Published in final edited form as:

J Health Commun. 2012 May 2; 17(Suppl 1): 44–53. doi:10.1080/10810730.2011.649159.

Text2Quit: Results from a Pilot Test of a Personalized, Interactive Mobile Health Smoking Cessation Program

LORIEN C. ABROMS,

George Washington University, Washington, District of Columbia, USA

MEENAKSHI AHUJA,

George Washington University, Washington, District of Columbia, USA

YVONNE KODL,

George Washington University, Washington, District of Columbia, USA

LALIDA THAWEETHAI,

George Washington University, Washington, District of Columbia, USA

JUSTIN SIMS,

Voxiva Inc., Washington, District of Columbia, USA

JONATHAN WINICKOFF, and

Harvard University, Boston, Massachusetts, USA

RICHARD A. WINDSOR

George Washington University, Washington, District of Columbia, USA

Abstract

Text messaging programs on mobile phones have shown some promise in helping people quit smoking. Text2Quit is an automated, personalized and interactive mobile health program that sends text messages and emails timed around a participant's quit date over the course of 3 months. The text messages include pre- and post-quit educational messages, peer ex-smoker messages, medication reminders and relapse messages, as well as multiple opportunities for interaction. Study participants were university students (n=23) enrolled in the Text2Quit program. Participants were surveyed at baseline and at 2 and 4 weeks post-enrollment. The vast majority of participants agreed that they liked the program at 2 and 4 weeks post-enrollment (90.5% and 82.3%, respectively). Support for text messages was found to be moderate, and higher than that of the email and web components. Seventy-five percent of participants reported reading most or all of the texts. On average, users made 11.8 responses to the texts over a 4 week period, although responses declined following the quit date. The interactive feature for tracking cigarettes was the most used interactive feature, followed by the craving trivia game. This pilot test provides some support for the Text2Quit program. A future iteration of the program will include additional tracking features in both the pre-quit and post-quit protocol and an easier entry into the not-quit protocol. Future studies are recommended that identify the value of the interactive and personalized features that characterize this program.

In the United States, 82% of American adults have mobile phones (Lenhart, 2010) and 72% of mobile phone owners send and receive text messages (Pew Internet, 2010). A handful of text messaging programs for mobile phones have been shown to be effective for smoking cessation in both the short-term (Rodgers et al., 2005; Riley, Obermayer, & Jean-Mary,

2008) and more recently in the long-term (Free et al., 2011; Brendryen et al., 2008). Overall, these programs—which send out automated messages timed around a quit date—have been found to double a users’ chances of quitting (Whittaker et al., 2009).

Text2Quit was designed as a state-of-the-art, smoking cessation text messaging program. Like previous programs (Rodgers et al. 2005; Riley et al. 2008; Brendryn 2008), the program features automated text messages that are timed around a quit date. However to a greater extent than in previous programs, the text messages are tailored and promote interaction, features which are associated with effective behavior change in other media platforms (Lancaster, & Stead, 2009; Glanz, Rimer, & Viswanath, 2008; Doak, Doak, & Root, 1996).

This paper examines the acceptability of the Text2Quit program following 4 weeks of use by an undergraduate population. Specifically, this study reports on participants’ rating of the program, their level of use of the interactive features, and the types of interactions that were favored. The results of the study have informed the redesign of the Text2Quit program, both for purposes of dissemination and for use in a larger study that is currently underway.

METHODS

Sample

Recruitment was conducted between September 23, 2010 and October 28, 2010, after the study received Institute Review Board (IRB) approval from the George Washington University. Recruiting took place at an undergraduate university and involved using flyers, campus-based listservs, and study-staff positioned outside the student center and main library. Eligibility for this study included: being a university student (full- or part-time), smoking 5 or more cigarettes a day, having an email address for personal use, having a cell phone for personal use with an unlimited text messaging plan, having an interest in quitting in the next month, and not being pregnant.

Eighty-three people were screened for eligibility and forty people (48.2%) were eligible for participation. Of those, 23 (57.5%) agreed to enroll in the study. Enrolled participants were assessed online at baseline and in-person at 2 and 4 weeks post-enrollment. Almost all participants (91.3%) were available for follow up at 2 and 4 weeks.

