Appointment reminders by text message in a safety net health care system: a pragmatic investigation

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ABSTRACT

Introduction: Short Message Service (SMS) appointment reminders may provide a wide-reaching, low cost approach to reducing operational inefficiencies and improving access to care. Previous studies indicate this modality may improve attendance rates, yet there is a need for large-scale, pragmatic studies that include unintended consequences and operational costs.

Methods: This pragmatic investigation was a before-after analysis that compared visit attendance outcomes among patients who opted into SMS appointment reminders with outcomes among those who declined over an 18-month evaluation period from March 25, 2013, to September 30, 2014. Eligibility in our integrated safety net health care system included age greater than 17, English or Spanish as a primary language, and a cell phone number in our scheduling system.

Results: 47,390 patients were invited by SMS to participate, of which 20,724 (43.7 percent) responded with 18,138 opting in (81.5 percent of respondents). Participants received SMS reminders for 77,783 scheduled visits; comparison group patients (N=72,757) were scheduled for 573,079 visits during the evaluation period. Intervention and comparison groups had, respectively, attendance rates of 72.8 percent versus 66.1 percent (p<0.001), cancellation rates of 13.2 percent versus 18.6 percent (p<0.001), and no show rates of 14.0 percent versus 15.3 percent. Patient satisfaction with text messaging ranged from 77 percent to 96 percent. Implementation challenges included a low rate of inaccurate reminders due to non-standard use of the scheduling system across clinical departments.

Discussion: SMS appointment reminders improve patient satisfaction and provide a low operating cost approach to reducing operational inefficiencies through improved attendance rates in an integrated safety net health care system.

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Introduction

Failure to attend scheduled healthcare appointments wastes resources, causes system inefficiency, and is associated with poorer health outcomes and higher need for acute care.[1-5] The impact is particularly important within safety net organizations, which primarily care for underserved patients and which often operate with limited resources.[3] This pragmatic investigation of the impact of short message service (SMS) text message appointment reminders was conducted as part of Denver Health's (DH) 21st Century Care program, funded under a Health Care Innovation Award grant from the Center for Medicaid and Medicare Innovation to explore the impact of novel models of care on the triple aim (1C1CMS331064-01-00). Previous SMS reminder studies have shown improved attendance rates.[2,6-7] The current study is unique in its size, duration, setting (i.e., a United States integrated safety net health care system), and inclusion of operating costs and unintended consequences.[6]

Cell phone technology is both widely available and frequently used for health purposes: 85 percent of adults in the United States (US) own a cell phone, of whom 31 percent use their phones to obtain health information – a near 100 percent increase in two years.[8] Of US cell phone owners, 80 percent report using their phones for text messaging. Both cell phone ownership and its use to access health information are higher among Latinos and Blacks than among whites;[8-10] this technology could reduce disparities through broad reach in a safety net population. In 2013, a DH patient survey indicated 93 percent use cell phones (of whom 51 percent use smart phones, 47 percent regular, and two percent did not specify) and that cell phone users were significantly more likely to send and receive text messages (84.4 percent) than to send and receive email (72.7 percent; $p<0.001$).[11] Using a pragmatic design, we examined whether SMS appointment reminders were an effective low-cost approach to improving operational efficiency in a safety net population.

Methods

Study Design and Participants

A before-after analysis compared DH patients who opted into SMS appointment reminders with those declining or not offered reminders over an 18-month evaluation period from March 25, 2013, to September 30, 2014. Eligibility criteria included age greater than 17 years, English or Spanish as a primary language, and a cell phone number on record in the DH registration system. DH, an integrated urban safety net health system that serves Denver, Colorado, includes a 525-bed hospital and academic medical center, nine federally qualified primary care clinics, and sixteen school-based clinics.

Using a customer relationship management (CRM) software foundation (Microsoft Dynamic™), a patient relationship management (PRM) platform was developed for text messaging with patients.[12-13] PRM integrated with DH's appointment scheduling system (Siemens) to obtain real-time appointment information through HL7 messages. Upon scheduling an appointment in primary care or women's care clinics during the study period, patients were sent an SMS text message in English or Spanish based on patient preference, inviting them to participate in the reminder program. Patients responding affirmatively were enrolled in the program; patients declining or not responding were not enrolled (opted out). Patients who declined a previous invite received no follow-up invitations, with newly-scheduled appointments. Participants received two SMS reminders three- and one-day(s) prior to their appointment from March 2013 through

April 2014, and a single SMS reminder two days prior from May through September 2014. Patient-level identifiers were excluded from messages due to HIPAA regulations. Reminders contained the time, date, and location for all primary care and most specialty clinic appointments, excluding appointments for radiology and most procedures. Clinic sites considered to be particularly sensitive, such as the sexually transmitted disease (STD) clinic, were excluded from the reminder program to protect patient privacy. Patients replied to the reminder with "yes" or "no" to indicate their planned attendance. An acknowledgement message was returned: "Thank you, your msg was received. If you want to cancel or reschedule, call Denver Health at 303-436-4949." Effective November 2013, appointments were cancelled based on a patient's response.

