

# Peer Mentoring and Automated Text Messages for Smoking Cessation:

## A Randomized Pilot Trial

Justin S. White, PhD <sup>1</sup>

Séverine Toussaert, PhD <sup>2</sup>

Johannes Thrul, PhD <sup>3</sup>

Jeuneviete Bontemps-Jones, MPH <sup>4</sup>

Lorien Abrams, ScD <sup>5</sup>

J. Lee Westmaas, PhD <sup>4</sup>

<sup>1</sup> Philip R. Lee Institute for Health Policy Studies, University of California, San Francisco, CA

<sup>2</sup> Department of Economics, University of Oxford, Oxford, UK

<sup>3</sup> Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD

<sup>4</sup> Behavioral and Epidemiology Research Group, American Cancer Society, Atlanta, GA

<sup>5</sup> Department of Prevention and Community Health, George Washington University, DC

Corresponding author: Justin White, PhD, Philip R. Lee Institute for Health Policy Studies, University of

California, San Francisco, 3333 California Street, Box 0936, San Francisco, California, 94118, USA.

Telephone: 415-476-8045; E-mail: [Justin.White@ucsf.edu](mailto:Justin.White@ucsf.edu).

## ABSTRACT

**Introduction:** Text-messaging programs for smoking cessation, while efficacious, have high drop-out rates. To address this problem, we developed and tested the feasibility and early efficacy of a peer-mentoring intervention for smoking cessation provided by former smokers.

**Methods:** Adult U.S. smokers were recruited nationally into a randomized pilot trial (N=200), comparing 6-8 weeks of automated text-messaging support (SmokefreeTXT) and automated text support plus personalized texts from a peer mentor who formerly smoked. The primary outcome was biochemically verified 7-day point-prevalence abstinence at 3 months post-quit date, assessed on an intent-to-treat basis (missing = smoking). Self-reported abstinence, program acceptability, user engagement, and user perceptions were also assessed.

**Results:** Biochemically verified abstinence at 3 months was 7.9% (8/101) in the intervention group and 3.0% (3/99) in the control group (adjusted difference 6.5, 95% CI 0.7–12.3;  $p=0.03$ ). Self-reported abstinence at 3 months was 23.8% (24/101) in the intervention group versus 13.1% (13/99) in the control group (adjusted difference 12.7, 95% CI 1.2–24.1;  $p=0.03$ ). The intervention had a positive but insignificant effect on overall satisfaction (78.3% vs. 72.9% control group,  $p=0.55$ ). Having a mentor did not significantly alter duration of interaction with the program, nor the proportion unsubscribing, although the intervention group reset their quit date with greater frequency ( $p<0.01$ ) and sent more messages ( $p<0.01$ ).

**Conclusions:** Peer mentoring combined with automated text messages was feasible and acceptable and increased smoking abstinence compared with automated messages alone. The results highlight the promise of this intervention approach and the need for a full-scale evaluation.

**Implications:** Providing quitting assistance by automated text messaging has been shown to increase smoking abstinence. Yet, dropout rates in text-messaging programs are high. No studies have tested the effectiveness of peer mentors who are former smokers as part of a text-messaging intervention, although

they represent a promising way to retain, engage, and support smokers. This randomized pilot trial suggests that peer mentors can complement automated text messaging programs to promote smoking abstinence.

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## INTRODUCTION

Despite efforts in recent decades to expand access to tobacco cessation treatment, two-thirds of quit attempts in the US are undertaken without the use of any smoking cessation treatment.<sup>1</sup> Smokers routinely forgo efficacious options such as counseling coupled with pharmacotherapy, as recommended by clinical practice guidelines.<sup>2</sup> Major barriers to smokers' adoption of evidence-based treatments are their restricted availability to medical facilities and the relatively high cost of medications. Although the Affordable Care Act of 2010 requires private insurers to cover tobacco cessation treatments with no patient cost-sharing, many insurers have failed to comply with this mandate.<sup>3</sup> Most state Medicaid programs also impose copayments and prior authorization requirements.<sup>4</sup> There is a need for new low-cost cessation alternatives that are readily disseminable at a population level.

Technology-delivered interventions can expand access to smoking cessation treatment. Today, 95% of US adults own a cell phone.<sup>5</sup> Several randomized controlled trials (RCTs) have found automated text-messaging programs increased smoking cessation.<sup>6-8</sup> While the efficacy of these programs has been established, as many as half of smokers enrolled in these programs drop out.<sup>9</sup> While the reasons for dropping out can vary (e.g., having returned to smoking, or having quit and not wanting further assistance), there is a need to find strategies to engage smokers in ways that increase retention and efficacy.

