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ORIGINAL RESEARCH

Recruiting pregnant smokers from Text4baby for a randomized controlled trial of Quit4baby

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Abstract

Recruiting pregnant smokers into clinical trials is challenging since this population tends to be disadvantaged, the behavior is stigmatized, and the intervention window is limited. The purpose of this study is to test the feasibility and effectiveness of recruiting pregnant smokers into a smoking cessation trial by sending recruitment text messages to an existing subscriber list. Recruitment messages were sent to subscribers flagged as pregnant in Text4baby, a national text messaging program for pregnant women and mothers. Four recruitment messages were rotated to test the effectiveness of different emotional frames and a financial incentive. Study staff called subscribers who expressed interest to screen for eligibility and enroll eligible women. Between October 6, 2015 and February 2, 2016, 10,194 recruitment messages were sent to Text4baby subscribers flagged as pregnant, and 10.18% (1038) responded indicating interest. No significant increase in cancellation was observed compared to subscribers who received other ad hoc messages. Of respondents, 54.05% (561) were reached by phone for follow-up, and 21.97% (228) were found to be eligible. Among the eligible, 87% (199) pregnant smokers enrolled. The recruitment message with a pride emotional appeal had a significantly higher response ($p = 0.02$) compared to the recruitment message with no emotional appeal, but enrollment did not significantly differ between recruitment messages with different emotional appeals. The recruitment messages with a reference to financial incentive yielded higher response ($p < 0.01$) and enrollment ($p = 0.03$) compared to a recruitment message without. This study demonstrates success recruiting pregnant smokers using text message. Future studies should consider building on this approach for recruiting high-risk populations.

Keywords

mHealth, Pregnant women, Smoking cessation, Quit4baby, Text4baby

Implications

Practice: An outreach recruitment text message sent to an existing text messaging subscriber list is a novel way to recruit pregnant smokers for a clinical trial.

Policy: Government programs such as Medicaid and other health plans may consider using text messages to identify and reach high-risk populations.

Research: Future research should consider building on the use of text message for recruiting at risk populations for future trials and established treatment programs.

BACKGROUND

Smoking during pregnancy has been shown to cause adverse fetal outcomes such as low birth weight, preterm birth, fetal growth restriction, and pregnancy complications such as ectopic pregnancies [1], in addition to the risks generally associated with smoking. It is estimated that at least 5% of preterm-related deaths, at least 23% of sudden infant deaths [2], and 13.1–19.0% of term low birth weight deliveries could be prevented by eliminating smoking during pregnancy [1].

Despite these known health risks, only 24.2% of women who smoked in the 3 months prior to pregnancy were able to quit before pregnancy [3] and an estimated 8.4–10.2% of women smoke during pregnancy in the USA [3, 4]. Furthermore, smoking rates during pregnancy are higher among women who are 20–24 years old (16.8%), among those with less than a high school education (14.1%) and among those with Medicaid insurance (14.0%) [3].

Pregnant women are underrepresented in clinical trials [5], and many of the clinical trials recruiting pregnant women have had difficulty meeting their enrollment goals [6–13]. Barriers to recruiting pregnant smokers into clinical trials include that this population tends to be socially disadvantaged [14], some may avoid or delay seeking prenatal care in the healthcare system [15], and some may be reluctant to

disclose their smoking status to providers because the behavior is stigmatized [16, 17]. Another challenge of recruiting pregnant smokers is that the intervention window defined by pregnancy is limited.

Effective techniques for recruiting hard to reach populations like pregnant smokers include providing an incentive [18–21] and targeting recruitment messages and materials to the population [5, 22–24]. Using emotion to frame messages may be an effective form of targeting. Distinct emotional appeals (e.g., pride, empathy) may have differential impacts on health behaviors [25], and high affect-arousing messages may be particularly persuasive among pregnant smokers [26]. The effects of emotional appeals have long been studied [27], but most have solely focused on fear [28] which is, perhaps, an inappropriate emotion to evoke in pregnant women. Thus, the focus here is to examine unique emotional frames to assess which might be effective with this population.

