Tailored behavioral support for smoking reduction: development and pilot results of an innovative intervention

Arnold H. Levinson1,2*, Russell E. Glasgow3, Bridget Gaglio3, Tammy L. Smith1,2, Jana Cahoon3 and Alfred C. Marcus1,2

Abstract

Reduction of smoking may increase the likelihood of eventual smoking cessation among those not ready to quit. We describe the development and acceptance of a smoking-reduction intervention that integrates telephone counseling sessions with newsletters. A computer-assisted telephone interviewing program generates real-time-tailored counseling delivered by lay interviewers. Pilot participants (n = 53) were adult smokers scheduled for outpatient procedures in a health maintenance organization, randomized to intervention or a control condition (quarterly mailings). Smoking levels were measured by self-report and biochemically. Among intervention participants continuing at 3 months, all but one rated their telephone support person positively on all dimensions. Counseling calls were ‘about right’ in number, and newsletters were perceived as quite personal. Intervention recipients reported smoking significantly fewer mean cigarettes per day at 3 months than at baseline, and significantly fewer than control participants. Comparisons were non-significant under intent-to-treat analyses and on biochemical measures. The program was well received by outpatients who were not ready to quit smoking, and was implemented successfully by telephone staff who had no previous smoking cessation counseling experience. An ongoing trial is evaluating effectiveness, cost and relationship to eventual cessation.

Introduction

Although one in four US smokers uses help when trying to quit [1], proven cessation strategies fail to attract most smokers [2–7], and only 25–35% of those who do use help achieve long-term cessation [2, 8–13]. For the majority of smokers who will not try cessation support or do not successfully quit, considerable scientific interest has focused on the possibility of reducing the harm they face from cigarettes [8, 14–17]. Approaches range from replacing conventional cigarettes with smokeless or other tobacco products, to use of other devices, changing the way cigarettes are smoked, or reducing the number of cigarettes smoked [18]. Research on harm reduction for smoking is needed to assess its feasibility, long-term impact on smoking cessation, and health effects [19–22]; a recent study reported that lung cancer risk is reduced among smokers who cut back their smoking by ≥50% [23].

In many countries outside the United States, smoking-reduction and other harm-reduction strategies have received considerable research and programmatic attention [24].

A randomized trial is currently underway to assess a tailored smoking reduction (TSR) intervention, based on social–cognitive and social–ecological theory, to help smokers reduce daily cigarette
consumption by two-thirds or more [25]. The ongoing trial provides the basis for the current paper, which describes the intervention and reports the results of a pilot study.

The TSR intervention being tested for smoking reduction incorporates a standard treatment for smoking cessation, namely behavioral telephone counseling [12, 26]. In general, counseling about smoking is delivered either face-to-face or by telephone. The face-to-face mode is impeded by barriers such as cost, transportation difficulties or perceptions that the method connotes mental illness or is emotionally intrusive [27–30]. In contrast, telephone counseling ‘quitline’ services are free to the user, have been found effective [25, 28, 31, 32], are directly operated by >30 states [33], and are nationally available under a federal initiative [34]. In a large state-level study, smokers trying to quit were four times as likely to use quitlines as face-to-face programs that made the same promotional effort [35]. The TSR intervention uses the telephone to deliver counseling for smoking reduction as a key part of the program.

Smoking cessation counseling typically includes problem solving and coping skills to manage psychological and social–environmental pressures that reinforce smoking or promote relapse—internal urges, external temptations, social invitations, etc. [12]. Comprehensive cessation counseling addresses not only physiologic dependence and tolerance but also affective [36], behavioral and social dependencies [37, 38]. Several of these approaches are incorporated into the TSR intervention for smoking reduction.

Cessation counselors have widely varying background and training in terms of clinical care, smoking cessation strategies and counseling skills [39–41]. In theory, counselor characteristics and training might influence cessation success, but to date this possibility has received little research attention. The current report explores the feasibility of delivering counseling for smoking modification through interviewers who have no training in clinical services or counseling.

