Text4baby: Development and Implementation of a National Text Messaging Health Information Service

Robyn Whittaker, MBChB, PhD, MPH, Sabrina Matoff-Stepp, PhD, Judy Meehan, BS, Juliette Kendrick, MD, Elizabeth Jordan, DNSc, Paul Stange, MPH, Amanda Cash, DrPH, Paul Meyer, JD, Julie Baitty, Pamela Johnson, PhD, Scott Ratzan, MD, MPA, MA, and Kyu Rhee, MD, MPP

Text4baby is the first free national health text messaging service in the United States that aims to provide timely information to pregnant women and new mothers to help them improve their health and the health of their babies.

Here we describe the development of the text messages and the large public–private partnership that led to the national launch of the service in 2010. Promotion at the local, state, and national levels produced rapid uptake across the United States. More than 320 000 people enrolled with text4baby between February 2010 and March 2012.

Further evaluations of the effectiveness of the service are ongoing; however, important lessons can be learned from its development and uptake. (*Am J Public Health.* 2012;102:2207–2213. doi: 10.2105/AJPH.2012.300736)

THE US INFANT MORTALITY rate (6.59/1000 live births) is higher than in most developed countries.[1] In the United States, the infant mortality rate for non-Hispanic African American women is 2.4 times the rate for non-Hispanic White women.[1] Rates are also elevated for Native American Indian and Alaska Native women. In 2008, 12.3% of the 4 251 095 babies born in the United States were born prematurely and 8.2% had a low birth weight.[2] Health-related behaviors in the prenatal and postnatal periods, such as nutrition, tobacco smoking, breastfeeding, safe sleep practices, and vaccination are known to affect maternal and infant outcomes.[3] Women without access to affordable and appropriate care may not be receiving information needed to support prenatal and postnatal pediatric care. Recent studies have also shown limited health literacy in the United States to be related to a lack of prenatal planning, such as taking folic acid, and difficulties with informed parental decision-making.[4,5]

Mobile phones may be an appropriate means for addressing the challenges of health literacy[6] and for reaching women from underserved communities. Mobile phone ownership in the United States is similar across racial/ethnic groups (80% of Whites and 87% of African Americans and Hispanics). African Americans (79%) and Hispanic Americans (83%) are more likely than are White Americans (68%) to send text messages.[7] Americans living in or near poverty are more likely to live in cell phone–only households (no fixed phone line), and those living in cell phone–only households are more likely to have experienced numerous barriers to health care.[8]

Mobile phone text messaging has been used to support healthy behavior change and health care delivery processes.[9–12] Successful behavior change interventions have used text messaging to support smoking cessation,[13–15] weight management through diet or physical activity,[16–19] and management of anxiety symptoms.[20] Health care process interventions have included appointment reminders[21–24] and reminders to take medications.[25–30]

Here we describe the development of text4baby, a free national text messaging service that provides timely information to pregnant women and new mothers to help them improve their health and the health of their babies. More than 320 000 people enrolled with text4baby between its launch in February 2010 and March 2012. Little has been published in peer-reviewed journals on mobile health initiatives of this scale in the United States. Published international examples of national-scale services include a text messaging smoking cessation service in New Zealand, which was established after a randomized trial and registered 3905 clients in the first year,[13,31] and a public health campaign in South Africa, which sent 968 million HIV/AIDS awareness messages embedded in free "Please call me" text messages over two years.[32,33] Lessons from the development of text4baby could guide similar mobile health developments.

PARTNERSHIP DEVELOPMENT

Interest in developing a model of how mobile health could be taken to scale in the United States led to discussions between staff from the US Centers for Disease Control and Prevention (CDC) and Voxiva Inc, a private mobile health company, in January 2009. These discussions focused on creating a public–private partnership to support a program that would deliver health messages via text messaging to pregnant women and mothers of infants. The National Healthy Mothers, Healthy Babies Coalition, a nonprofit group of 100 local, state, and national organizations focusing on improving the quality and reach of public and professional maternal and children's health education, joined the partnership to lead the program.

