BRIEF REPORT

A Pilot Study Testing SMS Text Delivered Scheduled Gradual Reduction to Pregnant Smokers

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ABSTRACT

Introduction: Smoking during pregnancy causes multiple perinatal complications; yet, the smoking rate among pregnant women has remained relatively stagnant. Most interventions to help pregnant smokers quit or reduce their smoking are not easily disseminable. Innovative and disseminable interventions are needed.

Methods: We recruited 31 pregnant smokers in their second trimester from prenatal clinics. We assessed feasibility, acceptability, and preliminary efficacy of an SMS text-based intervention in a 2-arm design. We compared SMS-delivered support messages to an intervention that provided support messages plus a scheduled gradual reduction (SGR) to help women reduce their smoking more than 3 weeks. We sent women in the SGR arm “alert texts” at times to instruct them to smoke. We asked women not to smoke unless they received an alert text.

Results: Most women (86%) reported reading most or all of the texts. Women in both arms rated the program as helpful ($M = 6$, $SD = 1$ vs. $M = 5$, $SD = 2$, SGR vs. support only, respectively). Women in the SGR arm had a higher rate of biochemically validated 7-day point prevalence at the end of pregnancy 13.4% versus 7.5%. Of those still smoking, women reduced their smoking substantially with more reduction in the SGR arm (SGR arm: $M = 16$, $SD = 11$ vs. support messages only: $M = 12$, $SD = 7$).

Conclusions: We developed an easily disseminable intervention that could possibly promote cessation and reduction among pregnant women with SMS texting ability. Women in this pilot were enthusiastic about the program, particularly those in the SGR arm. This program needs further examination.

INTRODUCTION

Smoking during pregnancy harms the fetus (ACOG, 2005; Dietz et al., 2010). Yet, half of women who smoke continue smoking when pregnant (Anderka et al., 2010; CDC, 2004). Cognitive-behavioral cessation interventions have had modest success (10%–30%) (Lumley et al., 2009); however, disseminating these programs is challenging.

Intervention delivery via mobile phones can reach many smokers and requires minimal personal contact (Whittaker et al., 2009). Recently, Short Message Service (SMS) texting has been used to promote smoking cessation (Franklin, Waller, Pagliari, & Greene, 2006; Patrick et al., 2009), with nonsignificant effects among pregnant smokers (Naughton, Prevost, Gilbert, & Sutton, 2012). Thus, for pregnant smokers, an SMS intervention might need to be supplemented. Adding scheduled gradual reduction (SGR) might help pregnant women, most of whom have already reduced their smoking (England et al.,

2001) but cannot quit (Pickett, Rathouz, Kasza, Wakschlag, & Wright, 2005) because “self-weaning” often undermines cessation (Cheong, Yong, & Borland, 2007).

SGR involves assessing smokers’ patterns, with a gradual reduction of cigarettes smoked over time by lengthening the interval between cigarettes (Cinciripini, Wetter, & McClure, 1997). Thus, smokers might be prompted to smoke when they do not want to smoke (e.g., a random time in the morning), and might not be prompted to smoke when they want to smoke (e.g., after a big meal). The smoking becomes unlinked from cues, and smokers must work through times of craving.

SGR helps smokers quit (Cinciripini et al., 1995; Lindson, Aveyard, & Hughes, 2010), but has yet to be tested among pregnant smokers. Even if SGR only helps women reduce the number of cigarettes they smoke, this reduced nicotine exposure benefits the baby (England et al., 2001; Goldenberg et al., 1993).

There were three aims of this pilot study: (a) to assess feasibility of a SMS text-based cessation intervention for pregnant

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smokers, (b) to determine the acceptability of a SMS text-based SGR plus support messages intervention, and (c) to obtain preliminary efficacy data for SMS text-based SGR to promote cessation during pregnancy.

METHODS

Design

The two-arm randomized controlled pilot study ($N = 31$) compared SMS text-based support messages alone ($n = 15$) with SMS text-based support messages plus SGR ($n = 16$). Two face-to-face surveys were conducted, one at baseline (10–30 weeks gestation) and another 6 weeks post-baseline. This study was approved by the Duke University School of Medicine IRB.

