit costs and require significant staff resources to administer.

In a prior pilot study, short message service (SMS) text messaging was used to remind patients of their outpatient appointment.[1] Preliminary findings indicated increased outpatient attendance, lower unit cost than telephone calls or posted letters, and significantly decreased staff resources to administer. These findings suggested that the use of SMS reminders has the potential to be a very efficient and cost effective method to improve outpatient attendance rates. However, in the prior pilot study, the trial was limited to patients with mobile telephone numbers attending only five clinics, which represented about 14% of the total hospital outpatient appointments. Also, the pilot study did not attempt to assess the financial benefits accruing from the increase in patient attendance rate. In the current evaluation, the use of SMS appointment reminders has been extended to include 120 separate outpatient clinics over a 3-month period to assess whether the FTA results achieved in the earlier pilot study could be replicated on a wider scale, and to evaluate the significance of the financial benefit accruing from the resulting improvement in clinic attendance.

Patients and methods

This study took place at the Royal Children's Hospital (RCH) in Melbourne Australia. RCH is a 250-bed hospital which provides tertiary, secondary and primary health services to children and adolescents.

Approval for the study was obtained from the RCH Outpatient Advisory Committee and Chief Executive Officer. Approval from the Hospital Ethics Committee was not sought because patients and parents had provided their mobile telephone numbers as a contact source upon registration with the hospital. Contacting patients to remind them of future hospital appointments was also an existing and accepted practice within the hospital.

The trial group population refers to all patients who had a new or review outpatient appointment scheduled during a 3-month period (October to December 2004). All patients in the trial group were sent an SMS reminder to their mobile telephone contact number three working days before their scheduled appointment date. A historical control group consisted of patients with a mobile telephone number registered in the RCH database and who had either a new or review appointment scheduled in the same outpatient clinics during the same 3-month period in the year before (October to December 2003). SMS reminders were not sent to the patients in the historical control group.

The information to be sent in the message was extracted from the hospital's outpatient clinic scheduling system and loaded onto a database (Access 2000, Microsoft, Redmond, Wash, USA). A query was then run on the database that selected for each outpatient appointment, the mobile telephone number, the name of clinic (where clinic names exceeded 20 characters an abbreviation of the name was used), the day (three-character abbreviation), date (dd mm yyyy format) and time (hh : mm am/pm format) of the appointment as well as the contact telephone number (nine characters) of the clinic. The query also standardised the format of the mobile telephone number to a ten number sequence. This was a requirement of the online SMS program. The data were uploaded into the Telstra Mobile Online SMS Business system (Box 1) and the reminder messages were sent in one consolidated batch. This method is the same as that used in the pilot study.

At the end of the 3-month trial period, patient attendance data were extracted from the outpatient scheduling system and the FTA rates for patients in the trial group were compared with the FTA rates of patients belonging to the historical control group.

Two-sample proportion tests were performed using Stata 8.2 for Windows (StataCorp, College Station, Tex, USA, 2003) statistical analysis software to study the significance in variations in FTA rates as well as in patient demographic profiles between the trial and historical control groups. Variables examined included SMS reminder, type of outpatient appointment (new or review), outpatient clinic attendance rate or failure to attend rate and patient age and sex. A risk ratio analysis was also undertaken to establish the link between the reminder being sent and the attendance outcome.

The financial trade-offs of the SMS reminders were analysed by determining the cost of sending the reminders and comparing it with the financial benefit resulting from the recorded increase in patient attendance rate.

The total cost of sending the SMS reminders was calculated by recording the amount of time required by staff to process the daily batch of reminders during the trial period, as well as the cost of sending each SMS message (22 cents).

In order to calculate the financial benefit, we estimated how much potential revenue the hospital was forgoing due to the lower attendance rate when no reminders were sent. The actual revenue generated from outpatient clinic attendance in the control group was determined by totalling the remuneration for each individual outpatient attendance. This amount was compared with the hypothetical revenue that could have been obtained by the hospital in the control period had they adopted the SMS reminder scheme. It was assumed that the SMS reminders would have resulted in a similar attendance rate to the rate experienced during the trial period.