Peer mentoring delivered by former smokers is one promising way to increase engagement and retention in text-messaging programs. Peer mentoring is a popular approach that has been adopted by Weight Watchers, 12-step programs for addiction recovery including Alcoholics Anonymous, and many other health promotion programs.<sup>10-12</sup> Peer mentors can augment the emotional support and informational support that a smoker attempting to quit may receive, and peer mentors can serve as role models by showing that cessation is possible and draw on personal experiences to help a mentee overcome barriers to health behavior change.<sup>13,14</sup> Mentors may also increase their self-efficacy and receive support for maintaining their own smoking abstinence.<sup>15,16</sup>

Though widely adopted, peer mentoring has rarely been rigorously evaluated.<sup>17</sup> According to a systematic review of the broader health behavior literature on peer mentoring, the results have been mixed, due in part to the diversity of approaches and contexts under study.<sup>17</sup> In the context of smoking cessation programs, peer mentoring has not been maximally leveraged. Peer support has been evaluated primarily as an adjunct to programs that include elements of social support, making it difficult to assess its potential as a standalone method.<sup>18</sup> Nevertheless, several observational studies find a positive association between peer support and increased quitting.<sup>13,19,20</sup>

We conducted a pilot RCT to test the feasibility of a novel intervention for US adult smokers that combined automated text messages with personalized text messages delivered by peer mentors. In principle, this intervention leverages digital technology to provide timely, personalized support tailored to each user's needs. These features, which are highly valued by smokers,<sup>21</sup> may enhance users' commitment to their quit attempt, thereby increasing program retention and efficacy.<sup>22</sup>

## **METHODS**

### **Trial Design**

We undertook a parallel-group, unblinded, pilot RCT with equal allocation to two groups, specified below. No changes to the pre-specified methods were made after trial commencement.

### **Recruitment and Participants**

The trial protocol was approved by the University of California San Francisco institutional review board and pre-registered with ClinicalTrials.gov (NCT03048786).

**Participants.** Participants of the “iQuit Project” were recruited primarily from paid advertisements placed on Google and Facebook. Recruitment notices were also disseminated through

various American Cancer Society (ACS) webpages, the SmokefreeTXT sign-up webpage, and Facebook webpages dedicated to smoking cessation. All advertisements directed participants to the study website, which included study details and a screening survey. Recruitment occurred from February through March 2017.

Inclusion criteria were: age  $\geq 18$  years, living in the US, having smoked  $\geq 100$  cigarettes in their lifetime, being a current cigarette smoker, wanting to quit within 30 days, not having used nicotine replacement therapy (NRT) or electronic nicotine delivery systems (ENDS) within the past 30 days, and agreeing to complete a salivary cotinine test at 3-month follow-up. Eligible participants gave informed consent and completed a web-based baseline questionnaire using Qualtrics survey software. NRT and ENDS users were excluded to reduce the chance their salivary cotinine test would give a false positive.

**Mentors.** Peer mentors were recruited from multiple sources: solicitation of facilitators of the ACS Freshstart® group-based cessation support program, online notices on ACS webpages, and posts to online smoking cessation forums. Eligibility criteria for mentors were: age  $\geq 18$  years, living in the US, having quit smoking  $>1$  year, willingness to mentor smokers through texting, completing the online training program, and creating a personal profile (described below) (Supp. Figure S1). The training included six narrated modules with an accompanying slide deck that took roughly two hours to complete, with a Qualtrics quiz at the end of each module. The modules covered study details, information about smoking and smoking cessation, guidance rooted in motivational interviewing techniques regarding how to advise mentees, and a tutorial about the study's web-based text-messaging platform. Study investigators verified that mentors had completed each quiz (i.e., each training module) before enrolling them in the study.

## Randomization

Participants were randomly allocated to receive cessation assistance through an automated texting program plus peer mentoring ( $n=101$ ) or an automated texting program alone ( $n=99$ ) (**Error! Reference source not found.**). Allocation, concealed from investigators, was performed through the Qualtrics survey flow randomizer. Mentor assignment in the intervention group was also random. Participants were informed of their group and mentor assignment at the end of the baseline questionnaire.

## Procedures

Text messages were based on SmokefreeTXT (SFTXT), a nationwide text-messaging service provided by the National Cancer Institute (NCI). SFTXT provides emotional and educational support concordant with US clinical practice guidelines for smoking cessation and uses 41 different behavior change techniques, including goal setting, problem solving, self-monitoring, feedback, and social support.<sup>23</sup>

SFTXT delivers one to five automated messages per day for up to two weeks prior to a user-selected quit date and six weeks post-quit date. A key feature of SFTXT, also incorporated in texts sent to both study groups, is that users are periodically sent messages to assess their smoking, mood, and craving status. Responses to status assessment messages prompt an automatic reply. Individuals can also request additional messages if they text the keywords MOOD, CRAVE, or SLIP.<sup>9</sup>

For our intervention, the SFTXT message library was imported into Wellpass (formerly Sense Health), a secure online portal designed for patient-clinician interactions. Wellpass allows for scheduled messages and automated dynamic responses. Participants also had the option to receive their messages through Wellpass' instant messaging smartphone app.

During the baseline questionnaire, participants selected a quit date within the next 5-15 days, with a default option of 15 days to maximize preparation time. A welcome text message was sent upon enrollment, and the SFTXT-based script began on the following day.

Participants in the control group received an identical set of text messages to SFTXT, as provided by SFTXT administrators in December 2015. The control group received no other intervention component.

Participants in the intervention (mentor) group received a modified version of the SFTXT messages and assignment to a peer mentor. Following the baseline questionnaire, intervention participants were automatically redirected to a webpage with their assigned mentor's profile (Figure S1). To increase salience and visibility of the profile, a link to the profile webpage was also sent to participants by email and within the welcome text message.