Measures and Analysis

Measures for this study were derived from the baseline, 2 week and 4 week post enrollment surveys and from the computer records of use of the Text2Quit system during the 4 week period of enrollment. The baseline survey included the collection of demographic and smoking characteristics of participants, as well as information that would be later used in the tailoring of the Text2Quit program. Nicotine dependence was measured on the baseline survey with the Fagerstrom Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). Information on text messaging habits, past 7 days smoking, number of consecutive days quit, and liking of Text2Quit were obtained from the 2 and 4 week follow-up interviews.

Engagement with the Text2Quit program was measured by the proportion of text & email messages participants reported reading at the 2 and 4 week post enrollment survey (*all, most, some, none*), and whether the website was visited in the last week. Participant liking of the program was also measured by a series of questions in which participants were asked to rate their agreement with statements of satisfaction about the texts (e.g., “The text messages were helpful in getting me to try to quit”). These statements were rated on a 5-

point Likert scale from *completely disagree* (=1) to *strongly agree* (= 5). Rating of the program overall was rated as agree/disagree.

A retrospective review of the computer records of participants was done to characterize the text message engagement of each participant. For each participant, the number of text message *responses* was calculated. Responses included replies to interactive text message surveys (e.g. participant texts “Yes” after receiving a text which says, “Please be honest, did you quit today?”) and/or unsolicited requests for help with quitting via keyword (e.g. participant texts CRAVE for help with a craving). Also of interest was the timing of responses in relation to enrollment and the quit date, and the types of responses that were most used by participants.

About Text2Quit

The Text2Quit program provides advice and support on quitting smoking. Text2Quit was developed with technical support from Voxiva Inc. between February-August 2010 and later revised in January 2011 following this pilot study. Text2Quit is currently sold by Voxiva to health insurance companies and quitlines. For the pilot, Text2Quit consisted of automated bidirectional text messages, automated unidirectional emails and a web portal. The inclusion of web and email components, in addition to text messages, was seen as preferable to a text only program both because most U.S. adults report using all 3 communication modalities (Pew Internet, 2011; HINTS, 2003–2007) and because multimodal interventions are generally found to be more effective with smoking cessation (USDHHS, 2008).

Text messages, which were intended as the primary component of the program, were tailored around a participant’s first name, chosen quit date, gender, top 3 reasons for quitting, money saved based on estimates calculated from their cigarettes smoked/day and average price paid for a pack of cigarettes, person selected for social support, up to 5 triggers for smoking, and use of selected quit smoking medications from the list of 7 first line FDA approved medications (USDHHS, 2008). Information on these fields was collected as part of the baseline survey and could be updated or changed after enrollment through the website. In most cases, tailored fields were integrated into the pre-quit and post-quit messages. In some cases, such as with medications and triggers for smoking, participants who selected a given option were sent additional texts tailored to their specific situation (e.g. 7 messages on use of NRT).

The texts were sent out around 3 main message protocols: pre-quit, post-quit, and not-quit. Most messages originated from the Text2Quit program, though 12 text messages originated from a fictitious peer ex-smoker matched on gender who offered social support. Messages were sent with the highest frequency in the week before and 2 weeks after the quit date (See Table 1 for schedule). As part of the registration process, participants set a quit date in the next month and were routed into the pre-quit protocol. Participants were assumed to have quit on their chosen quit date unless they replied to a message to say that they had not quit. In this case, they were routed into the not-quit protocol. (See Table 2 for sample messages).

Participants were regularly prompted to interact with the system. Specific messages in the *pre-quit protocol* that prompted interaction included periodic surveys to assess readiness to quit and to track the number of cigarettes smoked per day against a pre-set goal. Once a participant replied to a text message, the system would send an additional text message with the appropriate feedback (e.g. A participant who replied and indicated that they had met their goal for cutting down on cigarettes would receive the following feedback, “Text2Quit. Great! You reached your goal of cutting down to 16 cigs. Visit Text2Quit.com to see a graph of your progress.”) Interactive messages in the *post-quit protocol* included prompts to reply and get help with cravings through a trivia game or a craving tip, requests to take a

weekly smokefree pledge and periodic surveys to assess quit status. In the *not-quit protocol*, interaction was prompted around asking the participant to set a new quit date.