The TSR intervention combines telephone counseling with written newsletters that are produced by computer technology and expert systems to generate individually tailored contents [42–57]. To our knowledge, the combination of telephone counseling with tailored print has not previously been used as the primary intervention modality for smoking reduction. Tailoring increases the ‘self-relevance’ of print material for subjects, so the material is more likely to be read, comprehended and remembered, and can produce significant behavior change [58, 59] across a variety of cancer control outcomes (e.g. smoking cessation, diet and nutrition, cancer screening, perceptions of risk). Tailoring in the current intervention is ‘ipsative’, i.e. it provides feedback that explicitly compares a person’s current and previous behavioral performances. Ipsative tailoring may be more effective than tailoring that has no feedback or which compares the person’s current performance with a population norm [53].

This report has two primary objectives:

(i) to describe development of an expert computer-assisted telephone interviewing (CATI) system that enables non-professionals employed as telephone interviewers to deliver the behavioral counseling component of the TSR intervention;
(ii) to report the TSR intervention’s feasibility and acceptance among study participants.

Methods

Research design

The TSR intervention is designed for patients undergoing outpatient surgery or invasive screening (e.g. colonoscopy or mammography) in a large managed care organization. The focus on patients anticipating a medical procedure is based on knowledge that the situation can prompt individuals to re-evaluate smoking behaviors [60]. Study enrollees are adults (aged 18+) who smoke >10 cigarettes per day (CPD). They are randomized to receive the TSR intervention or generic health education materials from the managed care organization (Fig. 1). Smoking reduction is assessed twice, at 3 and 12 months after enrollment. Primary outcomes
are self-reported number of CPD and biomarkers of smoking. Future analyses will also explore potential psychosocial mediators (self-efficacy, autonomy support, perception of barriers.)

**Intervention overview**

Delivery occurs across a 6-month period and consists of four telephone counseling sessions, four tailored newsletters and a final, targeted newsletter (Fig. 2). The educational and behavioral strategies apply theoretical elements of harm reduction [61], self-efficacy [62], risk perception [63] and outcome expectancies [64]. The overall objective is to (i) establish an individually tailored schedule for smoking progressively fewer CPD, (ii) identify barriers to achieving the reduction goals and (iii) provide tailored guidance and support for self-management of nicotine dependence, social and environmental cues to smoke, individual high-risk situations for smoking [65], and strategies for reducing the number of cigarettes smoked each day. Nicotine replacement therapy was not offered to accommodate peer-reviewer concerns that it is not approved in the United States for use by individuals while they continue to smoke.

The starting point for intervention development was creation of a matrix in which each dimension of guidance and support was assigned to one or more...
specific intervention calls and/or newsletters. Location and frequency in the delivery sequence were chosen through team discussion of theoretical considerations and previous experience with smoking-reduction studies [66]. The intervention sequence was (i) timed to take advantage of the anticipated medical procedure as a ‘teachable moment’ to motivate initial reduction efforts, (ii) designed to fade gradually over time, (iii) timed to coincide with key decision points in the process of making significant, long lasting reductions and (iv) designed to make efficient use of alternating phone and newsletter contact to provide the ‘minimal intervention intensity necessary for change’ (R. Croyle, personal communication). The telephone sessions were tailored in real time while participant data were being collected, in order to respond appropriately to the amount of progress toward the reduction objective. Each newsletter that followed a tailored call was then tailored to new information from the call.

**Telephone calls**

**Call-support software**

The study call center is a core survey research unit for a National Cancer Institute-designated comprehensive cancer center. The unit typically conducts large numbers of CATI for cancer research studies. The CATI-based interviewers, like those employed in similar call centers around the country, are trained to (i) deliver scripted questions exactly as written, (ii) mark automated responses or record verbatim responses using a software program adapted to the specific study and (iii) rely exclusively on scripted language to handle ambiguity or uncertainty from respondents. Unlike most telephone quitline specialists, CATI interviewers usually have no formal education in a health- or counseling-related discipline.