Subsequently, intervention participants received a combination of automated and personalized text messages. Our messages were identical to SFTXT's, except insofar as they included five enhancements. First, we revised the messages to be more conversational in tone. Second, we rewrote one automated message each day to be a "conversation starter" that prompted users to reply. For example, an excerpt of one SFTXT message advises users, "Write down your top 3 [smoking triggers]...." Our modified message asked users: "What are your top 3 triggers?" All participant replies triggered an email push notification to the mentor. Prior to the trial, mentors received our message library, along with examples of follow-up prompts and probes that could be employed with each conversation starter. Third, we solicited information from mentors during a training module regarding their own experiences with quitting, and embedded the content into selected messages. For example, one control message reads: "Think of healthy ways to deal with stress & boredom instead of smoking. Go to the gym, take a jog, or walk the dog." In the mentor group, the second sentence was modified to read: "For instance, I [...]," inserting the mentor's own stress relief techniques into the bracketed text. This personalized content was designed to build a social bond between mentor and participant and to make the participant more comfortable with sharing personal experiences. Fourth, mentors could remove or edit automated messages to tailor them to each participant. Fifth, mentors could send spontaneous (unscripted) messages at any time. Mentors were advised to consult with study personnel via email if they were unsure how to respond to a participant. Further details on these enhancements are provided in Supp. Table S1.



Mentors received an email notification when assigned a new participant, including a brief mentee profile with baseline survey data (first name, gender, age, race, time zone, whether a daily smoker, average cigarettes per day, years smoking, reason for smoking, reason for wanting to quit, quit methods of potential interest, and quit date). If a mentor did not accept an assigned participant in the Wellpass system, study personnel sent a reminder after one day and assigned the participant to a new mentor after two days. Back-up mentors were kept in reserve for this purpose. Study personnel monitored chat logs daily, and contacted mentors by email if they went more than a day without responding to participant questions.

The intervention lasted 42 days post-quit date. Smoking status assessment messages continued at day 60 and day 90. On day 91, participants received an email message with a Qualtrics link to the follow-up questionnaire. For those who had not responded yet, we followed up in a staggered fashion with three emails, two text messages, and two phone calls. Self-reported abstainers at follow-up were mailed a salivary cotinine test kit. Participants received a \$25 gift card for completing the follow-up and an additional \$25 for sending by email a photograph of their salivary test results. Mentors received \$50 for completing the training, \$150 for mentoring (\$200 for accepting four mentees), and entry into a \$1,000 drawing.

## Measures

The pre-specified outcomes can be grouped into four categories: early efficacy, acceptability, engagement, and user perceptions of treatment assignment. All measures have been reported below.

**Early efficacy.** The primary outcome is 7-day point-prevalence abstinence at 3 months post-quit date, obtained from a self-administered salivary cotinine test (Alere™ iScreen® Oral Fluid Device [OFD] test). Cotinine detection through saliva may be preferable as it is less invasive than other methods.<sup>24</sup> The iScreen OFD test produces qualitative binary results within 10 minutes, with reliable detection at cotinine

levels of 30 ng/mL, including through remote verification.<sup>25</sup> Participants were provided with written and pictorial instructions for conducting the OFD swab and were instructed to send a photograph of the test result window as an email attachment to the study email account. A blinded outcome assessor evaluated the photograph to determine smoking status. A similar approach has been adopted with success in other digital smoking cessation trials.<sup>26,27</sup>

Secondary efficacy outcomes were self-reported 7-day point-prevalence abstinence and average cigarettes smoked per day at 3 months. Tertiary outcomes corresponded to self-reported responses to the status assessment messages used in SFTXT: repeated point-prevalence abstinence on days 7, 14, 21, 28, 35, 42, 60, and 90, repeated mood assessment (good, ok, or bad) on days 2, 10, 16, 23, 30, and 37, and repeated craving assessment (high, medium, or low) on days 1, 3, 5, 8, 25, 32, and 39. Mood and craving were assessed to see how the social support from mentoring affected participants' quit experience.

**Acceptability.** Program acceptability was assessed using a 13-item Likert questionnaire. The key acceptability measure was overall satisfaction with the text-messaging program assessed by: "I liked participating in the iQuit Project" (1 "strongly agree" to 5 "strongly disagree"). We also created an acceptability index, consisting of the mean of all 13 items. Further, we performed a principal components factor analysis, retaining factors with eigenvalues  $\geq 1$ , to determine the intervention's effect on latent constructs of acceptability. The factor analysis yielded two factors, one for satisfaction and one for personalization.

**Engagement.** Participant engagement was defined as duration of interaction with the program and volume of messages sent and received. The key outcome ("days of engagement") was the number of days from enrollment until the last reply to a status assessment message (e.g., about smoking, mood, and cravings). Other measures included: proportion who unsubscribed (either by texting STOP or via email), mean days to unsubscribing, proportion who reset their quit date after being asked on their quit day "Are you ready [to quit]?", number of words sent by participants, median word count per message sent, number of messages sent, number of messages received, and number of replies to status assessment messages.

**User perceptions of treatment assignment.** Participants' perceptions of treatment assignment were assessed primarily based on correctly identifying the type of messages they received: automated, personal from a mentor, or both. Among the intervention group only, we also assessed 5-point Likert scale responses to several statements: "I prefer mentor texts over automated texts;" "automated and personal texts worked well together;" and "I was satisfied with my iQuit mentor."