An exploratory meeting held in the second quarter of 2009 brought together representatives from private partners (Voxiva, Johnson and Johnson), nonprofit partners (Healthy Mothers, Healthy Babies, CTIA–The Wireless Foundation), and interested public organizations (White House Office of Science Technology and Policy;

within the US Department of Health and Human Services [HHS], the Office on Women's Health, CDC, and the Health Resources and Services Administration [HRSA]; US Department of Defense; US Department of Agriculture; Virginia State Health Commissioner; and George Washington University).

In January 2010, HHS (represented by Howard Koh, MD, MPH, Assistant Secretary for Health) and Healthy Mothers, Healthy Babies signed a memorandum of understanding that designated Healthy Mothers, Healthy Babies as the lead partner, with overall responsibility for the delivery of the service. The memorandum stated that HHS would oversee a department-wide effort to promote the initiative and that HHS components (the Office on Women's Health, CDC, HRSA, and Centers for Medicare and Medicaid Services) would provide guidance and input on the content of text messages, have final approval of the text message content, and be involved in the design, development, and evaluation of the service. (Later in 2010, HHS announced funding for an evaluation of the program.) The memorandum stated the goals of the program as demonstrating the potential of mobile health technology to address a critical national health priority for underserved populations, developing an evidence base on the effectiveness of mobile health interventions, and catalyzing new models for public–private partnerships in mobile health.

Healthy Mothers, Healthy Babies and Voxiva directly approached potential important sponsors and partners through their existing networks. In February 2010, Voxiva and Healthy Mothers, Healthy Babies reached out to Johnson and Johnson, a multinational consumer health care, pharmaceuticals, and diagnostics company that had previous relationships with some partners and an interest in digital health. The company signaled interest in serving as the founding sponsor. Through its relationships with the wireless networks, Voxiva approached CTIA, a nonprofit foundation representing the wireless communications industry. The foundation saw it as an opportunity to help quantify the value of mobile health and worked with the wireless carriers to garner their support. This resulted in 18 wireless carriers absorbing messaging costs so that text4baby could be provided free to the end users. CTIA and Healthy Mothers, Healthy Babies agreed to support the service for its first two years (2010–2011). This was a first for a health service of this kind in the United States and has since been extended to the end of 2013. Gray Healthcare Group, a marketing and design firm with an existing relationship with Voxiva, provided a marketing strategy, including a logo and promotional materials.

Also in February 2010, former US Chief Technology Officer, Aneesh Chopra, announced the launch of the service.[34] Healthy Mothers, Healthy Babies approached organizations in its networks about actively promoting the program directly to pregnant women and new mothers. Among the organizations that signed up to be outreach and promotional partners were state government organizations; national, state, and local nonprofit organizations; county and city health departments; health plans; and state-based teams (a full list of current partners is available at http://www.text4-baby.org/index.php/get-involved-pg/partners). Outreach partners have been supported via a Web portal with customizable resources, weekly Webinars, and e-newsletters with aggregated enrollment information.

MESSAGE DEVELOPMENT

CDC staff (medical epidemiologists and experts in obstetrics, pediatrics, family practice, and health communication) identified topics according to evidence-informed guidelines, particularly the American Congress of Obstetricians and Gynecologists guidelines for care[35] and the Bright Futures Guidelines for Health Supervision of Infants, Children, and Adolescents.[36] Identified topics ranged from tobacco effects on mother and infant to the importance of prenatal and well-baby care to the positive effects of breastfeeding. HHS staff prioritized topics by public health importance. Topics would be timed to the mother's stage of gestation or the infant's age.

Healthy Mothers, Healthy Babies held informal discussion groups with women from community health centers in six cities across the United States. They asked attending women about the types of topics they would like to see covered and the frequency of messages they would find acceptable. This input informed final topic selection and the regimen of three messages per week.

CDC and Healthy Mothers, Healthy Babies staff drafted the 150-character messages. The Mobile Marketing Association's best-practice guidelines recommended that each message begin with the phrase "Free msg" to reassure recipients that the service was indeed free.[37] The writers designed the messages to be understandable to low-literacy populations (approximately sixth-grade reading level). The draft messages underwent several levels of review and testing; among the reviewers were staff from across HHS, to ensure consistency with agency mission and policy, and expert consultants representing the American Congress of Obstetricians and Gynecologists, the American Academy of Pediatrics, and others. BabyCenter en Español translated the messages into Spanish, and the National Alliance for Hispanic Health reviewed the translations.

