

Text Messaging and Patient Engagement in an Increasingly Mobile World

Julie C. Lauffenburger, PharmD, PhD; Niteesh K. Choudhry, MD, PhD

The potential of short message system (SMS) text messaging and other mobile phone-based methods (collectively often called mHealth) to engage patients in their own health care has been met with great enthusiasm because of the relatively low cost, transportability, and widespread use of these technologies: More than 6 billion people worldwide have access to mobile phones.¹ By providing reminders and enhancing communication and interaction with healthcare professionals, there is compelling evidence for patients with HIV/AIDS that mHealth can improve adherence to medications and suppress viral loads.²⁻⁴

Article see p 592

The evidence of the effectiveness of these strategies for noncommunicable diseases is, unfortunately, less robust.^{5,6} A 2012 Cochrane systematic review identified only 4 randomized trials of text messaging interventions that included a total of 182 patients.⁶ These studies supported the effectiveness of text messaging to improve medication adherence but were limited in scope, size, and duration.⁶ An even more recent 2015 systematic review of cardiovascular disease management identified 3 additional studies, the largest consisting of 128 adults.⁵ Patient adherence to medications improved after the SMS interventions, but the results were mixed in terms of other outcomes, including glycemic control, costs, and emergency department use.⁷⁻⁹

Accordingly, developing and empirically evaluating mHealth tools is essential and particularly relevant in resource-poor settings where the burden of cardiovascular disease is exceptionally high and rapidly growing.⁵ In this issue of *Circulation*, Bobrow and colleagues¹⁰ describe what is, to the best of our knowledge, the largest reported trial of text messaging for noncommunicable disease. Their carefully conducted randomized-controlled effectiveness trial targeted patients with high blood pressure in Cape Town, South Africa and tested 2 different text messaging systems, unidirectional information-only messages and 2-way interactive messages, among 1372 patients of mostly black African or mixed

ancestry, the majority of whom had low monthly incomes.¹¹ The authors developed a bank of text messages that they mapped to behavioral change techniques, including goals and planning, repetition and substitution, social support, and natural consequences.¹¹ The content of the messages was largely advice, providing information about pillboxes, appointment reminders, or medication side effects.¹¹ In contrast, the interactive texting arm included texts from this bank but also asked participants to respond in a return text to an automated system.

Twelve months after randomization, the mean adjusted changes in systolic blood pressure among patients receiving information-only and interactive SMS modalities compared with usual care were -2.2 mmHg (95% confidence interval, -4.4 to -0.04) and -1.6 mmHg (95% confidence interval, -3.7 to 0.6), respectively. Patients receiving text messages were also more likely to have blood pressures at goal ($<140/90$ mmHg) compared with control patients at the end of the study (65% for both SMS arms versus 58% for control). Medication adherence, as measured by clinic dispensation data, was also better among patients receiving text messages than those receiving usual care (4% higher for both SMS arms than control). Notably, this study was not powered to examine differences between the 2 different modalities of text message delivery.

Unfortunately, the modest absolute effect of the tested interventions on blood pressure could have been predicted on the basis of several aspects of the study design. First, the trial was conducted in a robust and highly functioning clinic where visits are highly structured and medications are provided for free. As a result, patients in the usual care arm received quite good care, and it may have been hard to demonstrate an incremental improvement above this. Second, all patients received a non-health-related text weekly for 6 weeks. Although this was done to maintain masking, it could conceivably have delivered nonspecific attention to the control group (and might explain the relatively impressive 6.5-mmHg drop in blood pressure from baseline to 6 months). Lastly, patients were included in the trial if they had hypertension rather than poorly controlled hypertension. Although guidelines for hypertension are evolving¹² and differ globally, a mean systolic blood pressure of 135 mmHg at baseline generally represented acceptable control in the absence of specific comorbidities at the time the study was conducted. Aiming for even better blood pressure control in this context may have been challenging.

So, do the relatively modest clinical effects mean that text messaging is not a useful strategy to engage patients in hypertension control? The answer to this question is likely “no” for 2 separate reasons. First, the low cost of SMS texting interventions may still make small reductions in blood pressure relatively cost-effective, similar to the clinically modest yet

The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.