**Covariates.** The screening and baseline questionnaires collected information on age, gender, income, race and ethnicity, frequency of cell phone usage (recoded to daily vs. other), average cigarettes per day, number of years smoking, number of past quit attempts, reasons for smoking (recoded to relieve stress vs. other), reasons for wanting to quit (recoded to improve health vs. other), time to first cigarette of the day, importance of quitting (0 to 10 scale), confidence in ability to quit (0 to 10 scale), and expected difficulty of quitting (0 to 10 scale).

## Data Analysis

We performed tests of difference in means by study group to observe balance of baseline characteristics by study group. We also assessed missingness, nonresponse at follow-up, and predictors thereof.

Abstinence outcomes were assessed on an intent-to-treat basis, in which those who did not report their smoking status at follow-up were counted as smokers, as recommended by experts.<sup>28</sup> Estimates of difference in abstinence by study group were derived from logistic regression models, both unadjusted and fully adjusted for baseline covariates. The effect of study group assignment on cigarettes per day at 3 months was assessed using complete cases. As a sensitivity analysis, missing data for the self-reported efficacy outcomes and baseline covariates were multiply imputed with chained equations using 100 iterations.<sup>29,30</sup> We did not impute biochemically verified abstinence due to the small number of reports upon which the imputation would be based.

Other outcomes were analyzed based on *t*-tests of differences in unadjusted means, using complete case analysis. Likert responses were recoded to assess the proportion of participants who agreed or strongly agreed with the statement.

A power analysis indicated that 200 participants per group would provide 80% power to detect an 11-percentage-point improvement in abstinence for the intervention group, assuming an 11% abstinence rate in the control group. The latter assumption was drawn from the observed abstinence rate in standard text messaging interventions for smoking cessation.<sup>6,7</sup>

Analyses were performed in Stata v14.2 (Stata Corporation, College Station, TX). All regressions included heteroskedasticity-robust standard errors.

## RESULTS

The peer-mentoring intervention was feasible to implement. Thirty-eight mentors completed the online training, 36 of whom proceeded to enroll in the study and mentored at least one participant (Supp. Table S2). While the quality and timeliness of mentor communications varied markedly, we did not observe any adverse events in a review of chat logs, nor did we receive any reports of adverse events from study participants.

### Sample Characteristics

Overall, 200 participants enrolled. Demographic and smoking-related characteristics of participants were balanced across study groups (Table 1). Participants were predominantly female (77.5%), middle aged (median age 45.0), non-Hispanic white (74.5%), and daily text message users (75.5%). Most participants were moderate to heavy smokers (median 15.0 cigarettes per day) and had previously attempted to quit (median 3 past attempts).

While baseline data were relatively complete (195 complete cases), only 98 respondents (49%) completed the follow-up questionnaire. Nonresponse was unrelated to most baseline characteristics (Supp. Table S3).

## Efficacy of Interventions

The primary outcome of biochemically verified 7-day point-prevalence abstinence at 3 months was 7.9% (8/101) in the mentor group and 3.0% (3/99) in the control group. Adjusting for baseline characteristics, abstinence was 6.5 percentage points higher in the mentor group than the control group (95% CI 0.7–12.3;  $p=0.03$ ), a 260% increase over the 2.5% abstinence in the control group.

In total, 111 participants provided information on self-reported abstinence at follow-up (56 in the control group, 55 in the mentor group). Self-reported 7-day point-prevalence abstinence at 3 months was 23.8% (24/101) in the intervention group and 13.1% (13/99) in the control group (**Error! Reference source not found.**). Adjusting for baseline characteristics, self-reported abstinence was 12.7 percentage points higher in the mentor group than the control group (95% CI 1.2–24.1;  $p=0.03$ ), a 99% increase over the 12.8% abstinence in the control group. Multiply imputing the missing abstinence data, the effect size increased to 19.3 percentage points in the unadjusted model (95% CI 2.9–35.6;  $p=0.02$ ) and 21.5 percentage points in the adjusted model (95% CI 6.8–36.2;  $p<0.01$ ).

Repeated abstinence during the intervention began to diverge between study groups about 3 weeks post-quit date ( $p = 0.09$  for by-group difference in Week 3 vs. Week 2) and differences remained stable thereafter (Supp. Figure S2, Panel A); importantly, the proportion responding to smoking status assessment messages did not differ by study group. Mentored participants also experienced fewer cravings and better mood than the control group starting within one month post-quit date (Supp. Figures S3 and S4, Panel A).

The number of cigarettes per day decreased by 3.3 among intervention participants, compared with control participants, adjusting for baseline cigarettes per day and other covariates ( $p<0.01$ ) (Supp. Table S5). The results were robust to imputing missing outcome data.

## Program Acceptability

Program acceptability was high in both study groups; 78.3% of the intervention group liked participating in the trial compared to 72.9% in the control group (unadjusted difference 5.3, 95% CI -12.4–23.1;  $p=0.55$ ) (Table 2, Panel A). There was no difference by group in the acceptability index. While satisfaction derived from a factor analysis did not differ by group, personalization was 0.5 standard deviations greater in the mentor group than control group (95% CI 0.1–0.9;  $p=0.02$ ). This is consistent with increases in items heavily loaded on personalization, e.g., the messages “were created for me personally” (16.2-point increase for intervention vs. control groups,  $p=0.09$ ) and “made me feel someone cared if I quit” (28.2-point increase,  $p<0.01$ ). Moreover, the mentor group reported that the texts “made me feel I knew how to quit” (21.5-point increase,  $p=0.03$ ).