The final 117 prenatal messages covered usual symptoms during pregnancy; when and how to access health care; emotional support for the pregnant woman; safety; nutrition; smoking, alcohol, and drugs; infectious diseases; labor and delivery; postnatal information; and exercise. The 147 postnatal messages focused on care for the baby according to normal developmental stages; safety, feeding, and nutrition; when and how to access health care; emotional support for the mother; immunizations; and smoking. Toll-free numbers in some messages (e.g., 1–800-311-BABY) connected callers to their respective state or local maternal and children's health services. The box at the top of the following page provides examples.

The messages continue to be reviewed and refined. In 2010, Healthy Mothers, Healthy Babies contracted with a team at Emory University to recruit pregnant women in a Women, Infants, and Children Program waiting room at a large city hospital in Atlanta, Georgia. These women (n = 100) were predominantly African American (96%), single (66%), and low income (100% had < $35 000/year). The team asked participants to review the messages for their level of understanding. The team suggested revisions derived from its

The Six Initial Messages to All Enrollees in text4baby, a Text Messaging Health Service for Pregnant Women and New Mothers, February 2010, Version 1

Free msg: Congratulations, you're going to be a mom! Text4baby wishes you a happy and healthy pregnancy. Thanks for including us in this special time.

Free msg: You can choose who you see for pregnancy care. Midwives, family docs, OBs & nurse practitioners can all provide care. Call 800-311-2229 for free/low-cost care & to find a provider who's right for you.

Free msg: The flu can be dangerous for pregnant women & their babies. Talk to your doctor about seasonal flu & H1N1 flu shots. More from CDC: 1-800-232-4636.

Free msg: Get your baby off to a great start! You can help your baby's development by taking a prenatal vitamin each day. It should have 600 mcg of folic acid.

Free msg: For a healthy baby, visit a doctor or midwife early & keep all of your appointments. Hear your baby's heartbeat. See how fast she grows!

Free msg: Give your baby a good start by not drinking alcohol, smoking or using drugs. For help, call 800-784-8669 (smoking); 800-662-4357 (drugs & alcohol).

Note. CDC = Centers for Disease Control and Prevention; OB = obstetrician.

members' expertise in health literacy and the women's feedback, which were incorporated.

In addition, messages on emerging urgent issues were developed by CDC and Healthy Mothers, Healthy Babies; for example, a message about whooping cough immunization went to California enrollees in response to an outbreak, and a message went to all enrollees in response to a Food and Drug Administration recall alert.

Voxiva conducted extensive internal testing of the interactive mobile health platform, which enabled matching of each woman's stage of pregnancy and baby's development (from their self-reported dates) to the appropriate messages. The Virginia health commissioner and the state's

Infant Mortality Task Force formed a multistakeholder text4baby implementation team; this team provided input into enrollment processes and resources and acted as a beta testing site of the messaging platform in November 2009 (prior to launch). In addition to the stakeholder team, the task force enrolled a small group of mothers (n = 10) to test the messaging processes.

TEXT4BABY IN ACTION

The service launched in February 2010, and outreach partners immediately began promoting it to pregnant women, new mothers, and families in their communities and clinics. Healthy Mothers, Healthy Babies supplied promotional posters, flyers, tear pads,

referral cards, and other items. All promotions advised women to enroll online or by texting "baby," or "bebe" for the Spanish version, to 511411. After providing their zip code and estimated due date, women received three free text messages per week relevant to their stage of pregnancy or stage of their babies' development (up to age one year). The program collected no health information, included no advertisements in the messages, and adhered to a strict privacy policy for registration data. Enrollees received regular notifications by text message that they could opt out at any time. Over the last few weeks of pregnancy, they received 11 text messages advising them to update the system by texting their delivery date to receive postnatal messages.