Text messaging on mobile phones has become a ubiquitous communication channel among women of child-bearing age and may be an effective way to reach pregnant smokers. Among adults ages 18 to 29 years, 98% own a cell phone [29], and on average, they send and receive 87.7 texts per day [30]. Adults who are low income–which is typical of pregnant smokers–send and receive more texts compared to higher income adults [30]. Additionally, compared to other modalities (e.g., in-person, phone), text messaging may offer higher levels of anonymity and confidentiality [17].

Text4baby is the largest text messaging service for pregnant women and mothers in the USA with more than 1 million pregnant women and new mothers enrolled since its inception and more than 150,000 women enrolled a year [31]. The service sends three texts per week to women flagged as pregnant that are timed to her due date, as well as modules of messages on health issues such as influenza vaccination and ad hoc alert messages with breaking news on disease outbreaks [32]. Text4baby is promoted by a large network of more than 1400 partners including government agencies, such as state and local health departments and Medicaid agencies, health plans, professional associations, and non-profit organizations [31, 33, 34]. According to a survey of Text4baby subscribers, subscribers represent underserved populations with the majority reporting being covered by Medicaid and having an annual household income of less than $16,000 [35].

PURPOSE

The purpose of this study was to build on an earlier pilot [36] and to determine the feasibility and effectiveness of recruiting pregnant smokers from the Text4baby subscriber base for an efficacy trial of Quit4baby. Quit4baby is a smoking cessation text messaging program for pregnant women envisioned as an add-on service for smokers in Text4baby, as well as a standalone smoking cessation program [37]. While the Text4baby subscriber list has previously been used to recruit for Text4baby program evaluation efforts [29, 34], this study was the first to recruit via text message for a separate trial and to study the recruitment process. This paper does not report results from the efficacy trial rather it aims to contribute to the practice-based evidence [38] for recruiting high-risk population by focusing on the feasibility and effectiveness of recruitment. A supplementary goal of the study was to understand if varying the content of the recruitment text message–by changing the message appeal and removing mention of a financial incentive–affected the response and enrollment into the trial.

METHODS

A recruitment text message was sent to Text4baby subscribers flagged as pregnant to identify interested pregnant smokers for the Quit4baby trial. The Quit4baby trial had an enrollment target of 500 participants. Between August 2015 and February 2016, Text4baby subscribers were sent a recruitment message if they were flagged as pregnant, had reported a due date at least 8 weeks in the future, and were actively enrolled in the program at the time the recruitment message was sent (i.e., had not unsubscribed from Text4baby). Subscribers who registered for Text4baby with a zip code from California, Oklahoma, Ohio, or Louisiana were excluded because the Quit4baby program was already available to Text4baby subscribers in those states. Recruitment messages were broadcasted at 2:00 p.m. Eastern Standard Time, so subscribers received the recruitment message between 11:00 a.m. and 2:00 p.m. local time (or 8:00 a.m. for Hawaii subscribers). Tuesday was selected because this assured that in most cases subscribers would only receive one message on this day given that Text4baby standard weekly messages are not sent on Tuesdays. Subscribers were grouped into new subscribers, those who had signed up for the Text4baby service 4 to 10 days prior to the sending of the recruitment message, and older subscribers, those who had been in the program for longer than 10 days. For new subscribers, the 4 to 10 day window was chosen to give Text4baby subscribers a few days to become acclimated with the program before presenting them with the study offer and allowed the study team to send the broadcast on a weekly basis without sending the recruitment message to the same Text4baby subscriber twice.

Text4baby subscribers who responded "YES" to the recruitment message were then followed-up with by phone to complete the enrollment process. Research staff called interested Text4baby subscribers at least four times within the first week and up to eight times if a respondent continued to express interest until the Text4baby subscriber verbally refused or was screened for eligibility. Research staff assessed participants for eligibility by conducting a 3 to 5 min telephone screener. Participants were eligible for the Quit4baby study if they had a cell phone for their personal use, were willing to receive text messages on their cell phone, were 14 years or older, were

currently pregnant, and had smoked at least one puff of a cigarette in the past 2 weeks. The number of follow-up attempts it took to enroll participants was tracked. If eligible and interested, Text4baby subscribers consented to participate in the Quit4baby trial and were enrolled over the phone. The recruitment protocol was approved by the George Washington University Institutional Review Board.