## Engagement

Participants’ mean days of engagement and proportion unsubscribing did not differ by study group (Table 2, Panel B). Intervention participants were more likely to reset their quit date (11.9% vs. 2.0%,  $p<0.01$ ). They also sent significantly more words, more messages, and more words per message, and received more messages. For example, they sent 22.7 more messages on average than the control group ( $p<0.01$ ). However, intervention participants were not more likely to reply to assessment messages about smoking, mood, and craving status.

Overall, mentors showed strong engagement (Supp. Table S2). Of the 38 who completed the training, 36 (94.7%) mentored  $\geq 1$  participant and 32 (84.2%) remained in the program for the duration of

the trial. All mentors who had  $\geq 1$  mentee communicated through spontaneous (not automated) messages, sending an average of 24.5 messages per participant (range 1 to 215). On average, spontaneous messages constituted about one of every five messages received by participants (18.6%).

### **User Perceptions of Treatment**

Participants tended to correctly identify whether they had received automated messages only (89.6% of the control group) or a combination of automated and personalized messages (78.9% of the intervention group) (Table 2, Panel C). The intervention group tended to prefer the personalized texts from mentors over the automated texts (66.0%), and most intervention participants were satisfied with their mentor (81.0%).

## **DISCUSSION**

We found that our novel intervention combining peer mentoring and automated text messages was feasible and acceptable. The pilot results indicate promising early efficacy for the mentoring intervention, nearly doubling self-reported smoking abstinence and more than doubling biochemically verified abstinence at 3 months. Self-reported abstinence at 3 months in our control group was nearly identical to self-reported abstinence at 3 months observed in prior work of SmokefreeTXT (13.1% vs. 12.9%),<sup>9</sup> which may lend generalizability to our findings. On the one hand, our results are broadly consistent with a meta-analysis of telephone quitline counseling that found it increased quit rates by 1.4 times compared to self-help or brief counseling.<sup>31</sup> Yet, the use of quitlines is low<sup>32</sup> and they appear to be less appealing to the millions of smokers who have sought mobile phone-based quit assistance.<sup>33,34</sup> Text message-based support may offer an appealing alternative to these smokers. On the other hand, our results stand in contrast to null results found in randomized trials of buddy and partner interventions designed to

enhance social support for smoking cessation.<sup>35,36</sup> One potential difference is that mentor support in our trial was not layered on top of an intervention that already provided interpersonal support.<sup>18</sup> Further work is needed to assess whether mentors provide more effective support than a buddy or partner, who are often in the process of trying to quit themselves. In contrast, mentors in our study were able to draw on past experience in providing support to their mentees for quitting.

Our intervention diverges from the existing literature on mobile phone-based interventions for smoking cessation by pairing automated content with personalized responses from real individuals.<sup>37</sup> Several studies have shown that tailored automated text messages (e.g., by stage of change, demographics, and self-efficacy) can promote smoking abstinence,<sup>38-40</sup> and it will be important to determine whether personalized responses from mentors can outperform automated tailored content.

To our knowledge, former smokers have never been enlisted as peer mentors in a smoking cessation intervention. Former smokers perhaps uniquely understand the challenges involved in quitting smoking. Harnessing their past experiences may make them powerful and relatable “brand ambassadors” for a smokefree lifestyle. It may be that mentoring can help to stave off relapse, perhaps by solidifying former smokers’ identity as non-smokers. Former smokers represent an untapped resource meriting further attention from researchers.

The intervention effects on participant engagement were mixed. Mentored participants were not less likely to unsubscribe, nor more likely to reply to status assessment questions. It is possible that mentored participants who were communicating regularly with their mentors felt less of a need to respond to status assessment questions. Not surprisingly, mentored participants sent and received a much greater volume of messages. Greater use of quit date resets also points toward greater engagement. More work is needed to determine how best to engage smokers in texting interventions. Promising directions for future research may include tailoring messages to key user characteristics and leveraging principles of gamification to increase a user’s motivation and enjoyment.<sup>39,41-43</sup>



The combination of mentoring and automated texts appears to have created a generally positive user experience. Participants were generally satisfied with their mentor and thought the combination of automated and personalized messages worked well together. Yet, 21% of mentored participants believed they had received automated messages only, suggesting opportunities to further refine the intervention.

This study has several limitations. First, as a pilot trial aiming to test feasibility and early efficacy, it was not adequately powered to test certain relationships. A larger study with longer follow-up is needed to replicate our findings. Second, nonresponse at final follow-up was high, and may be associated with smoking status. Our analytic approach of retaining all randomized participants and assuming nonresponders continued to smoke is consistent with current statistical practice and has been recommended by experts for reducing bias relative to leaving out nonresponders or classifying them as non-smokers.<sup>28,44</sup> We also tested sensitivity of the results to multiple imputation. Nonresponse is related to low retention rates that have been common among text-messaging programs (e.g., 61% failed to complete the program in a study of >25,000 SmokefreeTXT users<sup>9</sup>). While nonresponse for biochemical verification was high, it is unlikely to have greatly affected interpretation of our results; experts suggest that biochemical verification is unnecessary in population-based studies,<sup>45</sup> and self-reports tend to be accurate in most studies,<sup>46</sup> including for text-messaging interventions<sup>47</sup> especially in cases where contact is remote.<sup>48</sup> In our study, only one participant who self-reported having abstained subsequently failed to test negative for cotinine (due to an inconclusive photograph of the test result). Third, our intervention bundled changes to the standard care messages, as well as addition of a peer mentor, and we cannot disentangle these effects. Fourth, excluding NRT and ENDS users at enrollment increased reliability of outcome measurement, but at the potential cost of reduced generalizability. Overall, 26 participants (15 in the control group) used NRT and 14 (7 per group) used ENDS during the trial, although only three of these participants submitted a saliva test result. Fifth, mentors were nominally paid part-time volunteers, not full-time professionals. Thus, they did not always respond promptly or appropriately to participants. In this respect, the pilot is more akin to a pragmatic trial than efficacy trial. Weak mentor engagement may reduce the efficacy of the intervention though the mentoring intervention was designed to minimize