Local partners promoted the service through, for example, billboards, mall displays, birth certificate mailings, mass e-mails, newsletters, health fairs, baby shower events, home-visiting programs, Medicaid member mailings, media events, and parenting classes. Virginia's implementation team developed its own outreach plan (see the box at the bottom of the page). In October 2010, Healthy Mothers, Healthy Babies determined that Virginia was the state with the third highest enrollment rate (3.5% of the estimated annual number of pregnancies). The maternal and children's health epidemiologist for the Virginia Department of Health examined the zip codes of the 3987 Virginia enrollees from February through August 2010 and concluded that

Virginia Outreach Plan for text4baby, a Text Messaging Health Service for Pregnant Women and New Mothers, 2010

Point of contact designations for 35 health districts

Press conference and press release

Stakeholders meetings and webinars

Promotion to women in WIC clinics

Information e-mails to members of local sections of AAP, ACOG, and AWHONN

Distribution of materials to clients and presentation at meetings by Richmond City Healthy Start Initiative and Virginia Healthy Start Initiative/Loving Steps

Information dissemination by Medicaid via Web site, letters to women, training conducted at eligibility entry points, and managed care outreach program

Information e-mails from a local health system to obstetric providers, recruitment of women in prenatal clinics

Promotion to women at a local hospital via obstetric and outreach staff

Note. AAP = American Academy of Pediatrics; ACOG = American Congress of Obstetricians and Gynecologists; AWHONN = Association of Women's Health, Obstetric, and Neonatal Nurses; WIC = Women, Infants and Children Program.

higher enrollment rates occurred in zip codes with higher proportions of families living in poverty and of low-birth-weight babies (Derek Chapman, maternal and children's health epidemiologist, Virginia Department of Health, oral communication, October 26, 2010). To augment these efforts, the partners promoted the text4baby service via a Web site (http://www.text4baby.org) and social networking sites. In February 2010, an episode of *Teen Mom* on MTV highlighted the service, with an ensuing jump in enrollment rates of several thousand new enrollees (similar increases occurred after the *New York Times* ran two articles in February 2011).

In the first 10 months of service, 109 201 women enrolled (including those who subsequently stopped the service and those testing or investigating the service). Most enrolled in the prenatal message module (75.6%; n = 82 548), likely because the majority of initial promotional activities targeted pregnant women (as opposed to new mothers). Of these, approximately one third (33.1%; n = 27 313) enrolled in the first trimester or earlier, according to the estimated due date they provided. Of total enrollments, 5.4% (n = 5869) chose the Spanish-language version. This proportion is much lower than the 12% of the population who speak Spanish at home, although 53% of these say they also speak English "very well."[38] It may be that Spanish speakers opted for the English version, or it may be that the service has not penetrated into Spanish-speaking populations on a large scale. Healthy Mothers, Healthy Babies has since partnered with the National Latino Research Center to examine this more closely and

has employed a multicultural outreach coordinator to identify strategies for reaching this population effectively.

At one month prior to their due date, enrollees were sent two text message questions asking them to rate the service (1–10, with 10 highest) and whether they would recommend text4baby to a friend. At the time of our analysis, 15% (4533/30 064 enrollees) responded by text to both questions. The average rating was 7.7 (SD = 2) and 95% (4308/4533 respondents) said they would recommend it. After 10 months, 27 749 (25.4%) enrollees had opted out by texting in the word STOP.

Two authors (J. B, R. W.) mapped zip code data in relation to the geographic distribution of high-need populations, such as medically underserved areas (counties, groups of counties, civil divisions, or urban census tracts designated as having too few primary care providers, high infant mortality, high poverty rate, or a large elderly population).[39] Approximately 40% of all text4baby enrollments and 34% of total live births (from 2002–2006, the most recent data available) came from medically underserved areas.[40] Nearly one third of all medically underserved areas (n = 1318) had no enrollments in the first 10 months (Figure 1). This enrollment information should be interpreted with caution. For example, although enrollments occurred within medically underserved areas, it is not known whether the actual enrollees were those in need of the service.

LESSONS LEARNED

The launch of text4baby provided valuable lessons about partnership and message development,

promotion, and dissemination. This was the first national-scale public–private partnership mobile health initiative in the United States (as recognized by an HHS*innovates* award for HHS innovative activities and programs that can help HHS better accomplish its mission[41]), and these lessons may be useful for future text messaging health programs.

Public–private partnerships can bring distinct benefits and challenges to collaborative projects.[42] In Austin's 7 pillars of strategic collaboration, of particular importance is the challenge of creating value.[43] In the development of this project, all partners brought something of unique and significant value:

1. Federal partners had the content expertise for message development and brought credibility with clinical, governmental, and community partners;
2. Healthy Mothers, Healthy Babies had a national and grassroots local network and could negotiate a memorandum of understanding with HHS;
3. Voxiva brought mobile health expertise and a proven scalable platform, championed the initial vision, and obtained the support of CTIA and the wireless industry;
4. Johnson and Johnson provided a broad range of in-kind support and a multimillion dollar, multiyear pledge; and
5. CTIA and the wireless industry supported the initiative by providing free messages.