The 21st Century Care program, of which this investigation was a part, was determined by the Colorado Multiple Institutional Review Board to be consistent with quality improvement and not human subjects research.

Statistical Analysis

The primary outcome was the appointment attendance rate. Secondary outcomes were 1) response and acceptance rates to SMS invitations; 2) cancellation and no-show rates; and 3) patient satisfaction based on CAHPS scores. Chi-square and logistic regression assessed significance. Baseline performance was calculated for all intervention and comparison group patients who received care at DH from April-September 2012.

We conducted our analyses with SAS software, and used binary logistic regression with a single categorical predictor to assess the impact of reminders on appointment outcomes and the potential impact of each demographic variable separately. Using age as an example, we established categorical values based on year-based range grouping (e.g., 18-29, 30-39, 40-49, 50-59, 60-69, 70+) and modeled against the binary variable of "appointment reminder yes vs. appointment reminder no." The probability modeled was that of the event (appointment reminder yes, i.e., an appointment reminder was sent). Fisher's scoring was used as the optimization technique, and the likelihood ratio statistic was used to assess model fit. Joint significance testing for all predictors (global null hypothesis) was assessed using the likelihood ratio and Wald chi-square with five degrees of freedom, with a result of $<.001$. Maximum likelihood estimate testing likewise showed significance for each of the individual parameters below $<.001$. Odds ratio point estimates were highest for the age group of 30-39 year olds (2.61 OR, with 95 percent confidence limits from 2.35 to 2.89) and lowest for the age group of 60-69 (1.52 OR, with 95 percent confidence limits from 1.36 to 1.70), compared to 70+ as a reference. The reference group was chosen from the older end of the age spectrum due to general lower prevalence of technology use among older adults (the "grey gap" or "silver digital divide").

Patient satisfaction was assessed by Clinician & Group CAHPS survey response to a question selected from the health information technology item set[14] and modified to inquire about perceived text messaging value in general. Implementation and operating costs and reports of unintended consequences were evaluated regarding program effectiveness. The intervention group was comprised of all patients who enrolled in the reminder program, and the comparison group included eligible patients who opted out or did not respond to an invitation to participate.

Results

Table 1 describes the demographics of intervention and comparison group patients. Differences (p<0.001) were observed by age, gender, race/ethnicity, and primary language. Patients who were 30-49 years old, women, Black or Latino, and Spanish-speaking were more likely to enroll in the reminder program.

Invitations were sent to 47,390 patients, of whom 20,724 (43.7 percent) responded and 18,138 enrolled (81.5 percent of respondents). Of the patients who opted in, 14,993 received a reminder; patients who opted in at the time of scheduling a same-day or next-day appointment did not receive a reminder if they did not schedule a subsequent appointment during the study period. Participants received SMS reminders for 77,783 scheduled visits (average 5.18 visits per patient) and comparison group patients (N=72,757) were scheduled for 573,079 visits (average 7.88 visits per patient) during the 18-month study period. The intervention and comparison groups had, respectively, visit attendance rates of 72.8 percent versus 66.1 percent (p<0.001), cancellation rates of 13.2 percent versus 18.6 percent (p<0.001), and no show rates of 14.0 percent versus 15.3 percent. A one-year look-back comparison showed that intervention patients were not historically better performers prior to the study period. Detailed results are shown in Table 2. A 62 percent overall response rate to SMS reminders was sustained over the study period (67.9 percent for Spanish reminders, 60.3 percent for English reminders). Patient satisfaction with text messaging in general ranged from a low of 77.0 percent to a high of 95.9 percent.

Operating costs for SMS appointment reminders included a contract with a text message gateway vendor, resources associated with personnel who managed enrollment, provided technical support, and monitored for incoming ad-hoc messages, and resources associated with a multidisciplinary design and implementation team including representation from clinicians, data evaluation, appointment registration, and technical support. Costs were assessed at the program level and did not include infrastructure development or maintenance. Total program operating costs during the study period were $58,985.84, or an average of $3,276.99 per month (Table 3).

Several unintended consequences were discovered during the intervention, resulting in implementation modifications. For instance, it became apparent several months into the study period that a handful of DH specialty clinics instruct patients to present for visits or procedures at times that did not match the appointment time in the registration system; these appointment types were subsequently excluded from SMS reminders. Also, at month seven, registration clerks suggested it preferable to cancel appointments for patients indicating they would not attend, as opposed to having the patient cancel and re-schedule their appointment. Patient reports of receiving too many reminders and feedback from registration and appointment center personnel about the best timing for cancellation changed SMS reminders from two to one per appointment. In addition, a programming update to PRM resulted in inadvertent release of clinic identifiers to five patients.