the burden on mentors. A tradeoff exists between having more intensive mentor involvement and overburdening mentors.

In summary, this pilot trial showed that peer mentoring combined with automated texting for smoking cessation is feasible, acceptable, and effective. A cessation program that enlists successful program participants to stay on as peer mentors may present one scalable and sustainable model worthy of investigation. Future studies should also seek to establish how best to structure the mentoring arrangements, including how much to pay them and how great of a workload they can handle. Digital peer mentoring is a relatively low-cost option that might appeal to smokers in need of quitting support.

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## **DECLARATION OF INTERESTS**

None declared.

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Table 1. Baseline Characteristics by Study Group

	Control Group (N = 99)	Mentor Group (N = 101)	Difference in Means
<i>Demographics</i>			
Male (%)	20.2	24.8	4.6
Age (mean $\pm$ SD)	43.3 $\pm$ 12.5	44.3 $\pm$ 12.2	1.0
Income (%)			
Less than \$20,000	38.4	27.7	-10.7
\$20,000 - \$39,999	25.3	24.8	-0.5
\$40,000 - \$74,999	22.2	18.8	-3.4
\$75,000 or more	8.1	15.8	7.8*
Decline to report	6.1	12.9	6.8
White (%)	75.8	73.3	-2.5
Send text messages daily (%)	73.7	77.2	3.5
<i>Smoking characteristics</i>			
Cigarettes per day (mean $\pm$ SD)	20.9 $\pm$ 20.6	17.8 $\pm$ 16.0	-3.1
Number of years smoking (mean $\pm$ SD)	26.5 $\pm$ 13.1	26.9 $\pm$ 12.5	0.5
Days until quit date (mean $\pm$ SD)	14.3 $\pm$ 3.6	14.0 $\pm$ 3.3	-0.3
Number of past quit attempts (mean $\pm$ SD)	5.1 $\pm$ 6.0	4.0 $\pm$ 4.2	-1.2
Smoke to relieve stress (%)	61.6	53.5	-8.2
Quit to improve health (%)	52.5	54.5	1.9
Minutes to first cigarette of the day (%)			
5 or less	44.4	38.6	-5.8

6 - 30	42.4	39.6	-2.8
31 - 60	8.1	14.9	6.8
More than 60	5.1	6.9	1.9
Importance of quitting (0-10) (mean $\pm$ SD)	9.6 $\pm$ 1.1	9.6 $\pm$ 0.8	-0.0
Confidence in ability to quit (0-10) (mean $\pm$ SD)	7.1 $\pm$ 2.8	6.9 $\pm$ 2.6	-0.2
Expected difficulty of quitting (0-10) (mean $\pm$ SD)	8.8 $\pm$ 1.8	9.0 $\pm$ 1.6	0.2

Note: This table reports mean (and standard deviation) for baseline characteristics by study group status, as well as the difference in means. All variables had 200 observations, with the exception of number of years smoking (n=196), number of past quit attempts (n=199), and confidence in ability to quit (n=199). Stars indicate significance from *t*-tests of the equality of means. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 2. Acceptability, Engagement, and User Perceptions of Intervention by Study Group

	(1)	(2)	(3)	
	Control	Mentor	Difference	
	Group	Group	in Means	N
<i>Panel A. Acceptability</i>				
Agreed or strongly agreed with the statement (%):				
"I liked participating in the iQuit Project"	72.9	78.3	5.3	94
"I would recommend iQuit to a friend trying to quit"	79.2	78.3	-0.9	94
"Texts contained helpful info. on quitting"	77.1	82.6	5.5	94
"Texts helped me try to quit smoking"	62.5	73.9	11.4	94
"Texts arrived at the right time"	45.8	44.4	-1.4	93
"Texts were created for me personally"	22.9	39.1	16.2*	94
"Texts should have been sent more frequently"	45.8	26.1	-19.7**	94
"Texts should have been sent less frequently"	8.3	10.9	2.5	94
"Texts applied to me specifically"	31.2	32.6	1.4	94
"Texts made me feel someone cared if I quit"	50.0	78.3	28.3***	94
"Texts made me think it worthwhile to quit"	66.7	80.4	13.8	94
"Texts made me feel I knew how to quit"	56.2	77.8	21.5**	93
"Texts gave me confidence that I can quit"	56.2	60.9	4.6	94
Acceptability index (mean of all questions) (mean $\pm$ SD)	2.5 $\pm$ 0.8	2.4 $\pm$ 0.7	-0.2	94
Factor analysis: satisfaction factor (mean $\pm$ SD)	0.1 $\pm$ 1.0	-0.1 $\pm$ 0.9	-0.2	93
Factor analysis: personalization factor (mean $\pm$ SD)	-0.2 $\pm$ 1.1	0.3 $\pm$ 0.8	0.5**	93
<i>Panel B. Engagement</i>				
Days of engagement (mean $\pm$ SD)	42.1 $\pm$ 16.0	44.9 $\pm$ 18.3	2.7	139
Unsubscribe (%)	15.2	17.8	2.7	200

