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Combining real-time ratings with qualitative interviews to develop a smoking cessation text messaging program for primary care patients

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ABSTRACT

Background Text messaging interventions show promise as a way to help cigarette smokers to quit. Few studies have examined the effectiveness of text messaging programs targeting smokers associated with primary care or hospital settings.

Objective To develop a text messaging program targeting primary care smokers.

Methods Adult smokers in primary care were recruited from February-April 2017. We sent patients 10-11 draft text messages over two days and asked them to rate each message in real-time. Patients were interviewed daily by telephone to discuss ratings, message preferences, and prior experiences with nicotine replacement therapy (NRT). Content analysis of interviews was directed by a step-wise text messaging intervention development process and the Information-Motivation-Behavioral Skills model of medication adherence.

Results We sent 149 messages to 15 patients. They replied with ratings for 93% (N=139) of messages: 134 (96%) were rated as clear or useful, 5 (4%) as unclear or not useful. Patients’ preferences included the addition of graphics, electronic cigarette content, and use of first names. Regarding NRT, patients identified informational gaps around safety and effectiveness, preferred positively framed motivational messages, and needed behavioral skills to dose and dispose of NRT.

Conclusion Patients recommended message personalization, inclusion of electronic cigarette information, and graphics and identified barriers to NRT use to address by text message. Combining real-time ratings with telephone interviews is a feasible method for incorporating primary care patients’ preferences into a behavioral text messaging program.

Keywords: Text messaging; smoking cessation; primary care
INTRODUCTION

Text messaging interventions show promise as a way to help cigarette smokers to quit. Text messaging programs for smokers deliver behavioral advice based on several behavior change theories[1] to increase self-efficacy,[2] and improve quit chances by 30-70% compared to self-help material or usual care.[3-6] Most prior text messaging programs for smokers have examined community-based samples recruited from schools or internet advertisements.[7, 8] Few studies have examined the effectiveness of text messaging programs targeting smokers associated with primary care or hospital settings.[9-12]

Primary care is an important site for delivering tobacco cessation interventions with 84% of US smokers being screened for tobacco use by a physician each year.[13] Yet, we have little information about whether text messaging campaigns like those tested in community-based samples are effective when integrated within primary care.[10, 12] Receiving messages from a trusted source, such as a local healthcare provider,[14] may boost the behavioral impact of text messages. We also do not know how patients’ expectations for communications from their health care provider effect their preferences for text message content or what literacy level is appropriate for text messages targeting patients.

Integrating text messaging programs within primary care also presents an opportunity to support other treatments including pharmacotherapy. Adherence to smoking cessation medications is suboptimal with nicotine replacement therapy (NRT) users continuing treatment for less than half the recommended duration.[15-19] Text messaging programs have been used to improve medication adherence in conditions including HIV, diabetes and schizophrenia[20-25] but there is only one prior study examining a text messaging intervention addressing medication adherence among smokers.[18, 26] In that study, text messages promoting varenicline use among
people with HIV did not increase adherence but abstinence was higher at eight weeks among patients receiving text messages plus telephone counseling compared to standard care.[27]

No published studies have described the development and adaptation of a text messaging program with behavioral advice and content encouraging NRT adherence for primary care patients. Here, we present a step-wise process for message development[28, 29] with the unique aspect of combining real-time ratings of messages with daily qualitative interviews with target users. This is similar to prior work combining behavioral smoking data from ecological momentary assessments with qualitative data to understand substance use behaviors.[30] Thus, we aimed to gather insights into primary care patients’ reactions to messages in the context of their daily lives and to understand their experiences with and barriers to using NRT. Specifically, we examined three text messaging intervention components: (1) the language and content included in an existing national text messaging campaign, (2) new content for smokers not ready to quit consisting of motivational advice and encouragement to practice quitting, and (3) new content promoting NRT use. Our objective was to develop a text messaging program targeting smokers in primary care by combining established message programs with new theory-based medication messages and incorporating patients’ preferences and language around smoking cessation.