Participant Recruitment

We recruited women from four clinics, including a county health department that provides care for uninsured and underinsured patients as well as a U.S. Army medical center. We either attended prenatal classes or identified women through appointment logs and sent them opt-out letters from their obstetric provider (OB). Eligibility criteria were as follows: >18 years of age, English-speaking, have smoked at least 100 cigarettes in their lifetime, smoked 5 or more cigarettes per day in the prior 7 days, are willing to try to quit smoking, are between 10 and 30 weeks pregnant, and have a cell phone with unlimited texting. We excluded women who could not properly provide consent.

Study staff obtained written informed consent, administered the baseline survey, and randomized women, stratified by number of cigarettes smoked and partner smoking status. Staff paid women \$10 for completing each survey and asked women who reported 7-day point prevalence abstinence to provide saliva and breath samples. Saliva samples were analyzed for the presence of cotinine using radioimmunoassay. A cut point of 10 ng/ml for saliva cotinine with pregnant women was used to discriminate abstainers and smokers.

Measures

The baseline survey included questions about pregnancy history, smoking history, and current smoking variables (e.g., nicotine dependence, triggers for smoking, etc.). The follow-up survey included the same questions as the baseline and process questions (primary outcomes) to assess the usability and acceptability of the support and SGR text messages. The primary outcome for determining preliminary efficacy was biochemically validated 7-day point prevalence abstinence.

Study Interventions

Support Messages Alone

Staff asked women randomized to SMS support messages alone to choose a quit date within the next 2–3 weeks and then texted them that quit date. Staff explained that women would receive up to 5 messages per day for 5 weeks. Each week, there was a new “theme” for a subset of the messages, such as reasons for quitting, getting ready for the quit date, partner smoking, and handling slips.

Scheduled Gradual Reduction

Staff told women randomized to support messages plus SGR that they would receive support messages for 5 weeks as described in Support Messages Alone section. Instead of setting a quit date within 2–3 weeks, they received “alert messages” that were designed to help them gradually cut down to zero cigarettes by the end of the fourth week. Study staff explained that the purpose of the SGR program was to break the connection between cues and smoking. Staff explained that it works when women follow the schedule closely, smoking only when they receive alerts.

Staff explained procedures, including texting each time they smoked, when they woke up, and when they went to bed. Using the algorithm implemented by Cinciripini and colleagues (1995), we calculated the number of cigarettes per day the woman should smoke in Weeks 2–4 of the study. The algorithm reduced the number of cigarettes smoked per day by one-third each week resulting in a longer interval between cigarettes. Staff explained that throughout the 3-week SGR program, women will receive “alert texts” at scheduled times to smoke. The end goal was to reduce to zero cigarettes at the end of the fourth week. Alert texts read, “U r on ur way to 0 cigarettes. If u feel the need to smoke, now is the time. Text back ‘s’ if u smoke in the next 20 mins, ‘ns’ if u don’t.”

If a woman smoked on her own rather than in response to an alert text, staff asked her to text “s.” Initially, when women texted smoking “off schedule,” staff reset their next alert text to correspond with the scheduled interval. If women texted 3 times “off schedule,” staff stopped sending alert texts and resumed the next day. If this pattern continued for more than a day, staff called the woman to determine if we needed to adjust her schedule. Staff asked women to sign a contract stating they will not smoke more cigarettes during the study than they did before they entered the study. To encourage adherence, women were told if they responded to 80% of the alert texts, they would be entered into a \$25 gift card raffle.

Analysis

This was a pilot study meant to assess preliminary feasibility, acceptability, and efficacy. Given the small sample size, the purpose of the arms is simply to monitor for unexpected, gross differences between arms. The two arms were combined to assess feasibility. We considered the intervention feasible if 80% of the 30 women reported reading some or all of the support text messages.

To determine acceptability, we asked women in both arms how useful the intervention was (1 = *Not at all useful* to 7 = *Extremely useful*) and whether they would recommend the program to a friend (1 = *Definitely would not recommend* to 7 = *Definitely would recommend*). For the intervention to be deemed acceptable, the mean level for each of these measures would have to be five or higher.

Efficacy of the intervention was based on saliva-confirmed 7-day point prevalence abstinence at the follow-up survey. Lost-to-follow-up participants were included as smokers. The abstinence rate was calculated with its 80% confidence interval within the two arms separately. Given the small sample size, this comparison was used to detect only unexpected, large arm differences (e.g., efficacies of 1 out of 15 in one arm vs. 8 out of 15 in the other arm).