Days to unsubscribing (mean $\pm$ SD)	19.5 $\pm$ 15.4	17.8 $\pm$ 14.4	-1.7	33
Reset quit date (%)	2.0	11.9	9.9***	200
Number of words sent by participants (mean $\pm$ SD)	28.2 $\pm$ 61.2	338.3 $\pm$ 888.3	310.1***	200
Median word count per msg. sent by participants (mean $\pm$ SD)	1.3 $\pm$ 1.4	5.1 $\pm$ 7.1	3.8***	200
Number of messages sent by participants (mean $\pm$ SD)	11.7 $\pm$ 13.9	34.4 $\pm$ 56.0	22.7***	200
Number of messages received by participants (mean $\pm$ SD)	104.6 $\pm$ 34.2	123.0 $\pm$ 59.5	18.3***	200
Number of replies to status assessment questions (mean $\pm$ SD)	6.4 $\pm$ 6.9	6.6 $\pm$ 7.6	0.2	200

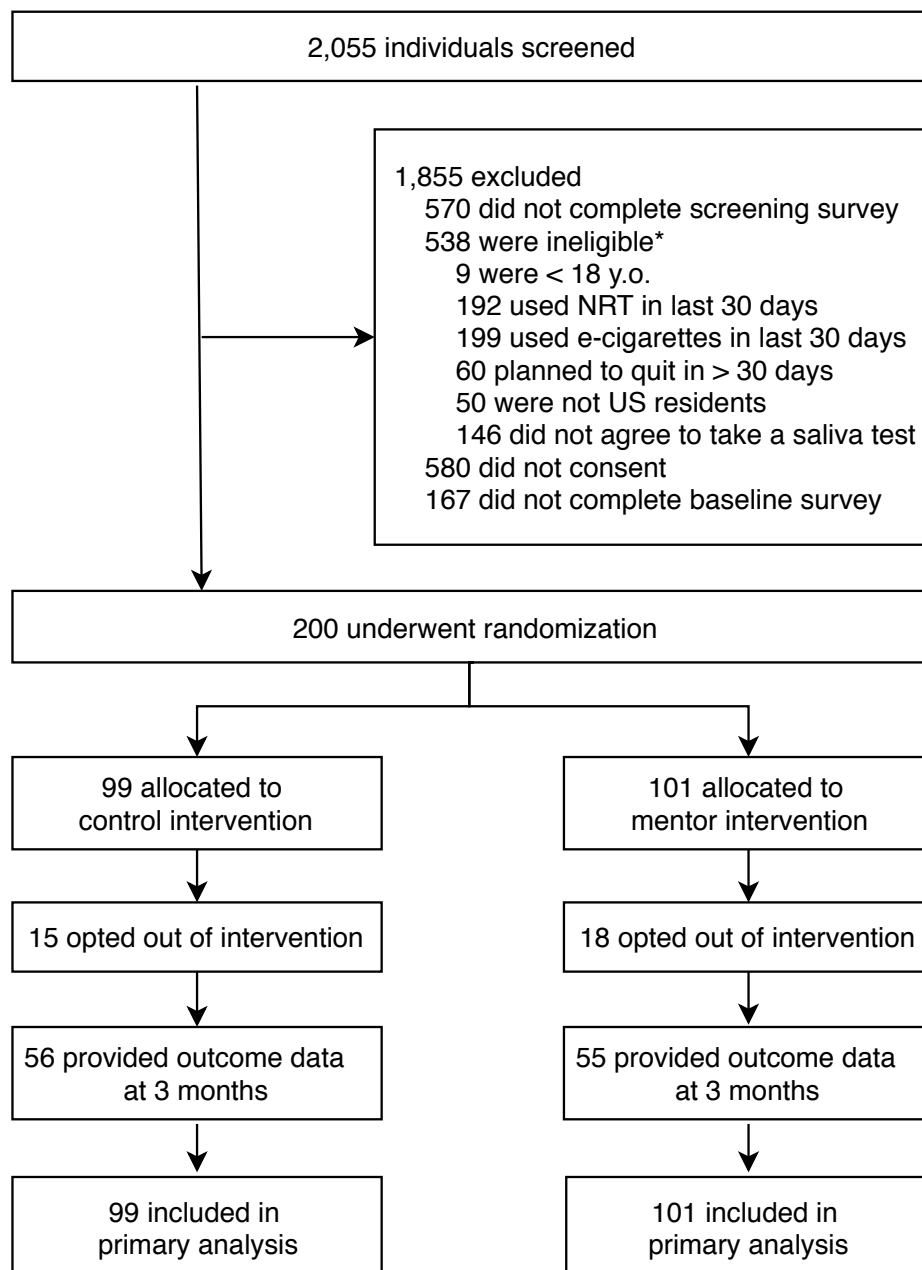
*Panel C. User Perceptions of Treatment Assignment*

Agreed or strongly agreed with the statement (%):