Throughout the program, participants could send in a variety of keywords at anytime to receive additional help. On-demand keywords included the ability to reset a quit date or indicate that they were not quitting (DATE), get help with a craving with a tip or by playing a trivia game (CRAVE), track smoking over the previous day against a pre-set goal (GOALS), request their reasons for quitting (REASONS), receive other peoples' reasons for quitting (WHYQUIT), and take a smokefree pledge (PLEDGE). Participants were frequently reminded of mobile keywords in text messages, as well as in the footer of each email sent by the system.

As noted, the text messages were supplemented by a personalized web portal (www.text2quit.com) and emails. The website provided access to a participant's quitting information and tools and resources for quitting smoking such as a tool to get a recommendation on a quit smoking medication. Emails were timed to be sent out around the quit date, although with lower frequency than texts, and generally reiterated and expanded upon key messages from the texts. Emails were only personalized around a participant's first name. Participants could not reply to emails or update information through emails.

The development of the Text2Quit program was based on the social cognitive theory (Bandura, 1986) within the framework of a biobehavioral model. Messages were aimed at improving self-efficacy for quitting, describing outcome expectations from quitting, increasing perceived social support for quitting, modeling effective quitting strategies and coping skills, and increasing behavioral capability for quitting. Messages were developed to be consistent with the U.S. Public Health Service Clinical Practice Guidelines (USDHHS, 2008) and regularly recommended calling a Quitline and considering the use of approved quit smoking medications.

RESULTS

Participants were typical of an undergraduate population, on average 20.9 years old. The majority of participants were White (56.5%), followed by Latino (13.1%), African American (8.7%), Asian (8.7%) and other (13%) ethnicities. Slightly more males (56.5%) enrolled than females. At the time of enrollment, participants smoked on average 11.1 cigarettes per day and reported 2.4 past quit attempts. The average nicotine dependence score on the FTND was 2.7. Prior to enrollment, participants sent and/or received an average of 39.8 text messages per day.

Over 80% of participants agreed that they had liked the program at both 2 and 4 weeks post-enrollment. Engagement in the Text2Quit program is reported in Table 3. Approximately three-quarters of participants reported having read most or all of the text messages at both 2 and 4 weeks post enrollment. Readership of the emails was somewhat lower than the texts--at 66.7% at 2 weeks--and further declined over time to 38.1% by 4 weeks. About one quarter of participants reported having visited the website in the past week at both the 2 and 4 weeks follow-up. While all participants made at least one quit attempt following enrollment, only 14.3% of participants ($n = 3$) reported not smoking in the past 7 days at 4 weeks post-enrollment.

Table 4 characterizes participant ($n=23$) text message responses, as measured by the computer records of text messages that were sent by participants into the system. The overwhelming majority of participants (91.3%) made at least one text message response during the 4 week period, with an average of 11.8 text message responses made during the period. Participants responded for an average of 21.7 days. Of all demographic and smoking

factors analyzed, only gender emerged as significantly associated with being a high responder--defined as sending in 10 or more text message responses during the study period. Seventy-seven percent of males were found to be high responders while only 23.0% of women were found to be high responders ($p<.05$).

The most popular interactive feature across both the pre-quit and post-quit phases—as measured by the number of responses made--involved tracking the number of cigarettes smoked in the previous day against an assigned goal. Almost half of participants stopped responding to the system (that is, stopped texting in keywords and replying to interactive surveys) once their quit date had passed and they entered the post-quit phase. Throughout the program, none of the participants indicated by web or text message that they were not ready to set a quit date or not quitting, and therefore, no participants made it into the not-quit protocol.