METHODS

Our overall stepwise approach to text messaging intervention development for primary care patients who smoke is shown in Figure 1.
Here we describe Phases 1-3. In Phase 1, we compiled a preliminary set of programmatic messages for primary care patients who smoke from established sources. In Phase 2, we asked a sample of primary care patients to rate messages in real-time to measure time to response, usefulness and clarity and we measured URL links clicked. Patients simultaneously participated in daily qualitative telephone interviews to explain their ratings and discuss their preferences. In Phase 3, the findings were used to design a set of modifications to the preliminary message set.
Participants
From February through April 2017, we recruited smokers from two Boston area community health centers affiliated with a large academic medical center who had previously participated in a pilot feasibility study of a preliminary text messaging intervention for smokers in primary care. [31] Eligibility criteria included: 18 years or older, current or former smoker, able to speak and read English, visited their primary care physician in the last two years, had a mobile number in their electronic health record, not pregnant, and able to provide informed consent.

Ethics
The project was approved by the Partners Healthcare Institutional Review Board. Participants provided verbal informed consent to participate and received a $40 gift card.

Preliminary text message set
A preliminary set of “programmatic messages” consisted of messages from three sources: (1) the National Cancer Institute’s SmokefreeTXT,[32] (2) novel content we developed for smokers not ready to quit[31] and (3) novel messages promoting use of NRT based on the Information-Motivation-Behavioral Skills model of adherence.[33]

*SmokefreeTXT*
Messages from a 2013 version of SmokefreeTXT were used. SmokefreeTXT targets smokers who are ready to quit in the next 30 days. The program invites users to enter a quit date in the next 30 days and sends messages to support them through the quit attempt by addressing motivation, self-regulatory capacity, and other behavioral skills.[1] It includes periodic assessments which query smoking status and other self-reported outcomes and offers real-time support through keywords which the user can text to request specific help with cravings, mood symptoms, or if they “slip” and have a cigarette.
Content for smokers not ready to quit

The content for smokers not ready to quit included motivational and quit induction messages developed for a previous pilot study[31] that aimed to test the feasibility of sending proactive text messages to smokers in primary care. Motivational messages encouraged users to identify personal reasons for change and internal motivations to quit.[34, 35] Quit induction messages are used in smokefree.gov[32] and encourage smokers to try a practice quit attempt (PQA) explained as an attempt to not smoke for hours or days without commitment to increase motivation and self-efficacy.[32, 36, 37]

Smoking cessation medication adherence content

Medication promoting messages were based on the Information, Motivation and Behavioral Skills (IMB) model of medication adherence.[18, 33] This novel content was not included in the prior feasibility study. In the IMB model, information relevant to medication adherence may be accurate or inaccurate and facilitate or hinder adherence and may include how to take medications, medication effectiveness, drug interactions, or side effects. Motivation to adhere to medications encompasses both personal and social motivations and may include individual’s attitudes towards adherence, beliefs about the effects of adherence, perceived social support to adhere to medication and interest in complying with the wishes of others. Behavioral skills include the self-efficacy and actual abilities to take medications including acquiring and using medication, dealing with adverse effects, communicating with healthcare providers, and calling up social support. Preliminary medication promoting messages included informational messages about mechanism of action and effectiveness of NRT, motivational reminders highlighting social factors, and behavioral tips about how to use NRT ad lib or after a slip.
Phase 1: Real-time Message Ratings

From our programmatic message set, we purposively selected subsets of messages with potential challenges for users. First, we selected messages with a high literacy level based on a Flesch-Kincaid score greater than 8th grade level. Second, we selected messages with URLs. Third, we selected messages describing the practice quit attempt and novel medication adherence messages. Using an internet-based mobile messaging platform (Upland Mobile Messaging, Austin, TX), we created four sets of 10-11 messages scheduled for delivery over a two-day span between the hours of 9:00AM and 5:00PM. Each programmatic message was followed by a “rating message” that asked the participant to rate the message’s usefulness or clarity depending on the message content. Each participant was assigned to receive one of the four sets of programmatic messages and ratings. Assignment to message subsets was sequential, with each message set being rated by three to four participants.