"Believe they received any personal texts"	10.4	89.4	78.9***	95
"Prefer mentor texts over automated texts"	-	66.0	-	95
"Automated and personal texts worked well together"	-	69.6	-	26
"I was satisfied with my iQuit mentor"	-	81.0	-	47

Note: Columns 1 and 2 contain the mean (and standard deviation) for each study group. Column 3 indicates the difference in means between the study groups. Column 4 contains the total number of respondents. Stars indicate significance from *t*-tests of the equality of means. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Statements in quotation marks (Panels A and C) were asked on a Likert scale from 1 = strongly agree to 5 = strongly disagree, and are displayed as percentages of respondents who (strongly) agreed. The acceptability index (Panel A) is the mean of all Likert-scaled acceptability survey questions in which the respondent (strongly) agreed. The satisfaction and personalization factors (Panel A) were determined using a principal components factor analysis on the full set of acceptability survey questions.

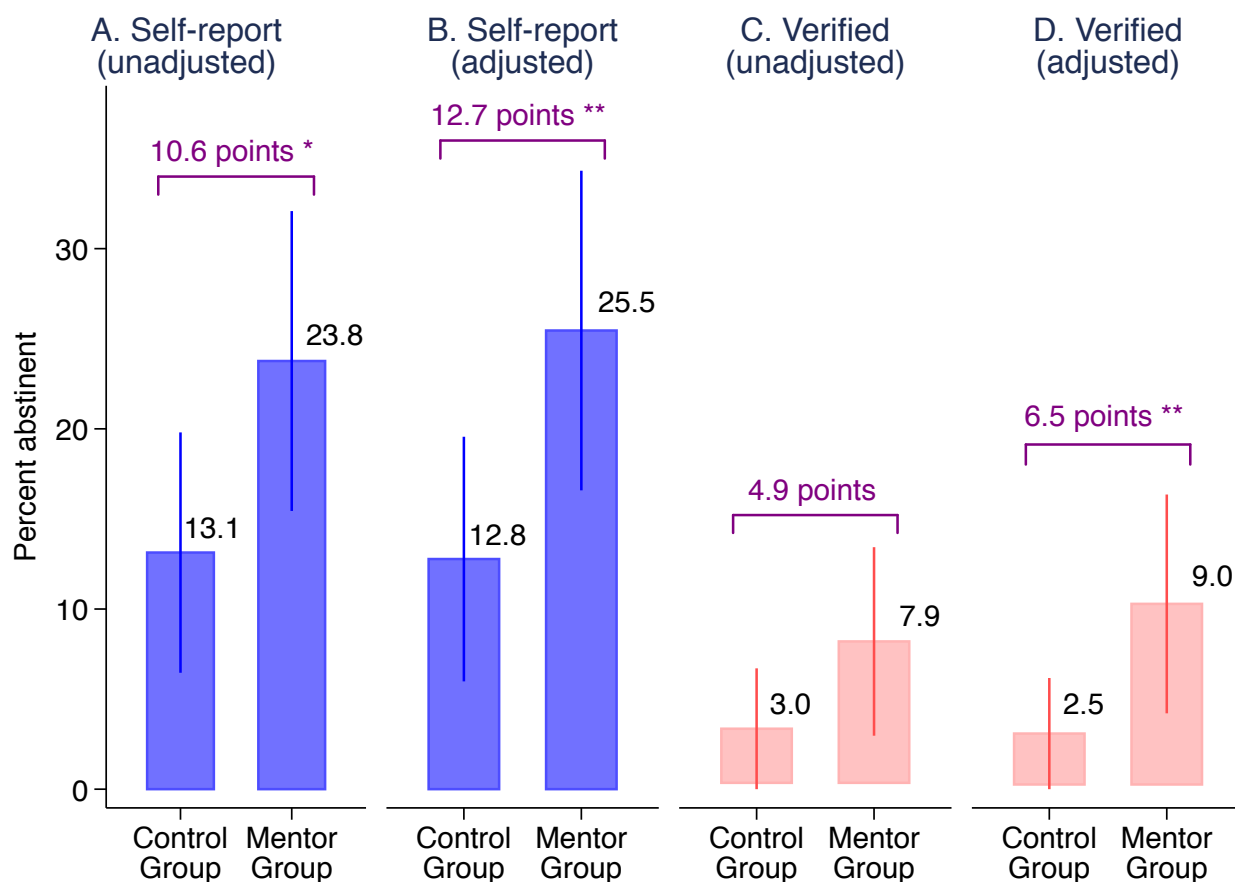
Figure 1. Study Flowchart



\* Individuals may be ineligible due to more than one factor.

Note: Individuals who opted out of the intervention were still contacted as part of follow-up procedures.

Figure 2. Effect of Study Group Assignment on 3-Month Smoking Abstinence  
(Intent-to-Treat)



Note: This figure shows the intent-to-treat effect of the mentor intervention on 7-day point prevalence abstinence 3 months after the person's quit date. The estimates are derived from logistic regression models. The adjusted models in Panels B and D adjust for the full set of baseline covariates listed in Table 2. The outcome variable is self-reported abstinence in Panels A and B and biochemically verified smoking status in Panels C and D. The full regression output is provided in the Supplement. The error bars represent 95% confidence intervals, based on robust standard errors. Above each panel is the difference in means between study groups and significance stars from a *t*-test on the study group coefficient. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$