For the current study, the research team determined that the CATI software would need to script the interviewers to respond to almost any situation that a participating smoker might present. For example, the baseline counseling interview needed separate script branches to address varying levels of anxiety about efforts to reduce smoking by one-third, which was the initial reduction goal based on average number of CPD. Subsequent calls required script branches to address various success–failure sequences that a participant might have experienced by the time of the call.

Development of each call started with a conceptual planning meeting that produced a branching outline of issue-and-resolution paths (sample flow diagram, Fig. 3). The outline was reviewed to ensure that key theoretical intervention components were addressed. The call was then fully scripted, reviewed by investigators and programmed into CATI software. Interviewers and research staff beta tested each call for logic and completeness; several rounds of review and revision were usually required.

**Interviewer selection, characteristics and training**

Already employed interviewers who were interested in working on the study were invited to participate in training and role-playing sessions and to conduct baseline interview calls during the study’s pilot phase. The research team monitored the activities and selected interviewers for the main study based on demonstration of two related abilities—forming alliances with participants to support their smoking reduction and delivering scripted interventions in one’s own words with fidelity to expert content. The seven interviewers on the pilot study included both sexes; five were college undergraduates in their early 20s, one was a graduate student in his late 30s and one was a high school graduate aged 55 years. None had previous training or experience in psychosocial counseling or smoking cessation counseling.

Initial training provided an overview of the project, and a specific training session was conducted for each call so interviewers would become familiar and comfortable with the contents and flow. Call-specific training sessions lasted two half days and included question-by-question analysis, review of designated opportunities for interviewers to provide support and counseling and supervised role-playing exercises. Additional training sessions strengthened...
Fig. 3. Sample counseling call flow diagram (second call).
interviewer skills for helping participants. Topics included motivational interviewing, reinforcement of the helping role; encouragement of individual language choice with content fidelity, active listening and ways to help participants enhance self-efficacy.

Throughout the study, supervisory staff extensively monitored live calls and provided feedback for quality control and improvement. When not conducting calls, interviewers were encouraged to enhance skills by practicing scenarios they had not recently encountered, reviewing call content and purpose and rehearsing calls using their own language. The purpose was to enhance their abilities to depart from the familiar CATI role of strict script-readers.

Newsletters
Each issue contained educational pieces from established sources on management of issues related to smoking reduction, such as stress, weight, social environment and relapse prevention. A self-assessment quiz helped participants reflect on their reasons for smoking. Each newsletter carried a regular column by the managed care organization’s Chief of Preventive Medicine, and a serial soap-operatic tale that followed the progress of a gender-matched fictitious reducer going through the program. Serial episodes depicted content corresponding to the participant’s assessed experience to date with the TSR intervention. Three newsletters were tailored by providing reinforcement and strategic feedback based on the participant’s relevant experiences recorded during the most recent telephone interview, i.e. either congratulations and reinforcement of successful goal achievement or normalization of failure and reinforcement of strategies for continuing to work toward a missed goal. In addition, some articles were tailored to the presence or absence of children or family in the home and to individual motivations for reduction.

The newsletter ‘look and feel’ was developed by a media subcontractor, then tested, along with the tentative masthead title (Smoking Less, Living More!), in a focus group of conveniently sampled managed care organization members who met intervention eligibility criteria. Additional focus groups provided feedback on specific newsletter contents.

Pilot study design, sampling and eligibility
The purpose of the pilot study was to test and debug all elements of recruitment, randomization, assessment and intervention delivery. The pilot was conducted in the Kaiser Permanente Colorado (KPCO) health care system, with institutional review board approval. KPCO is a not-for-profit, staff model managed care organization with ~480,000 members. Smoking status of KPCO members is recorded in their electronic medical record, and adult smoking prevalence was estimated at 18% when the pilot study began. Participants were recruited from the same eligibility pool as the main study uses, namely computer-generated lists of smokers aged 18+ scheduled to undergo outpatient surgery or an invasive screening procedure within the next 3 weeks. Potentially eligible patients received an invitation letter from the KPCO Chief of Preventive Medicine explaining the research program as well as other smoking control opportunities. Patients who did not return an ‘opt-out’ postcard received a call from the Survey Research Unit offering them a choice of help in reducing smoking, help in quitting smoking altogether or neither [25]. The choice of quitting or reducing was offered with an explanation that quitting ‘is the best way to reduce your risk of getting diseases from smoking’, and reducing ‘is not proven to reduce the risk of diseases from smoking, but scientific evidence shows that it might reduce the risk’. Telephone interviewers confirmed that the respondent was smoking >10 CPD, administered a baseline interview to participants who consented to participate in the smoking-reduction study and randomized each participant to the TSR intervention or control condition. The baseline interview was completed during the initial enrollment call. After baseline telephone assessment, participants in the control condition received the KPCO quarterly health class schedule; available classes ranged from weight management to chronic illness.
Data collection and outcomes