Table 1. Demographics of Patients by Message Reminder Status, Denver Health, 3/25/13-9/30/14

	MESSAGE STATUS			
	REMINDER		NO REMINDER	
	N=14,993	*%*	*N=72,757*	*%*
AGE*				
18-29	3,868	25.8	19,275	26.5
30-39	3,978	26.5	15,112	20.8
40-49	2,908	19.4	12,845	17.6
50-59	2,541	17.0	12,887	17.7
60-69	1,234	8.2	8,044	11.1
70+	464	3.1	4,594	6.3
GENDER*				
Male	3,994	26.6	28,237	38.8
Female	10,999	73.4	44,520	61.2
RACE/ETHNICITY				
Asian/PI	547	3.6	2,517	3.5
Black*	2,292	15.3	9,315	12.8
Hispanic/Latino*	5,946	39.7	25,287	34.7
White*	3,528	23.5	20,300	27.9
Other/Unknown*	2,680	17.9	15,338	21.1
LANGUAGE*				
English	10,021	66.8	51,803	71.2
Spanish	3,673	24.5	15,884	21.8
Other†	1,299	8.7	5,070	7.0

* significant difference (p<0.001)
† reminded patients received messages in English

Table 2. Visit Outcomes Associated with Text Message Reminders, 3/25/13-9/30/14

	VISITS WITH REMINDERS		VISITS WITHOUT REMINDERS	
	N = 77,783	**%**	**N = 573,079**	**%**
ALL VISITS, PRIMARY AND SPECIALTY CARE (n = 650,872)				
Kept/Attended*	56,630	72.8	379,092	66.1
Cancelled*	10,266	13.2	106,586	18.6
No Show	10,887	14.0	87,411	15.3
PRIMARY CARE VISITS ONLY (n = 424,637)				
Kept/Attended*	36,400	71.0	244,326	65.4
Cancelled*	7,469	14.6	72,535	19.4
No Show	7,353	14.4	56,554	15.2
SPECIALTY CARE VISITS ONLY (n = 226,235)				
Kept/Attended*	20,230	76.2	134,766	67.5
Cancelled*	2,797	10.5	34,051	17.0
No Show	3,534	13.3	30,857	15.5

* Chi-squre significant difference ($p<0.001$)

Table 3. Operating Costs Associated with SMS Reminder Program

	UNIT COST	NUMBER OF UNITS	TOTAL COST
Text message gateway vendor, per-month contract	$17.00	18 months	$306.00
Text message gateway vendor, per-message charge	$0.01	447,976 messages	$4,479.76
Technical support, including patient enrollment and message management, per-hour	$95.66	117 hours	
(1.5 hours per week)	$11,192.13		
Personnel time, multidisciplinary team participation, per-month	$238.93	180 hours	
(10 hours per month)	$43,007.95		
		Total program cost, 18-month study period	$58,985.84
		Average monthly operating cost	$3,276.99

Discussion

SMS appointment reminders, commonly employed across a variety of industries and venues, have positively impacted attendance, cancellation, and no show rates, consistent with other published studies.[6-7] Despite common employment, large-scale implementation studies are lacking, and little data are available on operating costs and unintended consequences. While up-front health care system integration costs between a scheduling system and text messaging platform (for delivery and receipt) are substantial , ongoing operating costs were small, building a case for utilizing this technology to lessen operational inefficiencies by improving clinic attendance.

While SMS appointment reminders can be successfully implemented in an integrated health care system, this investigation highlights some challenges. Use of a common scheduling system across diverse specialty clinics did not prevent clinic-specific workflow variation, which affected consistent appointment reminder implementation. More rigorously collected preferred phone numbers for text message communication during registration would allow reuse for multiple text messages (e.g., appointment reminders, vaccination outreach, tobacco cessation, and diet support). Iterative intervention assessment permitted timely modifications to better meet patient (i.e., adjustment of reminder frequency) and operational needs (i.e., cancellation of appointments). A notable limitation is that we did not test for the impact of season on the two study groups.

By definition, this self-selected group limits generalizability. However, the pragmatic design allowed for evaluating real-world implementation of SMS appointment reminders. No inherent differences in intervention and comparison groups were observed from historical analysis (e.g., similar attendance, cancellation, and no-show rate behaviors). This system level intervention and iterative quality improvement efforts confirms the value of SMS appointment reminders in improving visit attendance and lowering operational inefficiencies.

Acknowledgements

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