

Internet Use For Health: Socially Convenient Communication Technologies Support Integrated Medical and Dental Care.

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ABSTRACT

This paper presents a concept for using cell phone text messaging (SMS messaging or texting), as an accessible communications technology, to implement a spectrum of health support services, based on an assumed model of integrated medical and dental care. Texting provides a streamlined communication mechanism for health interventions. These interventions require the coordination of care between providers and patients. This coordination will allow for cohesive and better tailored messages. Consequently, better messages will more likely modify patients' behavior. The challenge addressed in this paper is identifying the characteristics that these messages should have, when generated through a healthcare coordinated approach. Metrics such as content, readability, literacy level, length and effectiveness of messages in texting are also discussed. A group of experts, through an iterative process, considered and evaluated the characteristics presented here.

KEYWORDS

medical, dental, mental health, Internet, texting, voicemail

1. INTRODUCTION

Communication between provider and patient (or the patient's parent(s)) is a vital element of delivering health care. There are certain examples in health care delivery where messages are valuable.

Appointment reminder categories include: Periodic medical, dental or orthodontic checkups; reminders for treatments requiring multiple visits (medical, dental or orthodontic); immunizations, especially where the timing of multiple successive doses is significant; prenatal care scheduling support for pregnant teens; referrals: based on diagnoses in an integrated patient record; if diabetes is diagnosed by a medical provider, reminders may be needed for referrals to an ophthalmologist (for a dilated eye exam), a dentist (for a periodontal screening), podiatrist (for a foot exam), etc.; if periodontal disease is diagnosed by a dental provider, there may be reminders for diabetes screening by a primary care physician, if oral manifestations of

bulimia are observed by the dental provider there may be reminders for referral to the appropriate professional, if oral manifestations of HIV are observed there may be reminders for referral to a primary care physician, etc.

Education and attempted persuasion categories include: tobacco usage campaigns; nutrition campaigns (BMI maintenance or goal achievement, obesity, diabetes, kidney disease, hypertension control); physical activity campaigns; other public health campaigns; and depression care access support.

Modalities of messaging transmitted over the Internet to a cellular telephone device considered in this paper include: Short Message Service (SMS) messaging (texting) to phone devices; email to suitably equipped and supported phone devices; voicemail to phone devices; voice phone call to phone device, possibly result in voicemail.

This paper assumes an integrated (with regard to medical and dental care) model of health care delivery. The artificial division of care into organizational silos, typical in the 20th century, ignores the fact that the mouth is part of the body (NIH, 2000), and that pathogens do not respect an artificial division of care preserved by organizational, professional, and political inertia in human affairs. Initiatives like the U.S. National Health Information Network (NHIN) fall short as a result, thus failing to promise delivery of the desired quality of care, safety, and health care cost reduction. Significant siloization persists in many nations despite international recognition of the need for integration of the disciplines. In certain countries (at least the U.K. and the U.S.) the serious impacts and risks of discrepancies between unsynchronized patient records in independent systems have been documented, thus underscoring the need for a coordinated approach to medical and dental care and patient records. At the outset of the 21st century, U.S. citizens were informed by their Surgeon General that many systemic diseases had oral manifestations (NIH, 2000). Such a model is implemented in the U.S. primarily by federal sector health systems: the systems of the Veterans Affairs Department, the Indian Health Service, and the Department of Defense, and only to a very limited degree is supported by payers in the private sector.

2. RATIONALE FOR INTEGRATED CARE MODEL

According to the World Health Organization (WHO), “The strategy is that oral disease prevention and the promotion of oral health needs to be integrated with chronic disease prevention and general health promotion as the risks to health are linked.” Further, “The objectives of the WHO Global Oral Health Programme, one of the technical programmes within the Department of Chronic Disease and Health Promotion, imply that greater emphasis is put on developing global policies based on common risk factors approaches and which are coordinated more effectively with other programmes in public health. The policy of the WHO Global Oral Health Programme emphasises that oral health is integral and essential to general health, and that oral health is a determinant factor for quality of life.”