For purposes of this analysis, the recruitment efforts that targeted only new subscribers between October 2015 and February 2016 are reported here. New subscribers were expected to be more responsive to a recruitment text than older subscribers who had been in the program for a longer period of time and had become more accustomed to receiving Text4baby appeals. Thus, new subscribers were selected because they were more uniform and the effects of the recruitment efforts could be better isolated. The data from the months of August and September 2015 were not included because the recruitment procedures and message content were being refined during this time.

Recruitment text messages

Recruitment text messages aimed to identify pregnant smokers within Text4baby who would be willing to be part of a smoking cessation study. All texts had the same call to action, asking subscribers to reply "YES" to learn more. Three of the messages varied the central appeal of the message, with two aimed at an emotional appeal (i.e., pride, empathy) and one emphasizing a free service. The pride message emphasized feelings of pride from quitting. This message was as follows (with italics for emphasis of the appeal): "Text4baby: *If you smoke, it's important to quit. You'll be proud you did!* Test messages to help you quit. Get gift cards if eligible. Reply YES to learn more." The empathetic message recognized the difficulty in quitting smoking and offered social support. This message was as follows: "Text4baby: *Quitting smoking is tough but it's easier with help.* Test messages to help you quit. Get gift cards if eligible. Reply YES to learn more." The third message conveyed that the service was free: "Text4baby: *Want FREE messages to help you quit smoking?* Test messages to help you quit. Get gift cards if eligible. Reply YES to learn more." One additional variant of the pride message excluded the reference to the gift card incentive in order to test whether the mention of a financial incentive drove participation. The gift card reference–"Get gift cards if eligible" was removed, as follows: "Text4baby: If you smoke, it's important to quit. You'll be proud you did! Test messages to help you quit. Reply YES to learn more."

Research staff planned to rotate the three types of appeals every Tuesday; however, the rotation was not practical to maintain given multiple factors, such as holidays. From October 2015 to February 2, 2016, the recruitment message was sent to new subscribers on 12 Tuesdays; the pride message was broadcasted 3 times, the free message was broadcasted 3 times, and the empathy message was broadcasted 5 times. Additionally, the pride message without the written reference to the incentive present was broadcasted once on February 9, 2016. This message was compared to the pride message with the written reference to the incentive only and was not included in the overall analysis unless specifically stated. The total number of recruitment messages varied based on how many weeks each message type was sent and the amount of subscribers who met the selection criteria each week.

Measures and analysis

Feasibility of recruitment was defined as the ability to send recruitment text messages to Text4baby subscribers flagged as pregnant and to send the recruitment messages without causing a significant spike in cancellations compared to other ad hoc messages sent by Text4baby. Text4baby subscribers were able to cancel the Text4baby program at any time by texting the keyword STOP. The percent of subscribers who cancelled during the recruitment period was defined as the number of Text4baby subscribers who cancelled from the Text4baby program on the Tuesday the recruitment message was sent. Three of the 11 days (2791 subscribers) were excluded from the cancellation calculation given that on these days Text4baby subscribers also received a Text4baby ad hoc message or topical module message and cancellation associated with just the recruitment message could not be determined. The percent who cancelled on a recruitment Tuesday were compared to the percent who cancelled among a similar group of pregnant, newly enrolled, Text4baby subscribers who received a Text4baby ad hoc message or topical module message on a Tuesday during the previous 6 months (between January 6, 2015 and July 14, 2015). These measures will test the operational feasibility of using the Text4baby platform for recruitment without disrupting the existing service.

The effectiveness of the recruitment efforts was measured in three main ways. First, effectiveness was measured by the percentage of subscribers who expressed interest via text. Percent interested was calculated by the number of subscribers who replied YES to the recruitment message out of the total number of subscribers who were sent the recruitment message. Second, effectiveness was measured by the percentage of subscribers who enrolled. Percent enrolled was calculated by the number enrolled out of the total number of subscribers sent the recruitment message. Third, in order to understand what fraction of the targeted population was reached, an important evaluation measure [39], effectiveness was measured by the percent of estimated pregnant smokers who enrolled. This was calculated by the number enrolled out of the total number of pregnant Text4baby subscribers who were estimated to be smoking based on the national prevalence rate of 10.2% [4]. This rate was considered a conservative estimate for pregnant Text4baby subscribers who represent low-income populations [31, 37] and are more likely to be smoking [3]. Other measures of effectiveness include percent contacted