From the Center for Healthcare Delivery Sciences (C4HDS) and Division of Pharmacoepidemiology and Pharmacoeconomics, Department of Medicine, Brigham and Women's Hospital and Harvard Medical School, Boston, MA.

Correspondence to Niteesh K. Choudhry, MD, PhD, Brigham and Women's Hospital, Harvard Medical School, 1620 Tremont St, Ste 3030, Boston MA 02120. E-mail nkchoudhry@bwh.harvard.edu

(*Circulation*. 2016;133:555-556.)

DOI: 10.1161/CIRCULATIONAHA.116.021182.)

© 2016 American Heart Association, Inc.

Circulation is available at <http://circ.ahajournals.org>

DOI: 10.1161/CIRCULATIONAHA.116.021182

cost-savings effect of mailed educational materials to encourage medication adherence.¹³ Clearly, SMS texting interventions may not be a standalone solution to address poorly controlled hypertension, but they could nevertheless be part of a larger strategy to improve disease control.

Second, the results of the Bobrow et al study are really generalizable only to the way in which the intervention itself was delivered, and dismissing the trial results as proof that text messaging or mHealth does not work may undermine future efforts that use these technologies in different ways. Alternative methods of text messaging could conceivably lead to larger effects. In fact, relatively little is known about the optimal frequency, design, content, or duration of text messages. For example, although it is laudable that participants could choose up to 3 different languages for the texts, other customizations might have further helped. For instance, allowing participants to choose the time of day of message receipt may also influence behavior change. All patients in this study also received only weekly text messages, which may have been insufficient to motivate true behavior change (particularly in patients whose primary barrier to optimal adherence is forgetfulness). Although it is true, as the authors point out, that daily texts appear less effective than weekly texts for antiretroviral therapy, the data on which this conclusion is based are very limited, and hypertension is a very different disease from HIV/AIDS. The content of text messages themselves (eg, informational versus motivational) and their framing (eg, admonishing versus supportive) are no doubt important yet remain incompletely understood. Similarly, identifying the types of patients who benefit most from text messages could also be critical to their effectiveness. Finally, patients may have better outcomes if they could interactively text with their providers rather than an automated system or if further personalizations are implemented, although understandably this functionality would likely substantially impair cost-effectiveness. Future studies should examine these, and many other, critical questions to optimize SMS texting interventions.

In this context, the study by Farmer and colleagues is an important scientific contribution and demonstrates the ability to conduct trials of mobile technology with rigor. The investigators should also be commended for their use of pragmatic methods (including limited inclusion and exclusion criteria and relatively simple methods for outcome assessment) and design techniques (eg, minimization) that are state of the art for more traditional efficacy trials. Perhaps most important, the trial was conducted in a resource-poor setting in which less evidence is available than in higher-income countries.⁵

Although text messaging and mHealth technologies may not work for all patients with chronic diseases, they represent a unique opportunity in health care. There is no other existing technology that could potentially improve human health that is already used many times per day by billions of people and whose use will assuredly increase over the coming years. Our challenge now is to figure out how to capitalize on its potential.

Disclosures

Dr Choudhry receives unrestricted grant support from Medisafe payable to Brigham and Women's Hospital to support his work on a trial of smartphone-based technology. Dr Lauffenburger reports no conflicts.