The U.S. Surgeon General’s “Report on Oral Health in America” (2000) detailed oral manifestations of systemic illnesses. More recent coverage of this topic is provided by Cappelli and Mobley (2008). The articulation of medical and dental care and records is supported in Migliorati and Madrid (2007) and in Powell and Din (2009). Din and Powell (2008) provided a list of conditions requiring collaboration of medical and dental providers caring for a patient. Even if integrated care delivery is not achieved, both medical and dental care can be enhanced by targeted messaging.

3. COMMUNICATION TECHNOLOGY MODELS AND DEMOGRAPHY

According to data gathered by the Pew Research Center in late 2009 (Rainie, 2010), 74% of American adults use the internet; 60% use broadband connections at home, and 55% connect to the internet wirelessly. The interviews were conducted in English or in Spanish. According to Shapiro et al. (2008), children “use electronic devices regularly; 45% of US teenagers ages 12–17 own a mobile phone and 33% use the short message service (SMS; text messaging).” At least two studies (Franklin et al., 2008; Shapiro et al, 2008) remark on positive attitudes toward SMS on the part of young participants.

For young populations SMS as the preferred method of communication is always available. These advantages outweigh the disadvantage of only having 140-160 characters per message. SMS is inherently as

secure as dialed phone calls, protected by spread spectrum CDMA (code division multiple access) or encrypted GSM technology, as long as the phone remains in control of its owner. It lacks only the voice authentication of the recipient available with phone calls, a risk which may be addressed through biometrics in the future. The use of texting as a form of provider-to-parent-or-patient communication raises the question of whether the approach complies with applicable privacy and confidentiality laws in different countries or in the European Union. Din et al. (2005) propose the use of Personal Information Managers (PIMs) and Medical Logic Modules (MLMs) to manage reminders, thus bypassing the confidentiality and privacy concerns that might apply to texting. Cell phone biometrics, already available, may add security in the future.

The sending of short text messages (texting) is attractive because it is clear and gets attention. Text messages have a sense of immediacy or urgency that may not apply to email embedded in a large file of received email. Kharbana et al. (2009) describe how texting (in English or Spanish) can be used to support immunization regimens. Effectiveness may depend on the ability of parents to use their own cell phones to “open, read, and respond to sample text messages.” The study conformed to institutional review board procedures and received informed consent from parents involved. The study found that texting a reply confirmation might be difficult for some parents, but that texted reminders were well received by many parents. Although the participants in the study were reported not to mind the costs associated with the reminder texting, one must note that all study participants received a \$25 check card. Texting costs remain a concern with regard to texting. If the texting of reminders is managed by the same provider clerical staff who would otherwise be responsible for phone or emailing reminders, then texting can be implemented so as not to be a direct burden on a provider who already faces a crowded daily schedule.

Texting, being targeted, contrasts with broadcast communication. With regard to the broadcast model of communication, Dooley et al. (2010) describe unintended behavioral responses to broadcast media messages and caution about the impact of “reactance.” They report that according to the theory of reactance in psychology, “when the target audience feels their freedom to engage in health risk behaviors has been threatened or eliminated, they will be motivated to re-establish the threatened or lost freedom, resulting in an increased likelihood for them to engage in the health risk behaviors.” According to Belay and Dietz (2009), primary care physicians realize that an important effort must be directed to community engagement and advocacy for policy and infrastructure change. The public health approach to obesity prevention and control has only just begun. Policy initiatives and environmental changes that provide healthful choices appear promising, since these strategies were also used in tobacco control.