No external funding was obtained for the study. SMS messages were charged at 22 cents per unit. (Telstra does not charge customers for use of the Telstra Mobile Online SMS Business system.) The total number of scheduled appointments in the trial group was 38 473. Of this total population 5452 (14%) were excluded for one of three reasons; either the clinic had their own reminder process in place and did not want to participate in the SMS trial, the clinic made a lot of appointment changes at short notice (within our 3-day

2 Statistics including FTA rates for patients with a mobile telephone contact number scheduled to attend the trial clinics for the months of October to December 2004

	SMS reminder recipients (Oct–Dec 2004)				SMS reminder non-recipients (Oct–Dec 2003)				
Outpatient appointment type	No. patients attended	No. patients FTA	Total appointments	FTA rate	No. patients attended	No. patients FTA	Total appointments	FTA rate	FTA reduction
New	4474	452	4926	9.2%	4357	750	5107	14.7%*	5.5%
Review	15974	1758	17732	9.9%	13716	3629	17345	20.9%*	11.6%
Total	20448	2210	22658	9.8%	18073	4379	22452	19.5%*	9.7%

FTA = failure to attend. * $P < 0.001$. SMS = short message service. ◆

window), or the clinics were held off-site and the standard message would have been ambiguous and led to the possibility of patients attending the wrong site. Patient appointments that did not have an associated mobile telephone number recorded in the outpatient database (10 363 [28%]) were also excluded from our trial. The remaining 22 658 scheduled appointments (59% of the total) constituted the trial group whose members were sent an SMS reminder.

Results

Efficacy of SMS reminders

A two-sample test of proportion revealed that FTA rates were significantly lower for the trial group (9.8%) when compared with the control group (19.5%) ($z = 29.32$, $P < 0.001$). The relative risk ratio analysis indicated that the risk of a patient not attending their scheduled appointment is more likely in the group of patients who did not receive the SMS reminder (risk ratio = 1.596).

Analysis of the patient demographics between the trial and historical control groups showed that there was no significant difference in the age profile of the patients ($z = 1.86$, $P = 0.172$). Similarly there was no significant difference identified in the proportion of men ($z = –0.72$, $P = 0.471$) or women ($z = 0.72$, $P = 0.471$) in the two groups.

To examine whether FTA rates differed by appointment type, the nature of the outpatient appointment was further classified into new or review appointment. As depicted in Box 2, review appointments accounted for 78.3% of all outpatient bookings during the trial period. FTA rates for review appointments were significantly lower for SMS reminder recipients in the trial group (9.9%) than for the non-recipients in the historical control group (20.9%) ($z = 28.59$, $P < 0.001$). Similarly, a two-sample test of proportion revealed that new appointment FTA rates in the trial group were significantly lower (9.2%) than the new appointment FTA rates for the historical control group (14.7%) ($z = 8.50$, $P < 0.001$).

Financial impact of SMS reminders

The cost of sending the SMS reminders during the trial period amounted to $5164. (Box 3). Applying the attendance rates achieved for new and review patients in the trial group to the patients in the historical control group generated a hypothetical 11.5% ($273 993) increase in revenue for the control period. The SMS reminders resulted in an increase of the modelled average revenue earned per scheduled outpatient appointment by $9.64 (6.4%) for each new appointment and by $12.96 (13.9%) for each review appointment (Box 4) due to the improved attendance rates observed. We did not adjust for the additional costs of diagnostic tests or other support services which would

have been consumed by the additional patients.

Discussion

Efficacy of short message service text reminders

This study sought to test the efficacy of SMS text message reminders for improving outpatient appointment attendances in a paediatric public hospital setting. This study employed a larger population sample over a longer period than the pilot study conducted by the hospital.[1] Acknowledging the slightly different sample sizes, a comparison of the FTA rate between the trial and control groups suggests that the lower FTA rate in the trial group represents 2353 additional outpatient clinic attendances during the 3-month period. These findings provide convincing evidence of the efficacy of SMS text messaging services in improving outpatient appointment attendance rates and demonstrate that SMS reminders generate an improvement in attendance that is at least the equivalent of more traditional reminder techniques.[2-7]

The scheduled duration of new appointments at the hospital is generally double that of review appointments, making non-attendance of new appointments more wasteful. Results suggested that the SMS reminders had a greater impact on the attendance rate of patients with a review appointment compared with those with a new appointment. Patient attendances for review appointments were 11% higher in the trial group (90.2%) than in the control group (79.1%). In comparison, there was a 4.8% improvement in the attendance rate of the trial group for new appointments compared with the control group (from 85.3% to 90.1%). The FTA rate for review patient appointments has historically been higher than for new appointments at RCH. Factors thought responsible for this include an improvement in the patient's condition, a generally longer wait for a review appointment or dissatisfaction with treatment previously received.