Austin also states that strategic collaborations need internal champions and that not all successful alliances start from the top.[43] Champions were important

within all partner organizations, perhaps particularly in HHS, where the momentum began at nonmanagerial levels within CDC and moved incrementally to those who were able to navigate support at higher levels.

Partnership challenges included information sharing and efforts to estimate the actual and in-kind costs of the initiative, some confusion in defined roles and responsibilities, and differing perspectives and priorities in evolving to the next stage of the partnership.

Elements of Success

The text4baby initiative's strengths were that it was a simple idea that used a popular and familiar technology that was well integrated into daily life, concerned a topic with a strong evidence base, was universally appealing (healthy pregnant women and healthy babies), and was noncontroversial. The involvement of federal scientific agencies (CDC and the HRSA) in message development and the assurance that messages accorded with existing national guidelines were critical to the initiative's credibility. Testing messages with the target audience and revising them according to participants' feedback was important; for example, each text message delivered just one action point, and participants received no more than three messages per week. Message development benefitted from federal agency scientists' and professional organizations' input as well as engagement from prospective end users.

Providing the service free to the end user appears to be an important element for rapid uptake, as well as for ensuring the involvement of public and nonprofit partners (governmental agencies might not have been
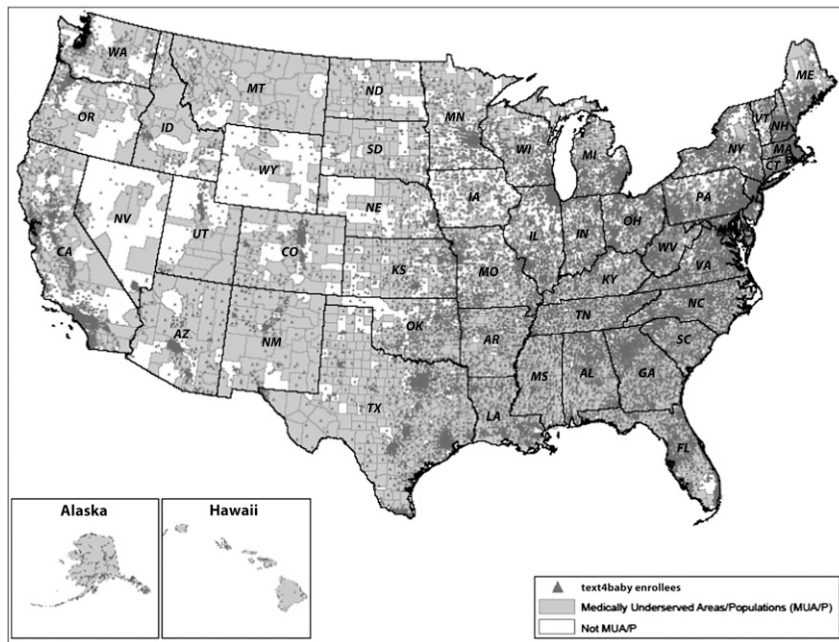
Source. Health Resources and Services Administration (HRSA). Available at http://datawarehouse.hrsa.gov.

FIGURE 1—Medically underserved areas and populations and enrollments in text4baby, a text messaging health service for pregnant women and new mothers, 2010.

able to participate in a for-profit venture). In addition, the combination of diverse national public and private partners and the involvement of grassroots local partners were vitally important in rapid and expansive national uptake. Some of these partners garnered considerable publicity for text4baby that might have aided uptake and that may not accompany other mobile health initiatives that follow this first free national service.

The funding and involvement of high-profile national partners made possible an aggressive timeline to national launch. The rapid spread of regional and local partners wanting to promote the service in their communities also helped push for a national launch. Some partners would have preferred pilot testing, which would have allowed some degree of evaluation prior to full launch.

Other partners saw the need to make the most of the momentum and now feel that text4baby has demonstrated in the field how to take mobile health to scale. It does not appear that text4baby suffered any negative consequences (e.g., unintended adverse effects) from its movement from development into a national launch.