Table 1 | Overview of feasibility and effectiveness of recruiting through text

Date	Message type	Feasibility			Effectiveness				
		messages sent	Cancelled[a]	% Cancelled (95% CI)[b]	Interested	% Interested (95% CI)[c]	Enrolled	% Enrolled (95% CI)[d]	% of smokers enrolled (estimate)[e]
October 6, 2015	Free	886	22	2.48% (1.56–3.74%)	74	8.35% (6.61–10.37%)	14	1.58% (0.87–2.64%)	15.49%
October 20, 2015	Empathy	974	12	1.23% (0.64–2.14%)	121	12.42% (10.42–14.66%)	24	2.46% (1.59–3.64%)	24.16%
October 27, 2015	Empathy	847	9	1.06% (0.49–2.01%	93	10.98% (8.95–13.28%)	17	2.01% (1.17–3.19%)	19.68%
November 3, 2015	Pride	888	–	–	109	12.27% (10.19–14.62%)	21	2.36% (1.47–3.59%)	23.18%
November 10, 2015	Free	836	25	2.99% (1.94–4.38%)	80	9.57% (7.66–11.77%)	16	1.91% (1.10–3.09%)	18.76%
November 17, 2015	Empathy	1147	18	1.57% (0.93–2.47%)	109	9.5% (7.87–11.35%)	15	1.31% (0.73–2.15%)	12.82%
December 8, 2015	Empathy	1118	–	–	101	9.03% (7.42–10.87%)	25	2.24% (1.45–3.28%)	21.92%
January 12, 2016	Pride	871	11	1.26% (0.63–2.25%)	91	10.45% (8.50–12.67%)	18	2.07% (1.23–3.25%)	20.26%
January 19, 2016	Free	858	13	1.52% (0.81–2.58%)	77	8.97% (7.15–11.09%)	16	1.86% (1.07–3.01%)	18.28%
January 26, 2016	Empathy	785	–	–	81	10.32% (8.28–12.66%)	16	2.04% (1.17–3.29%)	19.98%
February 2, 2016	Pride	984	22	2.24% (1.41–3.37%)	102	10.37% (8.53–12.44%)	17	1.73% (1.01–2.75%)	16.94%
Total		10,194	132	1.78% (1.08–1.53%)	1038	10.18% (9.60–10.79%)	199	1.95% (1.69–2.24%)	19.14%

[a] Days when Text4baby subscribers were sent another ad hoc or topical module message were excluded

[b] The number of "STOP" text responses among the number of recruitment messages sent

[c] The number of "YES" text responses among the number of recruitment messages sent

[d] The number enrolled in the trial among the number of recruitment messages sent

[e] The number enrolled in the trial among an estimated 10.2% of smokers who were sent a recruitment message

by phone, percent verbally refused, and the number of ineligible and eligible subscribers who were sent the recruitment message.

Text4baby subscribers' response to the recruitment message and timing of text response was captured by Text4baby system data. The number of follow-up attempts it took to enroll interested and eligible subscribers by phone was tracked by research staff within the recruitment database. The eligibility screener, consent process, and baseline questionnaire were managed using REDCap electronic data capture tools hosted at the Children's National Medical Center [40]. The baseline questionnaire captured participant socioeconomic characteristics, which were subsequently used to determine representativeness across subgroups.

The measures of recruitment feasibility and effectiveness were compared across the different messages using Fisher's exact test for significance with a 95% confidence level. A logistic regression was run to measure the odds of enrollment based on time to response to the recruitment messages. SAS 9.4 was used to conduct all statistical analyses.

RESULTS

Between October 6, 2015 and February 2, 2016, recruitment messages were sent to 10,914 Text4baby subscribers flagged as pregnant (see Table 1 for overview of feasibility and effectiveness results). The percent of Text4baby subscribers who were sent the recruitment message and cancelled was 1.78%. Percent cancelled during the comparison period for subscribers who received a Text4baby ad hoc or topical module message was 1.86% (64 of 3439). There was no statistical difference detected in cancellation between both groups.