Texting has been shown to be useful for providing reminders of immunization for parents (Kharbana et al., 2009). Similar efforts have been undertaken for the control of diabetes (Hanauer et al., 2009), health promotion among adolescents (Castaño and Martínez, 2007), improving patient attendance (Henderson et al. 2008), medication reminders (Mao et al., 2008). In supporting diabetes care, Franklin et al. (2007), reported that “[a]utomated, scheduled text messaging successfully engaged young people with diabetes. While the system was primarily designed to provide ‘push’ support to patients, submission of clinical data and queries illustrates that it was seen as a trusted medium for communicating with care providers.” They describe “Sweet Talk” as a “novel intervention designed to support patients between clinic visits using text messages sent to a mobile phone.” They report further that “[s]cheduled messages are tailored to patient profiles and diabetes self-management goals, and generic messages include topical “newsletters” and “anonymized tips from other participants” and that “[t]he system also allows patients to submit data and questions to the diabetes care team.” Shapiro et al. (2008) report on a use of text messaging to monitor three concerns related to obesity, consumption of sugar-sweetened beverages, extent of physical activity, and extent of sedentary screen time (in front of a TV or computer screen). In their study, use of text messages was compared to use of paper diaries and to no monitoring. Each family in the text messaging (SMS) group used a single phone restricted to study use (and thus not an ordinary cell phone in general use.) According to Shapiro et al., “children appear to prefer a technological, tailored, interactive program versus a more traditional paper diary program and when enrolled, those using SMS may have greater adherence and higher completion rates.”

Improvements in patient showing up for medical and dental appointments have been reported by a number of sources (Krishna, 2009; Andersson, 2009) in multiple countries. From Sweden, Andersson reports on Tieto’s dental SMS Reminder service, “Before Tieto’s solution was taken into use, around 10 percent of all patients missed their appointments with Folk tandvården.” In the U.S., Demandforce Dental claims “Sending a timely text message on the day of the appointment can help reduce the overall no show rate,” where the “average [dental] missed appointment rate is between 18 and 22 percent.” Because texting supports

a mobile population less tied to land line service, it facilitates decreased health disparities (as long as the population(s) encountering disparities in medical or dental care have cell phone technology and can afford text messaging) (Demandforce, 2010). Dental Economics/Dental News (2010) cites the assumption that close timing (closer than that of an email, postal mail, or phone message) contributes to effective intervention in preserving office scheduling.

In China, Zhang et al. (2008) report on a “mobile pharmacy service system (MPSS) to deliver individualized pharmaceutical care via text messages sent to the mobile phones of patients” with timed medication reminders, renewal reminders, adverse drug reaction information and other forms of information and conclude that “the MPSS should improve pharmaceutical care, widen the knowledge of pharmacists, reduce the burden on pharmacy staff, improve pharmacist-patient interaction, and improve the effect and safety of medication.” In Ireland, Joyce and Weibelzahl (2006) noted “reluctance amongst sufferers [of depression] to present for treatment.” They “examine how text messaging can be harnessed to encourage sufferers to overcome these barriers and seek help, by initiating dialogue and providing timely exhortations (via a student’s mobile phone) to avail of counseling services.” Joyce and Weibelzahl report that to prevent “students feeling targeted, these messages form part of a once-weekly stream of text messages from college to student, relating to finance, sports, exams etc.”

Krishna et al.(2009) reviewed “25 studies that evaluated cell phone voice and text messaging interventions, with 20 randomized controlled trials and 5 controlled studies” and reported that, “[n]ineteen studies assessed outcomes of care and six assessed processes of care. Frequency of message delivery ranged from 5 times per day for diabetes and smoking cessation support to once a week for advice on how to overcome barriers and maintain regular physical activity” and further that “[s]ignificant improvements were noted in compliance with medicine taking, asthma symptoms, HbA1C, stress levels, smoking quit rates, and self-efficacy. Process improvements were reported in lower failed appointments, quicker diagnosis and treatment, and improved teaching and training.”