DISCUSSION

Overall, we found some support for the Text2Quit program, especially the text-messaging component that was designed to serve as the central component of the program. The vast majority of participants agreed that they liked the program overall and on average, participants somewhat agreed or agreed that the texts were helpful in getting them to try to quit. Readership of the texts was high and sustained over time in contrast to readership of emails which was lower and declined substantially between 2 & 4 weeks and visiting the website which was low at both 2 and 4 weeks follow-up. No participants were found to have unsubscribed from the texting or email services.

It was encouraging that the majority of participants used the interactive features of the text messaging system, which were more developed than in previous text messaging programs (e.g. Rodgers et al. 2005; Brendryn et al. 2008; Riley et al. 2008). Almost all participants initiated or replied to a text message and on average participants sent in 12 responses over the 4 week period. While health promotion programs that stimulate interaction and engagement have been found to be more likely to result in behavior change (Doak, Doak, & Root, 1996), it remains to be seen to what degree engagement in this program will be associated with smoking cessation.

It is noteworthy that almost half of participants stopped responding to the system by text once their quit date arrived. This finding in all likelihood reflects the fact that many participants did not follow through with their chosen quit date or quickly relapsed and then disengaged from the program as messages arrived which assumed erroneously that they had indeed quit smoking.

Furthermore, while most participants admitted to smoking in the past week at the 4 week follow-up survey, not a single participant made it into the not-quit protocol for text messages. In hindsight, the system whereby participants had to use the interactive quit date keyword (DATE) to indicate that they were not quitting was somewhat unclear and cumbersome. (Participants had to reply to a sequence of three messages to indicate that they had not quit). It is recommended that future systems, including this one, be designed so that users can be entered into the not-quit protocol through one reply and be given multiple opportunities over time to enter this protocol.

The strengths of this study include that it involves the testing out of a novel text messaging system that makes-use of interactive and personalized text messages, features that appear to be more developed than in previous text messaging programs both for smoking cessation and other behaviors (Cole-Lewis & Kershaw 2010; Fjeldsoe et al. 2009; Abrams et al. 2011). The study also benefited from a high follow-up rate. Weaknesses include that there

was no control group and that the sample size was small. Furthermore, given that the sample was comprised of undergraduate smokers at a 4 year university who are likely to be lighter smokers and of higher SES than the average adult smoker (CDC 2010), the results of this study may not generalize to young adult smokers who are not in college or to older adult smokers.

The study shows that a text messaging system that makes use of interactive and personalized text messages is acceptable to an undergraduate smoking population. Insights gained from this study have informed the redesign of the Text2Quit program for a randomized trial, as well as for commercial distribution. Given that the results of a handful of studies support the use of text-messaging for smoking cessation (Whittaker et al. 2009; Free et al. 2011), it is recommended that future text messaging studies strive not only to understand whether a texting system works, but also to identify system features that increase a user's chances of quitting smoking.

Acknowledgments

Lorien Abrams thanks the staff at GW for their dedication to the study and the staff at Voxiva for technical support for Text2Quit, especially Rohiet Johri.

The George Washington University has licensed the Text2Quit program to Voxiva, Inc.

This research was supported by 5K07 CA124579-02 and AARA supplement to Lorien Abrams, from National Cancer Institute of the National Institutes of Health. Support also came from an award from the Department of Prevention and Community Health at the George Washington University School of Public Health and Health Services to Lorien Abrams.