Quantitative Analysis

We compared the characteristics of participants in this study with those who were unreachable or declined participation using chi-square and student’s t-tests. We calculated the proportion of messages rated as clear or useful, the proportion of URL links clicked, and the median and distribution of response times to ratings. Analyses were conducted in Stata v13 (College Station, TX).

Phase 2: Semi-structured Interviews

Each day of messages was accompanied by a qualitative telephone interview. Interviews were conducted by a clinical research coordinator (NS) and a physician-researcher (GK) with qualitative interview experience. Interview topics included structured data on participants’ smoking status, readiness to quit, and use of NRT, open-ended inductive inquiries exploring the
day’s real-time message ratings and message content, *a priori* inquiries about preferences for message timing and frequency, personalization, privacy concerns, prior experiences with cessation medications, *a priori* inquires asking about preferences among sample message types (e.g. preference for informational or motivational medication messages, spiritual content, inspirational stories, or games). Interviews were audio recorded and transcribed for content analysis. We used interim reviews of transcripts to determine whether new content was collected. We stopped recruitment when saturation was reached on key topics.

**Qualitative Analysis**

Qualitative interview transcripts were content analyzed using NVivo 11 (QSR International, Victoria, Australia) by two coders (GK and NS). Coders read the transcripts and identified the key concepts. These were used to develop a preliminary coding framework. Then coders reviewed each transcript using the preliminary framework to modify *a priori* themes and add emergent themes.[38] After iteratively analyzing all transcripts and reconciling discrepancies the final coding structure was reviewed with a third researcher (EP). All interviews were double coded with the final coding structure. Intercoder agreement across key themes between coders was 80% by Kappa statistic.

**Phase 3: Modifications to text messaging intervention**

In the final phase in this message development process, the qualitative interview findings and ratings informed changes to the text messaging program. To define the message modifications, the study team reviewed the final qualitative themes and through in-person and written discussion came to a consensus on the planned message changes.
RESULTS

Study sample

Of 76 participants in the prior feasibility study, 57 (75%) were reached and 15 (20%) enrolled in the current study. Characteristics of the 15 participants are shown in Table 1.

Compared to patients who did not participate, participants who enrolled in the current study were more often non-Hispanic white ($P=0.04$). Nine participants (60.0%) were daily smokers, four (26.7%) less than daily smokers, and two (13.3%) former smokers who quit after the previous pilot study. Ten (66.7%) reported using NRT in a prior quit attempt.
Table 1. Characteristics of participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Participants</th>
<th>Declined or unreachable</th>
<th>P-value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic characteristics</td>
<td>N=15</td>
<td>N=61</td>
<td></td>
</tr>
<tr>
<td>Age, years, mean (range)</td>
<td>46 (28-61)</td>
<td>52 (23-70)</td>
<td>0.10</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>6 (40.0)</td>
<td>41 (67.2)</td>
<td>0.08</td>
</tr>
<tr>
<td>Race/ethnicity, n (%)</td>
<td></td>
<td></td>
<td>0.04</td>
</tr>
<tr>
<td>White</td>
<td>12 (80.0)</td>
<td>58 (95.0)</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>1 (6.7)</td>
<td>2 (3.3)</td>
<td></td>
</tr>
<tr>
<td>Latino</td>
<td>2 (13.3)</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0 (0.0)</td>
<td>1 (1.6)</td>
<td></td>
</tr>
<tr>
<td>Medical comorbidities&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>Insurance status</td>
<td></td>
<td></td>
<td>0.51</td>
</tr>
<tr>
<td>Medicare</td>
<td>4 (26.7)</td>
<td>9 (14.8)</td>
<td></td>
</tr>
<tr>
<td>Medicaid</td>
<td>4 (26.7)</td>
<td>12 (19.7)</td>
<td></td>
</tr>
<tr>
<td>Commercial payer</td>
<td>7 (46.7)</td>
<td>39 (63.9)</td>
<td></td>
</tr>
<tr>
<td>Self-pay</td>
<td>0 (0.0)</td>
<td>1 (1.6)</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Based on student’s t-test or Fisher’s exact test.  
<sup>b</sup> Includes diabetes, hypertension, and coronary artery disease.