Table 1 – Properties of Communication Technologies

↓	→	Text message	Phone call	Email	Mailing
Timeliness		Almost instantaneous, but not guaranteed (some providers very good, others withhold delivery until the network load allows it); close to appointment time	Instantaneous, if not, the caller knows he/she has to try again	Almost instantaneous, but not guaranteed (some providers very good, others withhold delivery until the network load allows it)	Takes days
Security		point-to-point protocol; CDMA encoding or GSM encryption; possible biometrics	point-to-point protocol; possible biometrics	limited security if encrypted	USPS security level
Certainty of delivery/receipt		Partial	Full	Partial	Limited (you can request confirmation, but it becomes expensive)
Attention upon receipt		Immediate if cell phone on; can be timed close before appt.	Immediate if cell phone on or if landline and at home; usually 1 or 2 days before appt.	Depends on email load; competes with spam	Could be forgotten, lost, overlooked; postcard format best
Behavior change (appt.)		Highly likely	Depends on timing	Depends on timing and email load	Depends on timing
Cost transmitting		Free if generated from email	Local cost Long distance Depending on phone plan	Free through public service (privacy issues) Monthly plan cost	Mailing cost: (USA 0.44\$) (Ger. 0,55 €)

Cost receiving	Monthly data plan Fee based	Cellphone receivers: airtime costs Landlines free	Free through public service (privacy issues) Monthly plan cost	Free to receive
Length of message	160 characters (Latin) 140 chars. (Twitter) 70 characters (Chinese)	“Unlimited”	“Unlimited”	“Unlimited”
Readability	Limited to screen characteristics	Voice	Font size variable	Font size variable
Automation?	Can be fully automatic	Can be automated but loses some effectiveness; Can be done by humans but becomes expensive	Can be fully automated	Can be fully or semi- automated
Reach	Almost ubiquitous (carrier dependent)	Almost ubiquitous for cellphone users, limited to one location for landlines	Directly associated to access to internet	Limited to one physical address

Table 1 (Properties of Communication Technologies) identifies parameters that can be used to classify communication technologies and their respective advantages or disadvantages. Some of the classifications are affected by conditional circumstances like whether the intended message recipient is a home (for a land line call) or has his/her cell phone turned on (for a mobile phone user), or how the intended recipient typically handles email or postal mail or voice messages from phone calls. Because of such conditional circumstances it is difficult to assign quantified values (points) to the different parameters in order to rank them. Characteristics of the target population have to be taken into account. Young users are known to respond well to mobile phone technology and are likely to use that technology.

CONCLUSION

Short message system (SMS or texting) internet technology shows potential for use in support both direct care and public health objectives and is currently supporting medical and dental care. The phenomenon is clearly international. The technology is acceptable to youth and its use has been validated in a number of studies. Broadcast media approaches to meeting public health goals trying to work against risky behavior may be defeated by “reactance.” Various types of automation design have been used in configuring and implementing text messaging health care strategies for both medical and dental care and can support increasing integrated care models in the future.

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REFERENCES

- Andersson S-O, Dental care SMS reminder reduces no-shows and last minute cancellations. <http://www.tieto.com/default.asp?path=1.93.16080.163.9862.39287>
- Belay B and Dietz WH, 2009. Obesity Prevention and Control: From Clinical Tools to Public Health Strategies. *American Pediatrics* Vol. 9, pp. 291-2.
- Cappelli DP and Mobley CC, 2008. *Prevention in Clinical Oral Health Care*. (Elsevier).