RESULTS

Sample Characteristics

Table 1 contains data describing women in the sample. Although, we could not test for statistical significance, women in the support messages arm were more likely to be partnered with a smoker. Women in the SGR arm were heavier smokers, were less likely to have reduced their smoking during the pregnancy, and were less likely to have attempted to quit.

Feasibility

Of the 248 women approached, 10% refused. Most of the women we approached were ineligible ($n = 184$, 74% of 248) because they did not smoke (52%), smoked five cigarettes or fewer (7%), did not have a phone with texting or had an unreliable phone (9%), had miscarried (3%), or for other reasons (3%). Four women did not complete a baseline, and four women withdrew from the study (3%). Of the 31 women enrolled, 86% of women in both arms reported reading “all or most” of the support messages. Women in the SGR arm responded to 68% of alert texts within 60 min. Women rarely texted that they smoked off schedule (12% of all women in SGR arm).

Acceptability

Women found the program to be acceptable ($M = 6$, $SD = 1$ vs. $M = 6$, $SD = 2$, SGR vs. support only, respectively) and helpful ($M = 6$, $SD = 1$ vs. $M = 5$, $SD = 2$, SGR vs. support only, respectively). Most would recommend the program to a friend, with 78% in both arms reporting 7 on a 1–7 scale. One woman in the SGR arm stated in the follow-up survey, “Thinking about my quit date was scary, but it helped to have the alert texts as I could just then focus on ‘the next text’ rather than the big picture of quitting.” Several women reported that the support messages taught them about the health effects of smoking on the baby and that they appreciated the daily reminders of the importance of not smoking. One woman stated, “Several times I was about to light up and then I would get the text from your study and put the cigarette down.”

Efficacy

We obtained follow-up data on 29 of the 31 women. The two missing were counted as smokers. We compared 7-day point prevalence and found differences of 13.4% versus 7.5% in favor of the SGR arm. Of those still smoking, women reduced

their smoking substantially (reduction at follow-up—SGR arm: $M = 16$, $SD = 11$ vs. support messages only: $M = 12$, $SD = 7$).

DISCUSSION

In this pilot study, we established feasibility, acceptability, and preliminary efficacy of an SMS text-based intervention to help pregnant women quit and reduce their smoking. We found that the SGR arm was more efficacious than the support messages arm in terms of cessation and reduction. Further, the support messages alone were as effective as our previous face-to-face and telephone counseling intervention. This was despite women in the SGR arm being heavier smokers and being less likely to reduce their smoking or attempting to quit. With a more even distribution in a larger trial, the SGR intervention might fare even better.

Lessons Learned

We learned lessons from this pilot study. First, we learned that 3 weeks of reduction is not sufficient for heavier smokers. Three women in the SGR arm smoked a pack a day or more. The third week of reduction programmed them for six daily cigarettes and reducing from six to zero was too drastic. Thus, for a future study, we would add another week for heavier smokers.

We also learned that the SGR program needs to be sensitive to times when women cannot smoke. Several women were unable to smoke at work; thus, when they received alerts at times they could not smoke, they “missed” these cigarettes. Women felt somewhat demoralized and also had bigger reductions than they had planned, which undermined their cessation efforts.

Another lesson learned was that we were sending too many support messages daily, and this was particularly inhibitory for women in the SGR arm who were also receiving alert texts. Thus, in a large trial, we would reduce the number of support messages sent to no more than three a day with most days being just one.

Women in general found the program to be helpful and would recommend the program to a friend. This pilot study shows promise for a disseminable and innovative intervention to tackle the difficult challenge of helping pregnant women quit and reduce their smoking.

FUNDING

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DECLARATION OF INTERESTS

None declared.

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Table 1. Sample Characteristics

Demographic	Support	SGR + Support
Age	27 (6)	29 (6)
White	60%	38%
>High school	53%	38%
Weeks gestation	16 (6)	17 (5)
Number of cigarettes/day	10 (4)	13 (9)
Tried to quit in pregnancy	47%	25%
Cut down cigarettes	80%	69%
Partner smoke	87%	56%

Note. SGR = scheduled gradual reduction program.

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