Of the 10,194 Text4baby subscribers who were sent a recruitment message, 1038 (10.18%) texted YES indicating interest. Of those (1038), almost half of the respondents (477, 45.95%) were not reachable after their initial text for several reasons including no answer to study calls, inability to receive incoming calls, and phone being out of service. Research staff reached 561 (54.05%) respondents via phone call for follow-up and 152 (14.64%) refused, 181 (17.44%) were screened and found to be ineligible, and 228 (21.97%) were screened and found to be eligible. Reasons for ineligibility included not smoking a cigarette within the past 2 weeks (168, 92.82%), not currently pregnant (7, 3.87%), and not having a cell phone for their personal use (1, 0.01%) or a texting plan on their cell phone (5, 2.76%). Among the ineligible due to smoking status, 84 (50.00%) smoked every once in a while or quit smoking once they found out they were pregnant, 24 (14.88%) used to be regular cigarette smokers, and 60 (38.10%) never were regular cigarette smokers. Of those who were assessed for eligibility and found to be eligible (228), 199 (87.28%) went on to enroll in the study (see Fig 1 for the recruitment diagram). The percent who enrolled among Text4baby subscribers who were sent the recruitment message was 1.95%. Based on the 10.2% smoking prevalence among pregnant women in the USA [4], it is estimated that 1040 subscribers who were sent the recruitment message were smoking and therefore eligible to participate in the Quit4baby trial. Thus, an estimated 19.14% (199/1040) of smokers in Text4baby who were sent the message were enrolled (see Table 1 for feasibility and effectiveness measures by week).

The mean text response time to the recruitment message was 23 min (median is 212.05 min or 3.53 h) with response times ranging from 0 min to 12,873 min (8.84 days). There was no relationship between response

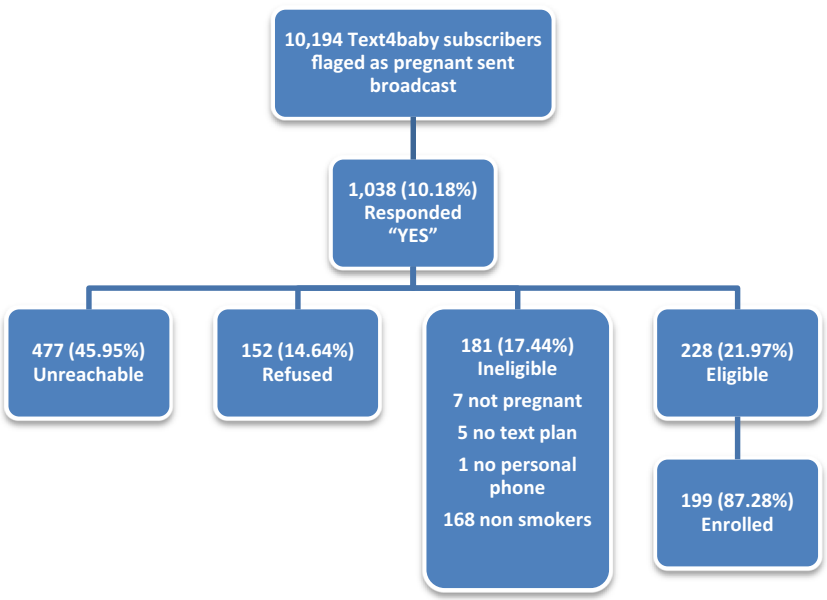

Fig 1 | Recruitment flowchart

time to the recruitment message and enrollment. The mean number of attempts to enroll was 2.35 (SD = 1.67) among participants. There were no significant differences among participants who enrolled on the first or second attempt compared to all other participants based on their education, race, or cigarettes smoked per day at baseline.

Effectiveness of recruitment message framing

Of the 10,194 subscribers who received a recruitment message, 2580 received the free message, 4871 received the empathetic message, and 2743 received the pride messages with reference to the incentive. The free message had a significantly higher cancellation (2.33%) compared to the empathy message (1.31%) ($p < 0.01$), but the pride message cancellation (1.78%) did not significantly differ from the free or empathy message cancellation. Subscribers responded significantly more to the pride message (10.97%) compared to the free message (8.99%) ($p = 0.02$). Subscribers responded more to the empathetic message (10.37%) compared to the free message (8.99%) ($p = 0.06$), but the results were not significant. There were significant differences in the proportion of subscribers who were ineligible between the three messages; the pride message had the most ineligible (2.44%), which was significantly more than the empathetic message (1.66%) ($p = 0.02$) and the free message (1.40%) ($p < 0.01$). Reasons for ineligibility did not significantly differ between the three groups. The proportion enrolled between recruitment messages was not significantly different. Thus, although the emotionally salient messages had a significantly higher response compared to the free message, the higher response did not translate to higher enrollment. The percent contacted via phone for follow-up and the percent refused after the initial text response also did not significantly differ between the three recruitment messages (See Table 2 for feasibility and effectiveness by message frame).