References

- Abrams, LC.; Padmanabhan, N.; Evans, WD. Mobile Phones for Health Communication to Promote Behavior Change. In: Noar, SM.; Harrington, NG., editors. *eHealth applications: Promising strategies for behavior change*. New York: Routledge; 2011. (in-press)
- Bandura, A. *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall; 1986.
- 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. [PubMed: 19087949]
- Centers for Disease Control and Prevention (CDC). Vital Signs: Current Cigarette Smoking Among Adults Aged 18 Years—United States, 2009. *Morbidity and Mortality Weekly Report*. 2010; 59(35):1135–40. [PubMed: 20829747]
- Cole-Lewis H, Kershaw T. Text messaging as a tool for behavior change in disease prevention and management. *Epidemiologic Reviews*. 2010; 32(1):56–69. [PubMed: 20354039]
- Doak, CC.; Doak, LG.; Root, JH. *Teaching Patients with Low Literacy Skills*. 2. Philadelphia: J.B. Lippincott Company; 1996.
- Fjeldsoe BS, Marshall AL, Miller YD. Behavior change interventions delivered by mobile telephone short-message service. *American Journal of Preventive Medicine*. 2009; 36:165–73. [PubMed: 19135907]
- Free C, Knight R, Robertson S, et al. Smoking cessation support delivered via mobile phone text messaging (txt2stop): a single-blind, randomized trial. *The Lancet*. 2011; 378 (9785):49–55.
- Glanz, K.; Rimer, BK.; Viswanath, K., editors. *Health Behavior and Health Education: Theory, Research, and Practice*. 4. San Francisco (CA): Jossey-Bass; 2008.
- Health Information National Trends Survey (HINTS). Do you ever go on-line to access the internet or world wide web, or to send or receive e-mail?. 2003–2007. [Cited: May 2011] <http://hints.cancer.gov/questions/allyears-chart.jsp?qid=752>

- Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO. The Fagerstrom Test for Nicotine Dependence: A revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction*. 1991; 86(9):1119–1127. [PubMed: 1932883]
- Lancaster, T.; Stead, LF. Self help interventions for smoking cessation (Review). *The Cochrane Library*; 2009.
- Lenhart, A. Cell phones and American adults. *Pew Internet & American Life Project*; 2010. Retrieved February, 2011, from <http://pewinternet.org/Reports/2010/Cell-Phones-and-American-Adults/Overview.aspx>
- Pew Internet & American Life Project. *Generations and Gadgets*. [Online] February 3, 2011 [Cited: May 2011] <http://pewresearch.org/pubs/1879/gadgets-generations-cell-phones-laptops-desktop-computer>
- Pew Internet & American Life Project. *Mobile Access 2010* [Online]. Jul 7. 2010 [Cited: January 2011] <http://pewinternet.org/Reports/2010/Mobile-Access-2010/Summary-of-Findings.aspx>
- Riley W, Obermayer J, Jean-Mary J. Internet and Mobile Phone Text Messaging Intervention for College Smokers. *Journal of American College Health*. 2008; 57 (2):245–248. [PubMed: 18809542]
- Rodgers A, Corbett T, Bramley D, Riddell T, Wills M, Lin RB, Jones M. Do U Smoke after TXT? Results of a randomized trial of smoking cessation using mobile phone text messaging. *Tobacco Control*. 2005; 14(4):255–261. [PubMed: 16046689]
- The Quit Group. *Evaluation of the first year of the Txt2Quit Services* (Online). Jul 31. 2009 [Cited: March 2011] <http://www.quit.org.nz/file/research/FINAL%202008-09%20Txt2Quit%20evaluation%20report%2020090731.pdf>
- U.S. Department of Health & Human Services. *Treating tobacco use and dependence: 2008 Update*. [Cited: April 2011] http://www.surgeongeneral.gov/tobacco/treating_tobacco_use08.pdf
- Whittaker, R.; Borland, R.; Bullen, C.; Lin, RB.; McRobbie, H.; Rodgers, A. Mobile phone-based interventions for smoking. *The Cochrane Library*; 2009.
- Whittaker R, Maddison R, McRobbie H, Bullen C, Denny S, Dorey E, Ellis-Pegler M, van Rooyen J, Rodgers A. A Multimedia Mobile Phone-Based Youth Smoking Cessation Intervention Findings From Content Development and Piloting Studies. *Journal of Medical Internet Research*. 2008; 10(5):e49. [PubMed: 19033148]

Table 1

Weekly Schedule of Texts and Emails by Protocol

Protocol		Texts/week ⁺	Emails/week
Pre-Quit	2–4 weeks before quitdate	3	1
	Week before quitdate	18	2
Post-Quit	1 st week after quitdate	25	5
	2 nd week after quitdate	12	2
	3 rd week after quitdate	7	1
	4 th week after quitdate	4	1
Not-Quit	Weekly	3	1

