Literature Review on the Effectiveness of SMS Text Messaging in Healthcare Interventions

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Background

Healthcare is at a tipping point and as such, unprecedented efforts are being made to improve health outcomes and foster efficiencies in healthcare delivery. What seems promising with the current reform and transformation efforts is the convergence of existing mass markets influencing healthcare innovation. For example, leveraging mobile phones to track, monitor, and engage patients in lifestyle and self-health management. Mobile text messaging communication in particular has proven to be an effective way to foster desired behavior change in patients and improve the way in which care is delivered by capturing important data that is actionable.

The need for improving outcomes and creating efficiency becomes increasingly important in the context of the coverage expansion in the Affordable Care Act where millions of Americans will enter the system, utilizing more healthcare resources. In particular, the Medicaid expansion is projected to result in a total of 75.6 million enrollees for 2014, an increase of roughly 19.5 million as a result of the ACA[1]. Leveraging mobile text message communication to facilitate convenient and efficient communication among patients and providers, as well encouraging desired behavior

[1] National Health Expenditures Projections 2010-2020. Forecast Summary. http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/downloads/proj2010.pdf.

change by providing patients with educational tools to improve health outcomes, is encouraging to achieve on the triple-aim objective of healthcare reform[2].

Caremessage aims to change healthcare delivery for disadvantaged populations by pioneering the effort of mobile technology as a way to improve access to critical health information and effective self-care management. A June 2013 Pew Research report estimated mobile phone penetration at 86% among American households earning less than $30,000 per year[3]. This compares to 59% of the same demographic who have access to a desktop or laptop, and 47% who have broadband set-up at home[4]. These figures imply a greater potential of mobile health innovations to accelerate adoption compared to other technology approaches for this demographic.

The opportunities to innovate using mobile technologies among the low-income and underserved populations are robust. A review of several research publications as well as surveying key constituents within the healthcare ecosystem serving these populations[5], it is clear that the unmet needs plaguing the healthcare safety-net and

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[2] The triple-aim is a framework developed by the Institute for Healthcare Improvement to address experience of care, population health (improving outcomes), and per capita cost of healthcare services; It is generally accepted that the Affordable Care Act uses the triple-aim as a core principle to design healthcare transformation: "Moving toward the "triple-aim": The Affordable Care Act and the implications for payment and quality reform". http://www.ehcca.com/presentations/pfpsummit6/dentzer_1.pdf.

[3] Rainie, L. "*Cell phone ownership hits 91% of adults"*. Pew Research Center. June 2013. http://www.pewresearch.org/fact-tank/2013/06/06/cell-phone-ownership-hits-91-of-adults/.

[4] Madden, M. "Technology Use by Different Income Groups". Pew Internet. May 2013. http://www.pewinternet.org/Presentations/2013/May/Technology-use-by-different-income-groups.aspx.

[5] Feedback from the healthcare community includes discussions with senior leadership of San Francisco Community Clinic Consortium, including St. Anthony's Foundation.

contributing to waste include poor appointment attendance[6], poor medication adherence[7], and poor health literacy[8].

Extending the successes of current mobile text message patient engagement strategies to each of these unmet needs has the potential to reduce waste and inefficiencies in the system by improving health literacy and self-health management of low-income and underserved populations. This paper intends to review studies and analyze the implications of using text messaging as a way to encourage patient behavior change. It also will include a discussion on caremessage's data collection strategy to evaluate the impact of the technology and inform product development.

The Literature

SMS text-messaging has shown a positive impact on fostering the desired behavior change in patients. A review of existing studies show that text messaging can support improvement in appointment attendance, increased medication adherence, and enhanced literacy through educational content outreach.

SMS text message appointment reminders

Patients failing to attend their scheduled doctor visits contribute to inefficiencies and misused resources[9]. In general it is found that a reminder, whether it be by text or phone, is helpful in improving attendance, however SMS technology is a more cost-effective approach[10].

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[6] Kaplan-Lewis, E. Percac-Lima, S. *"No-show to primary care appointments: why patients do not come."* Journal of Primary Care and Community Health. July 2013. http://jpc.sagepub.com/content/early/2013/07/26/2150131913498513.abstract.
Anecdotal feedback from St. Anthony's Foundation reported an approximate $250 loss in revenue from each no-show appointment.

[7] Nichol, M.B. Knight, T.K. Priest, J.L. Wu, J. Cantrell, C.R. *"Nonadherence to clinical practice guidelines and medications for multiple chronic conditions in a California Medicaid population."* Journal of the American Pharmacist Association. 2010. http://japha.org/article.aspx?articleid=1043767.

[8] Somers, S. Mahadevan, R. *"Health Literacy: implications of the Affordable Care Act."* The Institute of Medicine, Center for Health Care Strategies, Inc. 2010. *http://www.iom.edu/~/media/Files/Activity%20Files/PublicHealth/HealthLiteracy/Commissioned%20Papers/Health%20Literacy%20Implications%20of%20Health%20Care%20Reform.pdf*.