Phase 1: Real-time Message Ratings

We sent 149 programmatic messages and 149 rating messages. Of 24 unique messages with URL links, none were clicked. Participants replied with ratings for 93% (N=139) of messages sent. The median time from rating message to reply was 7.0 minutes (interquartile range 1.0-29.0) (Figure 2). Each message was rated by 3.6 participants on average with one message receiving only two ratings. The 10 missing ratings came from five participants. Of 139 ratings, 96% (N=134) rated messages as useful or clear. Messages rated as unclear or not useful
included two messages describing practice quit attempts, one informational message about NRT, one motivational message and one high literacy level message.

Figure 2. Distribution of response time to message rating queries

Legend: Excludes outliers (n=3) responding at 7200 minutes.

Phase 2: Semi-structured Interviews
All 15 participants completed the first qualitative interview, 87% (n=13) completed the second, two people were unreachable for the interview despite completing the message ratings.

Program Framework: Message frequency and timing
Participants recommended from one to five messages per day and some recommended sending messages before bed in the evening. When asked whether sample messages would be more effective if sent at other times all participants thought the message’s effectiveness would
not be altered if received at a different time. When asked separately about URL links, some participants reported being at work as a reason for not clicking at time of receipt.

*Program Framework: Personalization*

Most participants liked personalization with their first name and described it as humanizing and comforting. However, several participants had concerns about other types of personalization such as including their doctor’s name.

“*[Use of first names] makes it sound like it’s not coming from a robot caller.*” [Daily smoker, Female]

“*Yeah, I think [Using your doctor’s name] would feel invasive like, ‘Whoa, they-- what else do they know about me?’*” [Former smoker, Male]

*Program Framework: Privacy concerns*

Participants reported no issues with privacy of the messages they received. They also reported no concerns for privacy with a text messaging program about smoking and no concerns about other people seeing their messages about smoking.

*Message content: Electronic cigarette content*

Participants expected electronic cigarette (e-cigarette) content in messages about other tobacco products or treatments.

*The one thing it doesn’t include that they may want to include is the electronic cigarettes.*

*Because that's what I used to help me quit and I quit for almost six months...* [Daily smoker, Female]

*Message content: Graphic content*

A few participants recommended adding emoji-style images to attract interest.

*Suppose so if you have no time and you look at it and you see a picture, you’ll be more apt to look at it … make it look fun, have some balloons or something* [Non-daily smoker, Female]
Two participants recommended adding graphic images of lungs to enhance message effectiveness.

Nobody shows pictures of lungs...They don’t show family members sitting next to the people in bed...I think the shock value of things would really help with people too.

[Former Smoker, Male]

Message content: Specific facts about versus general statements about quitting tobacco
Participants reported that they found specific statements of the effects of quitting to be more impactful than more general statements.

If there are more specifics on what they’re going to gain out of it and then more specifics on what they’re going to expect doing it, people more likely want to take those steps, knowing what could happen to them. [Daily smoker, Female]

Message content: Encouragement and message framing
Participants reported that messages offering encouragement and praise would be more effective than negatively framed messages.

Every couple days you could say, "Well if you didn't smoke, know you can pat yourself on the back." And just kind of encourage the person and give them good feedback as to, "Good job if you didn’t smoke today." You know give yourself a high-five. As opposed to like, "Don't smoke, this will happen," and "Don't do that" [Non-daily smoker, Female]

Message content: Language clarity
Participants did not understand some terminology in the messages including slip, lozenge, trigger and the practice quit attempt.

Oh, those [lozenges] are the hard candy things? [Non-daily smoker, Male]

Message content: Counseling versus coaching
Participants reported counseling for tobacco use had negative connotation and made it seem more like an illness. Participants were interested in coaching.
I think coaches and things like are better off because people think of counseling and they think like, "I have mental issue. Oh, I have a drug problem, or--" people don't think of cigarettes as heroin or opiates or something like that. [Former smoker, Male]

**Message content: URL links**

Participants reported not clicking URL links because they did not have time, were not looking for or needing the information offered, were at work, had no internet access or lacked computer skills. Participants also made suggestions for how to encourage use of links such as offering a telephone number for those without internet access or use of a visual link rather than a URL to increase the appeal.