There are several issues specific to the use of SMS technology, including the incidence of incorrect mobile telephone contact numbers. Ninety-two (0.4%) of the 22 658 recipients contacted our outpatient services stating that they had no knowledge of the scheduled appointment in the reminder message. The number of reminders sent to the wrong recipient was possibly higher, as many incorrect recipients of the text message may have ignored it and taken no action to inform the hospital. The high prevalence with which consumers change their mobile telephone and/or mobile telephone service, perhaps changing their number in the process, will continue to be a source of error with this system, making it vitally important for the organisation to ensure patient contact details, particularly mobile tele-

3 Cost analysis of sending SMS text message reminders

Component	Data	Calculated cost
Number of days messages were sent	63	
Total time spent sending messages	10 h 15 min	
Computer clerk salary per hour	$17.51	
Total salary cost to send messages		$179.47
Cost per SMS message	$0.22	
Total number of messages sent	22 658	
Total number of attending patients	20 448	
Total cost of SMS messages		$4984.76
Total cost of sending SMS messages		$5164.23
Total cost per SMS message		$0.23
Total cost per attending patient		$0.25

SMS = short message service. ◆

4 Modelled financial benefit resulting from increasing outpatient attendance using SMS reminders

		Appointment type		
		New	Review	Total
Control group with no SMS reminders (Oct – Dec 2003)	Scheduled appointments	5107	17 345	22 452
	Outpatients attending scheduled appointments	4357	13 716	18 073
	Attendance rate	85.3%	79.1%	80.5%
	Revenue generated	$765 736	$1 612 446	$2 378 182
	Average revenue generated per scheduled appointment (n = 22 452)	$149.94	$92.96	$105.92
Hypothetical: control group with possible SMS reminders	Trial group attendance rate	90.8%	90.1%	90.2%
	Hypothetical number of outpatients attending scheduled appointments	4637	15 628	20 265
	Hypothetical revenue generated	$814 973	$1 837 202	$2 652 175
	Hypothetical average revenue generated per scheduled appointment (n = 22 452)	$159.58	$105.92	$118.13
Potential financial impact if trial group attendance rates applied to control group	Potential increase in outpatients attending scheduled appointments	280	1912	2192
	Potential increase in revenue generated	$49 237	$224 756	$273 993
	Potential increase in revenue generated per scheduled appointment (n = 22 452)	$9.64	$12.96	$12.20
	Potential percentage increase in revenue generated per scheduled appointment (n = 22 452)	6.4%	13.9%	11.5%

phone numbers, are current. The currency of contact information such as addresses and telephone numbers is also a significant problem with traditional telephone call and postal reminder systems.[3,4,8]

We observed that 5639 patients in our trial group (24.9%) had more than one mobile telephone contact number registered. Sending an SMS reminder to more than a single registered mobile number for the same appointment may further improve attendance rates. This will be tested in a future trial.

A small proportion of the reminder recipients replied by SMS to notify the hospital that they were unable to attend the appointment or to raise a query in relation to the appointment. These SMS responses were not acted on in this trial, as the message clearly indicated that people should telephone directly and also that it could not be ensured that the responses were legitimate. For example, if an appointment was cancelled based on the response of a recipient who was not the intended target for the message, additional scheduling problems would be created. We almost certainly increased the non-attendance rate by not acting on these responses, and this is an area we will investigate as the system develops.

A limitation in the application of this reminder process to the wider hospital community is the degree to which different patient groups are familiar with SMS messaging. The recipients of the reminders in our study were the parents of young children or adolescents, both groups being far more likely to be familiar with SMS messaging than patients attending general hospitals, who tend to be much older.