- Castaño PM, Martínez RA, 2007. Harnessing technology for adolescent health promotion. *Adolesc Med State Art Rev*. Vol. 8, No. 2, pp. 400-6, xiii.
- Chaloupka FJ and Powell LM, 2009. Price, Availability and Youth Obesity: Bridging the Gap. *Preventing Chronic Disease* Vol. 6, No. 3, pp. 1-6.
- Dental Economics/Dental News* Vol. 100, No. 1, 2010, Text messaging brings doctors, patients closer together. http://www.dentaleconomics.com/display_article/306533/54/none/none/DEPnw/Text-messaging-brings-doctors.-patients-closer-together.
- Din FM, Tao Y, Malhotra S, Zimmerman JL, Kukafka R, 2005. Improving Patient Compliance with Best Practices Guidelines: A Web based Automated and Personalized Reminders System. *AMIA Annual Symp Proc*. p. 939.
- Din FM and Powell VJH, Integration of Medical and Dental Records to Improve Healthcare Outcomes, Costs, and Overall Public Health, Report to Obama-Biden Transition Team. December 2008.
- Dooley JA, Deshpande S, and Adair C, 2010. Comparing adolescent-focused obesity prevention and reduction messages. *Journal of Business Research* Vol. 63, pp. 154-160.
- Franklin VL, Greene A, Waller A, Greene SA, Pagliari C, 2008. Patients' Engagement With "Sweet Talk" – A Text Messaging Support System for Young People With Diabetes. *J Med Internet Res* Vol. 10, 2, p. e20.
- Geist SMRY and Geist JR, 2008. Improvement in Medical Consultation Responses with a Structured Request Form, *Journal of Dental Education* Vol. 72, No. 5, pp. 860-868.
- Hanauer DA, Wentzell K, Laffel N, Laffel LM, 2009. Computerized Automated Reminder Diabetes System (CARDS): e-mail and SMS cell phone text messaging reminders to support diabetes management. *Diabetes Technol Ther*. Vol. 11, No. 2, pp. 99-106.
- Henderson R, 2008. Encouraging attendance at outpatient appointments: can we do more? *Scott Med J*. Vol. 53, No. 1, pp. 9-12.
- Hobdell M, Petersen PE, Clarkson J, Johnson N, 2003. "Global goals for oral health 2020," *International Dental Journal* Vol. 53, pp. 285-288. Available at http://www.who.int/oral_health/publications/goals2020/en/index.html
- Joyce D and Weibelzahl S, Text Messaging as a Means to Lowering Barriers to Help-seeking in Students with Depression. *Proceedings of LADIS International Conference e-Society, Dublin, Ireland, 2006*, pp. 211-214.
- Kharbanda EO, Stockwell MS, Fox HW, and Rickert VI, 2009. Text4Health: A Qualitative Evaluation of Parental Readiness for Text Message Immunization Reminders. *Amer Jour of Public Health* 99, 12, pp. 2176-2178.
- Krishna S, Boren SA, Balas EA, 2009. Healthcare via cell phones: a systematic review. *Telemed J E Health* 15,3, pp.231-40.
- Mao Y, Zhang Y, Zhai S., 2008. Mobile phone text messaging for pharmaceutical care in a hospital in China. *J Telemed Telecare*. 14, 8, pp. 410-4.
- Migliorati C and Madrid C, 2007. The interface between oral and systemic health. *Clin Microbiol and Infect* 13 (Suppl 4), pp. 10-16.
- NIH, 2000. *Oral health in America: a report of the Surgeon General*. Rockville, MD: U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health.
- Peterson, PE, 2008. World Health Organization global policy for improvement of oral health – World Health Assembly 2007, *International Dental Journal* 58, pp. 115-121.
- Powell VJH and Din FM, 2009. "The Medical-Dental Home: Achieving Comprehensive Care for Chronic Illness through Integrating Medical-Dental Care and Data," *Medical Home News* 1, 3, pp. 1, 5-7.
- Rainie L, 2010. Internet, broadband, and cell phone statistics. Pew Research Center.
- Shapiro JR, Bauer S, Hamer RM, Kordy H, Ward D, and Bulik CM, 2008. Use of Text Messaging for Monitoring Sugar-Sweetened Beverages, Physical Activity, and Screen Time in Children: A Pilot Study, *J Nutr Educ Behav*. 40, 6, pp. 385–391.
- Siegel M, and Biener L, 2000. The Impact of an Antismoking Campaign on Progression to Established Smoking: Results of a Longitudinal Study. *Amer Jour Public Health* 90, 3, pp. 380-286.
- VanLandeghem K, 2003. Preventing Obesity in Youth through School-Based Efforts, Issue Brief. NGA Center for Best Practices.