[9] Hasvold, P.E. Wootton, R. "Use of telephone and SMS reminders to improve attendance at hospital appointments: a systematic review". Journal of Telemedicine & Telecare. 2011. http://www.ncbi.nlm.nih.gov/pubmed/21933898.

[10] 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."* http://www.ncbi.nlm.nih.gov/pubmed/18196610.

A 2012 study analyzing the effect of SMS text reminders to reduce nonattendance for hospital outpatient visits found a significant difference in the attendance rate of patients who received a text reminder compared to patients who received no reminder[11]. The study was conducted at ITS-CDSR in the Departments of Prosthodontics, Endodontics, Orthodontics and Paedodontics through the Department of Public Health and Dentistry in India. Patients who had a mobile phone number on record were enrolled in the text message reminders, totaling 206 participants compared to 110 in the control group (patients receiving no reminder). The study was conducted across the departments for a period of 4 months. The results concluded that the attendance rate for patients who received text message reminders over the 4 month period were significantly higher (79.2%) compared to the attendance rate of those who received no reminder (35.5%).

Another study measuring the impact of SMS appointment reminders for outpatient clinic visits in Brazil found that text message reminders reduced nonattendance rates, improving patients' care and ensuring the right care at the right time[12]. Data was collected on appointment attendance through the clinics' scheduling systems. The nonattendance reduction rates for appointments at the four outpatient clinics studied were 0.82% (p= .590), 3.55% (p= .009), 5.75% (p= .022), and 14.49% (p= < .001). These results suggest that text is an effective and efficient way to ensure patients attend their scheduled clinic visits and do not have interrupted care.

The efficiency of being able to send bulk automated text message reminders to improve patient appointment attendance is buttressed in a study evaluating the effect of SMS appointment reminders on outpatient clinic appointment adherence[13]. Patients in Melbourne, Victoria who had a mobile phone number on record, were automatically enrolled in SMS appointment notifications. These patients were scheduled for a visit at any five outpatient facilities (dermatology, gastroenterology, general medicine, paediatric dentistry, and plastic surgery). The study found that the nonattendance rate for those who received text reminders was significantly lower (14.2%) compared to patients who received no reminder (23.4%).

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[11] Prasad, S. Anand, R. *"Use of mobile telephone short message service as a reminder: the effect on patient attendance."* International Dentistry Journal. 2012. http://www.ncbi.nlm.nih.gov/pubmed/22251033.

[12] da ,Costa TM, Salomão, 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 São Paulo, Brazil."* 2010. http://www.ncbi.nlm.nih.gov/pubmed/19783204.

[13] Downer, SR. Meara, JG. Da Costa, AC. "Use of SMS text messaging to improve outpatient attendance." Med J Aust. 2005; 183(7); 366-368. http://www.ncbi.nlm.nih.gov/pubmed/16201955.

The literature supports SMS text messaging as an effective way to reduce nonattendance for appointments. Ensuring patients attend scheduled visits is critical in providing consistent care as well as reducing waste and inefficiencies through a misallocation of important resources.

SMS text message medication reminders

Patients' failure to adhere to their medication regimen can lead to unnecessary disease progression and complications. This contributes to waste in the healthcare system including preventable visits to the emergency room and increased utilization of other healthcare resources. Researchers have evaluated the impact of SMS text reminders on promoting medication adherence. The results are promising, suggesting text as an efficient and effective way to ensure patients take their medication.

The World Health Organization conducted a review of trials and studies that evaluated the effectiveness of mobile text medication reminders for HIV patients on anti-retroviral therapy drugs[14]. The overall conclusion was that patients who receive text message reminders had a significantly higher adherence rate to their medications compared to patients that did not receive any kind of reminder. For conditions such as HIV where medication adherence is critical in preventing or stalling disease progression towards AIDS, as well as other comorbidities, the use of SMS technology can enable proper compliance of medication needs.

A study reviewing SMS reminders for diabetic patients concluded that text reminders improves adherence to oral antidiabetics[15]. In the study 56 patients were confirmed to receive text reminders to take their medication, compared to 48 patients who received no reminder. Medication of both groups was measured using Real Time Medication Monitoring (RTMM) of oral antidiabetics in terms of (1) days without dosing; (2) missed doses; (3) doses taken within predefined standardized time windows. Patients' experiences were surveyed through questionnaires. The results found that patients who received reminders had a higher rate of adherence including a higher rate of taking their medication in the predefined time interval of receiving the reminder. The study also concluded through the patient survey questionnaire that patients found the reminders helpful.

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[14] Sharma, P. Agarwal. P. *"Mobile phone text messaging for promoting adherence to antiretroviral therapy in patients with HIV infection."* The WHO Reproductive Health Library. The World Health Organization. 2012. http://apps.who.int/rhl/hiv_aids/cd009756_sharmap_com/en/index.html.