References

1. *The World in 2015: ICT Facts and Figures*. Geneva, Switzerland: International Telecommunication Union; 2015. <http://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx>. Accessed January 9, 2016.
2. Lester RT, Ritvo P, Mills EJ, Kariri A, Karanja S, Chung MH, Jack W, Habyarimana J, Sadatsafavi M, Najafzadeh M, Marra CA, Estambale B, Ngugi E, Ball TB, Thabane L, Gelmon LJ, Kimani J, Ackers M, Plummer FA. Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya1): a randomised trial. *Lancet*. 2010;376:1838–1845. doi: 10.1016/S0140-6736(10)61997-6.
3. Gurman TA, Rubin SE, Roess AA. Effectiveness of mHealth behavior change communication interventions in developing countries: a systematic review of the literature. *J Health Commun*. 2012;17(suppl 1):82–104. doi: 10.1080/10810730.2011.649160.
4. Viswanathan M, Golin CE, Jones CD, Ashok M, Blalock SJ, Wines RC, Coker-Schwimmer EJ, Rosen DL, Sista P, Lohr KN. Interventions to improve adherence to self-administered medications for chronic diseases in the United States: a systematic review. *Ann Intern Med*. 2012;157:785–795. doi: 10.7326/0003-4819-157-11-201212040-00538.
5. Piette JD, List J, Rana GK, Townsend W, Striplin D, Heisler M. Mobile health devices as tools for worldwide cardiovascular risk reduction and disease management. *Circulation*. 2015;132:2012–2027. doi: 10.1161/CIRCULATIONAHA.114.008723.
6. de Jongh T, Gurol-Urganci I, Vodopivec-Jamsek V, Car J, Atun R. Mobile phone messaging for facilitating self-management of long-term illnesses. *Cochrane Database Syst Rev*. 2012;12:CD007459. doi: 10.1002/14651858.CD007459.pub2.
7. Nundy S, Dick JJ, Chou CH, Nocon RS, Chin MH, Peek ME. Mobile phone diabetes project led to improved glycemic control and net savings for Chicago plan participants. *Health Aff (Millwood)*. 2014;33:265–272. doi: 10.1377/hlthaff.2013.0589.
8. Arora S, Peters AL, Burner E, Lam CN, Menchine M. Trial to examine text message-based mHealth in emergency department patients with diabetes (TEXT-MED): a randomized controlled trial. *Ann Emerg Med*. 2014;63:745–754.e6. doi: 10.1016/j.annemergmed.2013.10.012.
9. Park LG, Howie-Esquivel J, Chung ML, Dracup K. A text messaging intervention to promote medication adherence for patients with coronary heart disease: a randomized controlled trial. *Patient Educ Couns*. 2014;94:261–268. doi: 10.1016/j.pec.2013.10.027.
10. Bobrow K, Farmer AJ, Springer D, Shanyinde M, Yu LM, Brennan T, Rayner B, Namane M, Steyn K, Tarassenko L, Levitt N. Mobile phone text messages to support treatment adherence in adults with high blood pressure (SMS-Text Adherence Support [StAR]): a single-blind, randomized trial. *Circulation*. 2016;133:592–600. doi: 10.1161/CIRCULATIONAHA.115.017530.
11. Bobrow K, Brennan T, Springer D, Levitt NS, Rayner B, Namane M, Yu LM, Tarassenko L, Farmer A. Efficacy of a text messaging (SMS) based intervention for adults with hypertension: protocol for the StAR (SMS Text-message Adherence support trial) randomised controlled trial. *BMC Public Health*. 2014;14:28. doi: 10.1186/1471-2458-14-28.
12. Wright JT Jr, Williamson JD, Whelton PK, Snyder JK, Sink KM, Rocco MV, Reboussin DM, Rahman M, Oparil S, Lewis CE, Kimmel PL, Johnson KC, Goff DC Jr, Fine LJ, Cutler JA, Cushman WC, Cheung AK, Ambrosius WT; SPRINT Research Group. A randomized trial of intensive versus standard blood-pressure control. *N Engl J Med*. 2015;373:2103–2116. doi: 10.1056/NEJMoa1511939.
13. Ito K, Shrank WH, Avorn J, Patrick AR, Brennan TA, Antman EM, Choudhry NK. Comparative cost-effectiveness of interventions to improve medication adherence after myocardial infarction. *Health Serv Res*. 2012;47:2097–2117. doi: 10.1111/j.1475-6773.2012.01462.x.

KEY WORDS: Editorials ■ health policy ■ health services research ■ hypertension ■ medication adherence ■ outcome assessment (health care)

Text Messaging and Patient Engagement in an Increasingly Mobile World Julie C. Lauffenburger and Niteesh K. Choudhry

Circulation. 2016;133:555-556; originally published online January 14, 2016;
doi: 10.1161/CIRCULATIONAHA.116.021182

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2016 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the
World Wide Web at:

<http://circ.ahajournals.org/content/133/6/555>

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Circulation* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the [Permissions and Rights Question and Answer](#) document.

Reprints: Information about reprints can be found online at:
<http://www.lww.com/reprints>

Subscriptions: Information about subscribing to *Circulation* is online at:
<http://circ.ahajournals.org/subscriptions/>