Costs and Benefits

In some areas, current results bode well for future mobile health initiatives in the United States: (1) initial national launch reached more than 200 000 participants in 17 months; (2) of those who responded to the customer service survey, 95% would recommend it to a friend; and (3) 40% of enrollments were in the targeted medically underserved areas (34% of live births occurred in these areas). However, results also indicate potential for improvement:

(1) enrollment of the targeted audience of Spanish speakers was lower than expected, and (2) the rate of cancelled enrollments and enrollees who did not update the service to move from prenatal into the postnatal phase was higher than expected (25%). These preliminary results seem to indicate that text4baby had high rates of initial acceptability for both the general and the medically underserved area population, but this acceptability either did not reach or was not as strong for Spanish speakers. Although withdrawal rates were lower than those seen in the first year of the New Zealand national text messaging smoking cessation intervention,[31] and withdrawal could also indicate an uncompleted pregnancy, more lessons likely can be learned. For example, the extra step required to update the service with the birth date is

being removed in case this has been a barrier to maintaining participation.

The challenges of proprietary budgetary information and the diffuse, numerous, and varied types of in-kind contributions of many organizations make it difficult to accurately determine the full costs of developing, operating, and promoting the service nationally. One important barrier to text messaging programs in the United States is the cost to the end user for receiving text messages. Without a messaging plan, mobile phone users in the United States can expect to pay 20 cents per text message received—this is not the case in many other countries.[44] For text4baby, the wireless networks bore the costs of allowing the service to be free to the public. It is hoped that with future changes to mobile phone pricing plans, and the rapid adoption of bulk and unlimited messaging, this cost will become less of a factor for future initiatives.

NEXT STEPS

The text4baby public–private partnership continues to evolve. In the winter of 2010, HHS created a Text4Health task force to address two primary tasks: (1) identify a best-practice playbook for how to execute health text messaging programs at HHS, and (2) identify other topics to which this text messaging playbook could be applied at HHS going forward. The work of this task force has concluded, and recommendations are being considered by HHS.

The text4baby initiative continues to evolve, and six evaluations are under way, with results expected by the end of 2013. A $1.2 million HHS-funded independent evaluation focuses on measuring changes in knowledge,

behavior, processes, and outcomes among program participants and nonparticipating comparison groups. It also includes key stakeholder interviews to gain greater insight into lessons learned. Other evaluations being undertaken by a variety of partners include prospective trials with pregnant women and research on acceptability for Spanish-speaking women.

The text4baby public–private partnership has set an ambitious goal of reaching one million enrollments by the end of 2012. The current evaluations should provide much-needed information about its reach into high-risk groups and about its effectiveness in behavior change. ■

About the Authors

At the time of the study, Robyn Whittaker was with The Commonwealth Fund, New York, NY. Sabrina Matoff-Stepp was with the Office of Women's Health, Julie Baitty was with the Office of Information Technology, and Kyu Rhee was with the Immediate Office of the Administrator, Health Resources and Services Administration, Rockville, MD. Judy Meehan was with the National Healthy Mothers, Healthy Babies Coalition, Alexandria, VA. Juliette Kendrick and Paul Stange were with the Centers for Disease Control and Prevention, Atlanta, GA. Elizabeth Jordan was with the Community and Public Health School of Nursing, Johns Hopkins University, Baltimore, MD. Amanda Cash was with the Office of the Assistant Secretary for Planning and Evaluation, US Department of Health and Human Services, Washington, DC. Paul Meyer and Pamela Johnson were with Voxiva Inc, Washington, DC. Scott Ratzan was with Johnson and Johnson, New Brunswick, NJ.

Correspondence should be sent to Dr. S. Matoff-Stepp, Director HRSA Office of Women's Health, 5600 Fishers Ln, Rockville, MD 20857 (email: smatoffstepp@hrsa.gov) or Dr. J. Kendrick, Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta GA (email: jsk1@cdc.gov). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

This commentary was accepted February 8, 2012.

References

1. MacDorman S, Mathews T. *Recent Trends in Infant Mortality in the United States.* Atlanta, GA: Centers for Disease Control and Prevention; 2008. Available at: http://www.cdc.gov/nchs/data/databriefs/db09.htm. Accessed July 23, 2011.