Maybe you could leave a phone number too, something like that… because like I said, I don't have all them fancy phones that can go on the computer. [Non-daily smoker, Male]

**Message content: Games for distraction**

Participants were asked *a priori* questions about preferences for message content from a list of options. Nearly all participants preferred games for distraction.

**Progressive things where today you do this, and then tomorrow, you're going to add to your score for this. And then it leads up to you get a silver cup, and then next week, you go for a gold cup…You know how games grab you and bring you in.** [Former smoker, Male]

**Barriers to NRT use: Cost**

Participants identified several barriers to starting or continuing NRT use including cost, side effects and safety, effectiveness, forgetting, and difficulties or dislikes. Cost was a commonly cited barrier to using NRT and something participants wanted to receive information about by text message.
I don't know if they give them free in places. So maybe more information on how you can get them if you don't have money. Because they are pretty pricey. [Non-daily smoker, Female]

**Barriers to NRT use: Side effects and safety**

Concerns about NRT side effects and safety included cancer risk beliefs, risks of smoking while using NRT and potential for addiction to NRT. These concerns were a source of stress.

*I was just like, "Oh my God. If I do smoke with this on, I'm going to like, blow up or something."* So, I just felt like there was a lot of pressure. So, I wanted to smoke more. [Non-daily smoker, Female]

*All these things to help you quit smoking, it's still nicotine going into your body. Can't that still cause you to get cancer?* [Non-daily smoker, Female]

**Barriers to NRT use: Perceived effectiveness**

Some participants reported NRT was ineffective in their prior attempts and this was a barrier to subsequent use.

*[The patches] they're not really great for-- if you smoke a lot and you've been smoking a long time, the patches don't help all that much.* [Daily smoker, Male]

**Barriers to NRT use: Difficulties and dislikes**

Participants described disliking the taste of lozenges and the difficult process of patch disposal.

*I mean it's not a real pain in the neck, but they talk about it [the patch] like you got to get rid of it like it's a contaminant. Like it's medical waste or something.* [Non-daily smoker, Male]
Barriers to NRT use: Forgetting

Few participants reported forgetting medications and some reporting feeling aware of having the patch on.

*I'm pretty much like oh my gosh it's on me.* [Non-daily, Female]

Facilitators of NRT use: Information

Queries about facilitators of medication use were organized around information, motivation, and behavioral skills constructs. People identified informational needs about side effects, safety and dosing of medications and recommended providing this in simple, short formats.

*Maybe, I don't understand how they say if you smoke less than ten cigarettes a day, start on a number two patch. If they explain that a little more.* [Non-daily smoker, Male]

Facilitators of NRT use: Motivation

When asked *a priori* questions about their preferences for informational, motivational or behavioral skills medication messages, participants who preferred motivational messages described them as caring and conversational.

*It's more personal, I don't know. More like let's get to it, it just seemed to me more normal.* [Daily smoker, Female]

Facilitators of NRT use: Behavioral skills

Participants who liked the behavioral skills messages described them as straightforward and useful. Participants identified needed skills to take NRT such as how to manage slips, ad lib use, side effects, and getting refills.

*In order not to slip up, take a couple of more-- of the lozenge or the patch. You know what I mean?* [Non-daily smoker, Male]

When asked about tips or skills for remembering to take medications, participants thought
reminders by text message could be helpful.

Well, probably if I got a reminder on my phone, a text message or something. [Daily smoker, Female]

Phase 3: Modifications to text messaging intervention

Based on the interview findings, we modified existing messages including delivery timing, message text and pictorial content and we added new medication focused messages for a final program of 244 scheduled messages. We adjusted message timing to add evening messages on some days for a total of 3-5 messages per day. Sample messages that were modified or developed based on qualitative data are shown in Table 2. In addition to these changes, we tried to leverage the user’s relationship with their healthcare system by referencing local tobacco cessation resources. Given the preferences for normal or conversational messages, we added a feature to respond with “You are welcome” whenever someone texts “Thank you.”