[15] Vervolet, M. van Dijk, L. Santen-Reestman, J. "SMS reminders improve adherence to oral medication in type 2 diabetes patients who are real time electronically monitored" In J Med Inform. 2012;81(9); 594-604. http://www.ncbi.nlm.nih.gov/pubmed/22652012.

The American Heart Association also found that text message reminders improved the medication adherence of patients who were recovering from a heart attack[16]. The study included 90 patients over a 30 day period. The patients were divided into three groups: one received two medication reminders daily along with educational tips, the second group only received educational tips, and the third group received no messages at all. The results show that the group who received both reminders and tips had an 88% rate of correct prescription adherence compared to 72% of the patients who received no texts at all. The group who received the heart-healthy tips had a 95% rate of adherence.

These studies prove a positive impact of text message technology to solve for medication nonadherence that leads to poor health outcomes and inefficient use of healthcare resources[17]. The literature shows that this approach has applications across several chronic diseases that require consistent prescription drug compliance.

SMS text message delivering educational content

SMS text-based education is emerging as an effective way to engage patients in better self-care. Lack of education around basic health information leads to approximately $106 billion to $238 billion in economic burden each year[18]. Text message outreach with educational content can be an efficient way to improve patients' health literacy.

The Center for Connected Health in Boston reported in a study that text messaging improved treatment adherence and self-care for dermatology patients suffering from atopic dermatitis[19]. In the study, 25 patients received daily text messages over a period of six weeks. The text messages included treatment reminders and educational content pertaining to their health condition. At the end of the six week study, patients reported an improvement of treatment adherence of 72% and roughly 68% of the patients reported an improvement in self-care behaviors to help their conditions.

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[16] Thomson, D. Health Day. *"Text Message from your heart doc: 'Take your meds."* U.S. News & World Report. Nov 17 2013. http://health.usnews.com/health-news/news/articles/2013/11/17/text-message-from-your-heart-doc-take-your-medicine.

[17] Foreman, KF. Stockl, KM. Le, LB. Fisk, E. Shah, SM. Lew, HC. Solow, BK. Curtis, BS. *"Impact of a text messaging pilot program on patient medication adherence."* Clinical Therapy. 2012. http://www.ncbi.nlm.nih.gov/pubmed/22554973.

[18] Vernon, JA. Trujillo, A. "Low Health Literacy: Implications for National Health Policy." Rep. Washington: George Washington University, 2007. http://sphhs.gwu.edu/departments/healthpolicy/CHPR/downloads/LowHealthLiteracyReport10_4_07.pdf

[19] Pena-Robichauz, V. Kvedar, J. Watson, A. *"Text Message as a Reminder Aid and Educational Tool in Adults and Adolescents with Atopic Dermatitis: A Pilot Study."* Dermatology Research and Practice. 2010. http://www.connected-health.org/programs/dermatology/research-materials--external-resources/text-messages-as-a-reminder-aid-and-educational-tool-in-adults-and-adolescents-with-atopic-dermatitis-a-pilot-study.aspx.

Two other studies evaluated the use of text messaging in improving self-care and desired behavior change for Type 1 diabetic patients[20]. One study tailored text message communication to self-management goals, as well as untailored content such as newsletters and tips from other patients. The results showed that the patients enrolled in the text program were engaged in interacting with the technology. The participants seemed to enjoy the community aspect of the technology through the ability to connect with their provider and peers. The second study evaluated the use of text message technology among families of children with type 1 diabetes. In this study, the parents received informational messages pertaining to their children's care needs. The study results concluded that the text messages were helpful and aided in better dialogue between parent and child around the disease condition.

A 2012 evaluation of text messaging for the glucose management of diabetic patients proved that mobile text messages could improve self-health management. The study was a pilot that included 47 diabetic patients receiving care at a Federally-Qualified Health Center. Over a three-month period, the patients received blood-sugar reading requests three times per week. The results stated that 68% of patients who received text message requests provided their glucose readings compared to 12% who were asked for their glucose levels at preceding visits.

Ensuring proper self-care is important for patients living with chronic disease as much of the care needed to manage these diseases occurs outside of the clinic and provider supervision. Providing patients with easy and consistent access to information to better understand their conditions and comply with proper care practices can lead to improved health outcomes.

Conclusion

Mobile text communication can be a cost-efficient and effective way to engage patients in the desired behavior change to improve appointment attendance, medication adherence, and self-care management of disease. As the healthcare system transitions to a focus on improving health outcomes, engaging patients in the management of their health is critical. SMS text messaging is a low-cost way to facilitate engagement and enhance the health literacy of individuals living with chronic conditions and other health challenges.

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[20] Franklin, V. Greene, A. Pagliari, C. *"Patients' engagement with 'Sweet Talk'- A text messaging support system for young people with diabetes."* Journal of Medical Internet Research. 2008. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2483928/#!po=2.50000.
Wangberg, SC. Arsand, E. Andersson, N. *"Diabestes education via mobile text messaging."* Journal of Telemedicine and Telecare. 2006. http://www.ncbi.nlm.nih.gov/pubmed/16884582.