Financial benefits

The cost effectiveness demonstrated in this study is a consequence of the SMS reminders being both effective in reminding patients of their appointment and cost effective to process and send. We have assumed that an existing personal computer, Microsoft Access software and Internet connection exist when calculating the cost of sending the reminders, as these items are now standard in most office environments. There is no special capital investment required for this reminder technique, unlike some other reminder systems that require up-front capital investment.[9]

There were several simplifying assumptions in the calculation of financial benefit that may limit its accuracy. We assumed that revenue earned is directly related to outpatient attendance and that the failure of a patient to keep their appointment results in no revenue being generated. While this is the funding mechanism that applies at RCH and in some other primary care settings (where activity-related revenue is uncapped, or caps have not been reached) it may not be the case in other hospitals and health care settings. The potential financial benefits may not be as large in those cases. We also ignored the impact of additional costs such as investigations and tests resulting from increasing outpatient attendance. Finally, we did not consider any additional labour costs in operating the clinics with more patients. The experience of the trial indicated that clinics could absorb increased attendance within the time and space allowed.

Notwithstanding these shortcomings in the assessment, the basic premise that this reminder technique is a relatively inexpensive way to generate additional patient attendances and related income in settings where this type of funding mechanism applies is essentially proven.

Because of the huge interstate and international variability in the unit cost of SMS, landline telephone calls and postage it is difficult to make an assessment of SMS compared with other reminder techniques on a unit-cost basis in other geographic areas. The significant advantage of SMS relative to other traditional reminder methods, however, is the much lower labour cost. Telephone calls and postage are resource intensive and do not generate results significantly different to those in this study.[2-6]

The total cost per success (attending patient) in this trial was A$0.25 — significantly less than the cost per success of letters, post cards or automated telephone messages reported in other studies.[8-12]

The labour cost per reminder message in our trial was less than one cent. This compares very favourably to the reported labour costs of telephone reminders, which vary from US$0.20 to US$0.91,[2,10] and reminder letters and postcards, which vary from US$0.22 to US$0.80.[9-11] Using SMS software, the labour cost per message is variable depending on the number of SMS reminders sent per batch and the salary and efficiency of the operator. A clear advantage of using SMS software is that the per unit labour cost can be reduced by sending larger quantities of reminders per batch. In this study, one batch of reminders was sent per day containing an average of 360 SMS messages. Depending on the telecommunication carrier, it is also possible to negotiate to reduce the unit cost of each SMS as the volume of messages increases.

Another potential but controversial means of lowering the cost of an SMS reminder system is to include some form of paid advertising in the message, a scheme that has recently been considered by health care providers using SMS reminder programs in the United Kingdom.[13] The potential ethical and privacy issues surrounding the use of patient contact details provided in confidence for the purpose of advertising a sponsor's product may prohibit such a course. There is also the disadvantage of a larger message size.

The observed increase in outpatient attendance in this study of (2353 appointments) was achieved at a modest cost of $5164. The hypothetical increase in patient-related revenue for a 3-month period was $273 993. Annualising the result of the 3-month trial, it is estimated that the SMS reminders will cost about $21 000 and

result in an additional 9000 patient attendances, generating in excess of $1 000 000 of revenue which would otherwise not have been achieved in that time frame. There is also potential to significantly reduce patient treatment times. Further, if the proportion of patients that can be contacted with an SMS reminder can be increased from the 58% of total appointments observed in this trial to 100% of appointments these benefits would correspondingly improve.

The potential benefits of SMS technology in health care services are significant. Real-time communication with patients to remind them to take medications or to fast before tests as well as sending and receiving test results can improve patient wellbeing and health care efficiency enormously. Converting text messages to other languages is also a huge potential advantage for communicating with patients where a language barrier may impact on their health care. Existing SMS technology has the capability to be used in such a manner, and the potential benefit in a variety of settings certainly warrants further investigation. Further, the ease with which the SMS software can be accessed and applied in real-world settings significantly diminishes the required technical skill compared with other software-driven reminder systems, a factor which has been identified as a significant barrier to uptake of more technologically advanced reminder techniques.[14]

In summary, this study indicates that SMS text messaging is a very efficacious technique to improve clinic attendance, access to services and revenue generation in the ambulatory care setting.

Competing interests

Sean Downer and Annette Da Costa are Telstra shareholders.

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