The pride message without reference to the gift card incentive was sent to 724 new Text4baby subscribers. The percent cancelled (1.24%) was not significantly different than the percent cancelled among subscribers who received the pride message with reference to the incentive (1.78%). The percent of subscribers who responded (7.18%) ($p < 0.01$), the percent of subscribers who enrolled (0.83%) (p = 0.03), and the percent of subscribers who were found to be ineligible (0.83%) ($p < 0.01$) were significantly lower compared to the pride message with reference to the incentive.

Table 3 provides an overview of the demographic characteristics of participants recruited through this method. Participants represent low income; more than half had an annual household income less than $15,000 and 81% had an annual household income less than $30,000. More than half of participants did not work at all (121, 60.80%) and had Medicaid insur-

Table 2 | Overview of feasibility and effectiveness of recruitment by message frame

Message type	Feasibility			Effectiveness				
	Messages sent	Cancelled[a]	% Cancelled (95% CI)[b]	Interested	% Interested (95% CI)[c]	Enrolled	% Enrolled (95% CI)[d]	% of smokers enrolled (estimate)[e]
Free	2580	60	2.33% (1.78–2.98%)	232	8.99% (7.92–10.16%)	46	1.78% (1.31–2.37%)	17.48%
Empathy	4871	39	1.31% (0.94–1.79%)	505	10.37% (9.53–11.26%)	97	1.99% (1.62–2.42%)	19.52%
Pride	2743	33	1.78% (1.23–2.49%)	301	10.97%[f] (9.83–12.20%)	56	2.04% (1.55–2.64%)	20.02%
Total	10,194	132	1.78% (1.49–2.11%)	1038	10.18% (9.60–10.79%)	199	1.95% (1.69–2.24%)	19.14%

[a] Days when Text4baby subscribers were sent another ad hoc or topical module message were excluded. The total excludes November 3, 2015; December 8, 2015; and January 26, 2016

[b] The number of "STOP" text responses among the number of recruitment messages sent on the days Text4baby subscribers received the recruitment message only (free messages sent = 2580, empathy messages sent = 2968, and pride messages sent = 1855; total n = 7403)

[c] The number of "YES" text responses among the number of recruitment messages sent

[d] The number enrolled in the trial among the number of recruitment messages sent

[e] The number enrolled in the trial among an estimated 10.2% of smokers who were sent a recruitment message

[f] Fisher's exact test two-tailed p value is <0.05 where empathy and pride messages were compared to the free message

Table 3 | Baseline demographic characteristics ($N = 199$)

	Frequency mean	%, SD
Age	26.33	6.15
Race[a]		
White	133	66.83
Black	54	27.14
Other	15	7.54
Hispanic, Latina, or Spanish origin	17	8.54
Income[b]		
Up to $15,000	108	54.27
$15,001–$30,000	53	26.63
$30,001–$47,099	22	11.06
$47,100 or more	9	4.52
Education		
12th grade or less with no high school diploma	50	25.13
High school graduate, GED or equivalent	64	32.16
High school graduate	49	24.62
Some college	63	31.66
Associate's, bachelor's, or master's	20	10.05
Work[c]		
Part time	40	20.10
Full time	35	17.59
Not at all	121	60.80
Insurance		
None	14	7.04
Medicaid/medicare	148	74.37
Veterans or military	21	10.55
Private insurance/from employer	14	7.04
Had a smartphone[d]	172	85.15
Cigarettes smoked per day before pregnancy	15.95	10.17
Cigarettes smoked per day now	6.75	5.87
Weeks Pregnant	16.24 weeks	54.42

All variables had missing data for two participants unless otherwise stated

[a] Not mutually exclusive

[b] Missing data for seven participants

[c] Missing data for three participants

[d] Missing data for three participants

ance (148, 74.37%). On average, participants reported smoking 15.95 (SD = 10.17) cigarettes per day before finding out they were pregnant and 6.75 (SD = 5.87) cigarettes per day at the time of study enrollment. Participant's race, education, employment status, insurance type, and cigarettes smoked per day at baseline did not significantly differ by recruitment messages.