⁺Number of texts/week may vary depending on the number of medications selected for use and numbers of identified triggers

Table 2

Examples of Text Messages from the Text2Quit Program

	Message	Sending Algorithm
Help with Cravings	Text2Quit. Reply TIP for tips to get through your craving or reply GAME to play celebrity trivia and earn Craving Points. Std msg rates apply. Txt STOP2end.	Participant texts CRAVE
Message from peer ex-smoker	Dee/Text2Quit. 4 more days to go. Don't talk yourself out of it. Think of why you're quitting & stay committed. You'll love being smoke-free! Txt STOP2end.	Quit date -4
Pre-Quit Tracking	Text2Quit. Time for a pre-quit check-in. Reply with the number of cigarettes you smoked yesterday (e.g. 16). Find out if you've met your goal. Txt STOP2end.	Quit date -14 to Quit date -1, every other day
Pre-Quit Advice	Text2Quit. Tomorrows the big day! Throw out all your cigs & clean out ashtrays. Keep busy and avoid smokers. Text CRAVE to fight cravings. Txt STOP2end.	Quit date -1
Medication Tips	MEDS/Text2Quit. Be Sure to have your NRT patch on hand. Open the pack & read the instructions so you're ready to use it tomorrow when you quit. Txt STOP2end.	Quit date -1 (If participant uses NRT patch)
Quitting Survey	Text2Quit. Please be honest, did you quit today? Reply YES or NO. Txt STOP2end.	Quit date
Monday Pledge	PLEDGE/Text2Quit. Make a pledge towards a smokefree life and earn T2Q points and get your latest Text2Quit quitting stats. Reply PLEDGE.	Mondays after entry into post-quit protocol
Not-Quit Protocol	Text2Quit. It's normal to make some mistakes while quitting. Learn from them. Ready to try again? Reply DATE for a new date. Txt STOP2end.	First Friday after entry into protocol

Table 3

Engagement in and Rating of the Text2Quit Program

		2 week (n=21)	4 week (n=21)
Text2Quit Engagement	Read most/all texts (%)	75	76.2
	Read most/all emails (%)	66.7	38.1
	Visited the website in last week (%)	23.8	28.6
	Made at least one quit attempt (%)	100	100
	Not smoked in the past 7 days (%)	28.6	14.3
Text2Quit Rating	Liked the Text2quit program (%)		
	Agree	90.5	82.3
	Disagree	9.5	17.6
	Number of text messages received (%)		
	Just right	76.2	52.4
	Too many	19.0	28.6
	Too few	4.8	19.0
	Number of emails received. (%)		
	Just right	61.9	66.7
	Too many	19.0	19.0
	Too few	19.0	14.3
	The texts were helpful in getting me to try to quit. (SD)	3.8 (1.2)	3.6 (1.2)
	The emails were helpful in getting me to try to quit. (SD)	2.7 (0.6)	1.9 (1.2)
	The website was helpful in getting me try to quit. (SD)	2.6 (1.0)	2.1 (1.4)
	I would recommend the text messages to a friend. (SD)	3.9 (1.0)	3.4 (1.2)
	I would recommend the emails to a friend. (SD)	1.8 (1.0)	2.3 (1.4)
	I would recommend the website to a friend. (SD)	3.6 (1.2)	3.4 (1.1)

Table 4Characteristics of Responses to Text Messages[^] (n=23)

Frequency of Response	At least 1 (%)	91.3
	Average total (SD)	11.8 (8.2)
	Average period in days (SD)	21.7 (12.3)
Types of Responses (% of Participants)	Pre-Quit	Track Smoking (65.2)
		Readiness survey (30.4)
		Help with cravings (26.1)
	Post-Quit	Cravings game (34.8)
		Quitting Survey (30.4)
		Weekly pledge (26.1)
	Not-Quit	<i>No responses</i>
Timing of Last Response	Pre-Quit (%)	10 (47.6)
	Post-Quit (%)	11 (52.3)

[^] A response includes a reply to a text survey or an unsolicited request for support with quitting via text (e.g. CRAVE)