2. Heron M, Sutton PD, Xu J, Ventura SJ, Strobino DM, Guyer B. Annual summary of vital statistics: 2007. *Pediatrics.* 2010;125(1):4–15.

3. *Health, United States, 2009: With Special Feature on Medical Technology.* Hyattsville, MD: National Center for Health Statistics; 2010.

4. Yin HS, Johnson M, Mendelsohn AL, Abrams MA, Sanders LM, Dreyer BP. The health literacy of parents in the United States: a nationally representative study. *Pediatrics.* 2009;124(suppl 3):S289–S296.

5. Endres LK, Sharp LK, Haney E, Dooley SL. Health literacy and pregnancy preparedness in pregestational diabetes. *Diabetes Care.* 2004;27(2):331–334.

6. Nielsen-Bohlman L, Panzer A, Kindig D, eds. *Health Literacy: A Prescription to End Confusion.* Washington, DC: National Academies Press; 2004.

7. Smith A. *Pew Internet and American Life Project. Mobile Access 2010.* Washington, DC: Pew Research Center; 2010.

8. Blumberg S, Luke J. *Wireless Substitution: Early Release of Estimates From the National Health Interview Survey,* January–June 2009. Atlanta, GA: National Center for Health Statistics; 2009.

9. Cole-Lewis H, Kershaw T. Text messaging as a tool for behaviour change in disease prevention and management. *Epidemiol Rev.* 2010;32(1):56–69.

10. Fjeldsoe BS, Marshall AL, Miller YD. Behavior change interventions delivered by mobile telephone short-message service. *Am J Prev Med.* 2009;36(2):165–173.

11. Whittaker R, Borland R, Bullen C, Lin RB, McRobbie H, Rodgers A. Mobile phone-based interventions for smoking cessation. *Cochrane Database Syst Rev.* 2009;7(4):CD006611.

12. Krishna S, Boren SA, Balas EA. Healthcare via cell phones: a systematic review. *Telemed J E Health.* 2008;15(3):231–240.

13. Rodgers A, Corbett T, Bramley C, et al. Do u smoke after txt? Results of a randomised trial of smoking cessation using mobile phone text messaging. *Tob Control.* 2005;14(4):255–261.

14. Brendryen H, Kraft P. Happy ending: a randomized controlled trial of a digital multi-media smoking cessation intervention. *Addiction.* 2008;103(3):478–484; discussion 485–486.

15. Brendryen H, Drozd F, Kraft P. A digital smoking cessation program delivered through internet and cell phone without nicotine replacement (happy ending): randomized controlled trial. *J Med Internet Res.* 2008;10(5):e51.

16. Joo N-S, Kim B- T. Mobile phone short messaging service messaging for behaviour modification in a community-based weight control programme in Korea. *J Telemed Telecare.* 2007;13(8):416–420.

17. Hurling R, Catt M, De Boni M, et al. Using internet and mobile phone technology to deliver an automated physical activity program: randomized controlled trial. *J Med Internet Res.* 2007;9(2):e7.

18. Haapala I, Barengo NC, Biggs S, Surakka L, Manninen P. Weight loss by mobile phone: a 1-year effectiveness study. *Public Health Nutr.* 2009;12(12):2382–2391.

19. Patrick K, Raab F, Adams M, et al. A text message-based intervention for weight loss: randomized controlled trial. *J Med Internet Res.* 2009;11(1):e1.

20. Riva G, Preziosa A, Grassi A, Villani D. Stress management using UMTS cellular phones: a controlled trial. *Stud Health Technol Inform.* 2006;119:461–463.

21. Downer SR, Meara JG, Da Costa AC, Sethuraman K. SMS text messaging improves outpatient attendance. *Aust Health Rev.* 2006;30(3):389–396.

22. 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. *Int J Med Inform.* 2010;79(1):65–70.

23. Koshy E, Car J, Majeed A. Effectiveness of mobile-phone short message service (SMS) reminders for ophthalmology outpatient appointments: observational study. *BMC Ophthalmol.* 2008;8:9.

24. Liew SM, Tong SF, Lee VK, Ng CJ, Leong KC, Teng CL. Text messaging reminders to reduce non-attendance in chronic disease follow-up: a clinical trial. *Br J Gen Pract.* 2009;59(569):916–920.