Table 2. Description of text message modifications and examples by theme

<table>
<thead>
<tr>
<th>Theme</th>
<th>Modification</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Framework and Content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personalization</td>
<td>We personalized seventeen messages to the user’s first name. Other types of personalization were not used, such as referencing the user’s primary care provider.</td>
<td>You are getting closer to the big day [first_name]. It may help to cut back on the number of cigarettes you smoke. Give it a try.</td>
</tr>
<tr>
<td>Electronic cigarette content</td>
<td>We added messages that acknowledged that people are using electronic nicotine delivery systems.</td>
<td>Using e-cigs or vaping? We don't know if these help people quit cigarettes. Keep your smokefree goal in mind—to quit cigarettes completely.</td>
</tr>
<tr>
<td>Graphic content</td>
<td>We added emoji icons to seven messages. We added links to personal stories from the</td>
<td>Wow, 3 weeks smokefree. [balloon emoji] Give yourself a pat on the back! Just don't light up to</td>
</tr>
<tr>
<td>Specific facts versus general statements</td>
<td>We added messages with facts about the effects of quitting smoking.</td>
<td>Quitting smoking improves your health immediately, it lowers your blood pressure in the first 20 minutes.</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Encouragement and framing of messages</td>
<td>We used participants’ own language to replace negatively framed messages with encouraging messages</td>
<td>Wow, 2 weeks smokefree! Ask the person next to you for a high five! You did well! You deserve it.</td>
</tr>
<tr>
<td>Language clarity</td>
<td>We added definitions of triggers, lozenges, and slips and modified our description of the practice quit attempt.</td>
<td>You might slip by having a puff or even 1 or 2 cigarettes after you quit. Don’t let one slip be an excuse to start smoking again. Learn from the situation ASAP and move on.</td>
</tr>
<tr>
<td>Counseling versus coaching</td>
<td>We edited all messages to use the words “coach” or “coaching” instead of counseling.</td>
<td>Quit-Tobacco coaches &amp; medication can increase your chances of quitting. Free 1-on-1 coaching is available at MGH Community Health Centers. Call XXX-XXX-XXXX for more info.</td>
</tr>
<tr>
<td>URL links</td>
<td>We modified the link content to reflect requested information such as information about e-cigarettes or patch dosing. We added telephone numbers together with URL links to additional tobacco treatment resources.</td>
<td>Using e-cigs or vaping? We don’t yet know if vaping is safe or if it helps to quit smoking. Nicotine patches are safe &amp; effective. Learn more: URL.</td>
</tr>
<tr>
<td>Games for distraction</td>
<td>We created a trivia game prompted by a keyword TRIVIA</td>
<td>Distract yourself with trivia for a few minutes. When did MGH open its doors? Text A for 1801, B for 1821 or C for 1905&lt;BR&gt;&lt;BR&gt;&lt;B response&gt; That's right! [gold cup emoji] MGH opened in 1821. It is the 3rd oldest general hospital in the US.</td>
</tr>
<tr>
<td>Medication Information, Motivation, and Behavioral skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information-Dosing</td>
<td>We added messages with simple dosing instructions.</td>
<td>Patch users, if you smoke 10 or more cigs per day start with step 1. If you smoke less than 10 cigs start with step 2: URL.</td>
</tr>
<tr>
<td>Information-Safety and side effects</td>
<td>We added messages with information about maximum daily dose to reassure participants concerned about overuse and describing the low risk of addiction to nicotine medications. We also added messages with advice for dealing with common side effects of skin irritation or sleep disturbance.</td>
<td>The nicotine patch and lozenge have less nicotine than cigarettes. You are not likely to become addicted to the patch or lozenges.</td>
</tr>
<tr>
<td>Information-Medication effectiveness</td>
<td>We added messages encouraging users to consider combination therapy in consultation with their doctor to address concerns of ineffectiveness and advice on correct medication use to maximize effectiveness.</td>
<td>Consider using the patch and gum or lozenge together if you’ve been unable to quit with medication in the past. Ask your doctor for advice.</td>
</tr>
<tr>
<td>Motivation-Forgetting</td>
<td>We added weekly reminder messages offering conversational encouragement and asking users if they used medications that day</td>
<td>We hope you are doing well. Did you use your nicotine patch or lozenge today? Reply with USED or NOTUSED</td>
</tr>
<tr>
<td>Motivation-</td>
<td>We added motivational messages</td>
<td>Nicotine patches and lozenges increase your</td>
</tr>
</tbody>
</table>
DISCUSSION