DISCUSSION

Recruitment for a smoking cessation trial through Text4baby was found to be operationally feasible and effective [39]. Within a 5-month period, more than 10,000 new Text4baby subscribers flagged as pregnant were sent a recruitment text message. The percent who cancelled as a result of the recruitment message was found to be similar to cancellation from other ad hoc messages sent to Text4baby subscribers. This suggests that this recruitment approach did not disrupt the Text4baby service more so than other ad hoc messages sent by the program.

More than 10% of Text4baby subscribers flagged as pregnant who were sent a recruitment message replied expressing interest in the study and given that about 10.2% of pregnant women smoke in the USA based on national averages [4], this recruitment approach was successful at obtaining interest from the target population of pregnant smokers receiving Text4baby. The success may be because of the conveniences associated with text messaging; the target audience could read the short solicitation on their own time without much additional effort and easily express interest (i.e., reply YES). Recruiting by text message from an existing text messaging subscriber list has a number of advantages. It was possible to rapidly identify potential study participants from a large, national pool of pregnant women on a weekly basis, perhaps using fewer study resources than if more traditional approaches were used such as online advertisements, provider outreach, or making phone calls to marketing lists of pregnant smokers [6]. Also, because text responses were received within minutes, the study team could follow-

up with interested Text4baby subscribers close to their time of decision.

Although interest in the recruitment message was high, research staff had to persistently follow-up with interested subscribers' multiple times to enroll them in the study, and almost half of subscribers who expressed interest via text never answered the follow-up phone call (477, 45.95%). Of the participants who took the phone call, many verbally refused or were ineligible (333, 59.36%). On average, it required more than two phone attempts to enroll an interested Text4baby subscriber in the trial. It is important to note that participants who enrolled on the first phone attempt were representative of the entire study population. Given this, for future studies of this nature, it may be possible to use staff time more efficiently by focusing on refining procedures for those who answer on the first phone attempt.

The recruitment message appeal was important for generating initial responses via text. Recruitment messages that had a pride emotional appeal had a better response over one that offered a free service. Furthermore, the proportion of subscribers found to be ineligible differed between the three groups. This may have been the case because non-smokers or women who recently quit sympathized with pregnant smokers more after receiving the pride or empathetic message and wanted to help. There is potential to increase enrollment in the future, perhaps by using other types of appeals (e.g., fear-based).

As expected, removing the reference to the incentive in the recruitment message significantly reduced response and enrollment. Nonetheless, it is noteworthy that a portion of subscribers (7.18%) still responded to the recruitment message without reference to the incentive suggesting that, while inferior, this recruitment message may still be effective. It may be that the emotionally salient message alone elicited a perception on non-tangible benefits, and these perceived benefits outweighed the cost of participation [6].

A limitation of this study was that the different messages were not randomly assigned at the individual level or randomized across weeks. Therefore, there is potential for confounding as a result of seasonality or other changes that may have occurred over time. Furthermore, the representativeness of Text4baby pregnant smokers compared to other pregnant smokers must be considered in generalizing the results of the study. Text4baby subscribers may differ in their comfort with texting and may be more willing to be recruited via text message compared with other pregnant smokers such as those who may be recruited through a health system.

Despite these limitations, the results herein support the utility of text messages for study recruitment, as well as the importance of testing message elements, including the type of appeal and the inclusion of incentives. The results may have implications not only for recruiting pregnant smokers into trials but also for existing smoking cessation services and demonstrates the importance of more practice-based research [38].

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Compliance with ethical standards The recruitment protocol was approved by the George Washington University Institutional Review Board.

Comments to the editor: The findings reported have not been previously published and this manuscript is not being simultaneously submitted elsewhere. Preliminary findings were presented at the Society of Behavioral Medicine's 37th Annual Meeting in March 2016. The authors have full control of all primary data and agree to allow the journal to review their data if requested.

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Statement of human rights: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1975 Helsinki Declaration and its later amendments or comparable ethical standards. Animal experimental subjects were not used in this research.

Statement on informed consent: Informed consent was obtained from all individual participants included in the study.

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