25. Mao Y, Zhang Y, Zhai S. Mobile phone text messaging for pharmaceutical care in a hospital in China. *J Telemed Telecare.* 2008;14(8):410–414.

26. Strandbygaard U, Thomsen SF, Backer V. A daily SMS reminder increases adherence to asthma treatment: a three-month follow-up study. *Respir Med.* 2010;104(2):166–171.

27. Miloh T, Annunziato R, Arnon R, et al. Improved adherence and outcomes for pediatric liver transplant recipients by using text messaging. *Pediatrics.* 2009;124(5):e844–e850.

28. Franklin VL, Waller A, Pagliari C, Greene SA. A randomized controlled trial of Sweet Talk, a text-messaging system to support young people with diabetes. *Diabet Med.* 2006;23(12):1332–1338.

29. Vilella A, Bayas JM, Diaz MT, et al. The role of mobile phones in improving vaccination rates in travelers. *Prev Med.* 2004;38(4):503–509.

30. Cocosila M, Archer N, Haynes RB, Yuan Y. Can wireless text messaging improve adherence to preventive activities? Results of a randomised controlled trial. *Int J Med Inform.* 2009;78(4):230–238.

31. Milne K, Bowler S, Li J, Salmon P. Evaluation of the first year of the Txt2Quit service: 17 June 2008–16 June 2009. The Quit Group. 2009. Available at: http://www.quit.org.nz/file/research/FINAL%202008-09%20Txt2Quit%20evaluation%20report%2020090731.pdf. Accessed July 23, 2011.

32. Yale School of Management. Design and social enterprise case series; project M: texting and testing to fight HIV/AIDS in South Africa. Available at: http://

nexus.som.yale.edu/design-project-m/?q=node/99. Accessed July 23, 2011.

33. PopTech. Project Masiluleke: a breakthrough initiative to combat HIV/AIDS utilizing mobile technology and HIV self-testing in South Africa. Available at: http://poptech.org/system/uploaded_files/27/original/Project_Masiluleke_Brief.pdf. Accessed July 23, 2011.

34. Chopra A. New mothers get digital helper right on their phones. The White House Blog. Available at: http://www.whitehouse.gov/blog/2010/02/04/new-mothers-get-digital-helper-right-their-phones. Accessed July 23, 2011.

35. American Congress of Obstetricians and Gynecologists. You and your baby: prenatal care, labor and delivery, and postpartum care. Available at: http://www.acog.org/publications/patient_education/ab005.cfm. Accessed December 12, 2010.

36. American Academy of Pediatrics. Bright Futures 3rd edition guidelines, pocket guide, tool and resource kit. Available at: http://brightfutures.aap.org/3rd_Edition_Guidelines_and_Pocket_Guide.html. Accessed March 1, 2011.

37. Mobile Marketing Association. U.S. consumer best practices version 6.1. 2011. Available at: http://mmaglobal.com/Consumer_Best%20Practices_6.1%20Update-02May2011FINAL_MMA.pdf. Accessed July 23, 2011.

38. US Census Bureau. 2005–2009 American Community Survey. Available at: http://www.census.gov/acs/www. Accessed January 14, 2011.

39. Health Resources and Services Administration. Data sources. Data warehouse. Available at: http://datawarehouse.hrsa.gov/sources.aspx. Accessed July 23, 2011.

40. Centers for Disease Control and Prevention, National Center for Health Statistics. Births and infant deaths 2002–2006. Available at: http://www.cdc.gov/nchs/linked.htm. Accessed July 23, 2011.

41. Text4Baby wins outstanding innovation award. Available at: http://www.whitehouse.gov/blog/2010/08/04/text4baby-wins-outstanding-innovation-award. Accessed July 23, 2011.

42. Reich M, ed. *Public-Private Partnerships for Public Health*. Cambridge, MA: Harvard Center for Population and Development Studies; 2002.

43. Austin J. *The Collaboration Challenge: How Nonprofits and Businesses Succeed Through Strategic Alliances*. San Francisco, CA: Jossey-Bass Publishers; 2000. Available at: http://hbswk.hbs.edu/item/1263.html. Accessed July 23, 2011.

44. Costhelper. Text messaging cost. Available at: http://www.costhelper.com/cost/electronics/text-messaging.html. Accessed July 23, 2011.