This study aimed to develop a text messaging program tailored to readiness to quit using preferences of primary care patients who smoke cigarettes and to explore patients’ prior experiences with NRT with the purpose of developing messages promoting NRT use.

Principal Findings

By combining real-time message ratings with daily interviews, we identified text message modifications including preferences for the inclusion of graphics, expectations around e-cigarette content, preferences for the inclusion of personalization by user’s name, and recommendations to make URL links more impactful by using pictures or adding telephone numbers for those without internet access. Real-time ratings provided feedback, in most cases, within 30 minutes of receiving the message. We also identified preferences for message style such as a conversational tone and use of emoji graphics. Participant’s described barriers to taking smoking cessation medications including costs, side effects and safety concerns, and perceived effectiveness.

Comparison with Prior Work

Most prior text messaging interventions used focus groups, interviews with individuals in the target population, or professional input to develop message content.[29, 39, 40] Our work used a hybrid approach based on recommended steps for text messaging program development.
Few prior studies have combined real-time assessments of text messages with daily interviews. Our interviews provided insight about what patients were doing when they received messages and their reaction in that setting. While we used this real-time rating for intervention development, it has also been used within interventions through machine-learning and five-item real-time user ratings to select messages which influence smoking cessation behaviors.

In our study, when presented with different options for personalizing messages, participants liked personalizing text messages with their first names but use of the physician’s name was viewed as intrusive by some. Prior work examining preferences for text messages about health topics have produced conflicting results with some participants expressing concerns about privacy of message content about health screening tests while others expressed no concern despite the inclusion of sensitive material such as HIV status. We tried to balance privacy concerns by using first names but excluding personal information described as intrusive. For example, instead of referencing the individual physician we included the name of the local healthcare system.

Prior work has explored the effectiveness of graphic images or emoticons in nutrition campaigns. Prior work has also shown that individuals communicate about tobacco products via social media using emoticons or images. To our knowledge this is the first study describing user preferences for graphic images or emoticons in a text messaging programs for smokers. It is possible that proactively sending text messages with a link to graphic images may confer some of the benefit graphic warning labels confer on smoking cessation.
Limitations

Our sample recruited participants from a prior text messaging feasibility study. All of them have seen a version of the program previously; this experience may have introduced bias. Several were former smokers. We tested only a subset of messages over two days and did not gather participants’ reactions to the entire text messaging program. We used a two-item rating scale for simplicity and with this scale most of the messages were rated positively. Use of a non-binary rating instrument, changing the rating system to reflect the targeted behavioral constructs such as self-efficacy, or rating usability [50] may produce greater insight into message preferences and impact.

Conclusions

This message development method of combining message ratings with daily telephone interviews is novel and was feasible among a sample of smokers in primary care. This method produced insights and modifications to the text messaging intervention including edits to the messages style such as addition of graphics, conversational tone, editing of URL links, and clarifying language. User reported barriers and facilitators of NRT use, were used to generate informational messages about medication safety, use and effectiveness, motivational messages in a conversational style, and messages describing behavioral skills such as dealing with slips while on NRT.

Combining real-time text message ratings with qualitative data was feasible among primary care patients who smoke, directed modifications to text message content to better tailor it to primary care patient preferences, and was used to produce novel medication adherence messages. The final text messaging program is being tested in a pilot randomized controlled trial.
of text messaging and mailed nicotine replacement therapy among primary care patients who smoke (NCT03174158).
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CONFLICTS OF INTEREST
GK has a family financial interest in Dimagi, Inc. and is a paid consultant for Click Therapeutics, Inc. NR has consulted without pay for Pfizer and received royalties from UpToDate for chapters on smoking cessation.
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