Information used for tailoring the intervention was collected by interviewers during counseling calls. Self-reported CPD was computed from answers to a pair of questions about workday smoking and non-workday smoking [(5 times workday smoking plus 2 times non-workday smoking) divided by 7]. Reduction goals were based on computed CPD. Intervention acceptance and smoking-reduction outcomes were assessed at 3 months after enrollment using mailed questionnaires that were returned in person and discussed with study staff. Participants were informed that their telephone specialist would not learn how each participant responded. Questions measured readership of each newsletter (1 = all, 5 = almost none) and satisfaction with the number of support calls (1 = too many, 5 = too few), newsletter tailoring (1 = not personalized, 5 = very personalized) and telephone interviewer qualities presented as dichotomous characteristics (e.g. ‘friendly’ or ‘not friendly’). Self-efficacy to reduce smoking was assessed by asking for a numeric response to a question about confidence (0 = not at all confident, 100 = very confident) to reduce smoking by one-third of the current CPD. Smoking-reduction outcomes were assessed by self-report and biochemically (expired carbon monoxide (CO), saliva cotinine). During the baseline call, participants were advised to maintain their smoking level before meeting with study staff to provide samples. Expired CO was measured in expiration, and cotinine in saliva samples evaluated at the Clinical Pharmacology Laboratory, San Francisco General Hospital.

Analysis

The current report includes descriptive proportions and means with 95% confidence intervals (CIs) of intervention acceptance, and comparisons (two-sided \( \alpha = 0.05 \)) by treatment condition of change in self-reported CPD (dichotomized as \( \geq 50\% \) or \(< 50\% \) reduction) and biomarkers (\( t \)-tests for continuous measures, Fisher exact for categorical measures). Some biomarkers were transformed for normal distribution before analysis. Both complete-case and intention-to-treat analyses are reported.

Results

Details of recruitment reach and response are reported elsewhere [25]. In brief, 236 eligible patients were contacted, of whom 22% enrolled in the pilot study of smoking reduction, 12% chose support to quit smoking altogether and 66% declined both types of support. The reduction, cessation and non-participation groups did not differ in age, gender, education, cigarettes smoked per day, receipt of past year clinical advice to quit or readiness to quit. Those who chose reduction were more likely than the other two groups to be white non-Hispanic and less likely to have attempted quitting in the previous year.

Sample description and participation

Pilot study participants (\( n = 53 \)) were mostly white non-Hispanic (Table I) and middle aged (mean 55 years). Twenty-eight percent had no more than high school education, 62% were women and most were middle aged. Mean cigarette consumption was slightly more than 20 CPD, and average duration of smoking exceeded 30 years. Most participants had recently received clinical advice to quit, but few were planning to do so in the next month. After randomization, the two study groups were similar in age, sex, ethnicity, education or smoking-related characteristics, but not baseline self-efficacy to quit smoking (mean score for intervention condition = 49 versus 28 for controls, where 0 = not at all confident and 100 = very confident; \( P = 0.01 \)) or to reduce smoking (53 versus 30, \( P < 0.05 \)).

Study dropout was higher among intervention than control participants (37% versus 8%, \( P = 0.01 \)). Attrition in the intervention group was associated with higher baseline smoking levels (27.4 versus 17.4 CPD, \( P = 0.02 \)) and indicators of dependence (smoking urge strength at morning awakening) but was not associated with age, gender, self-efficacy to
reduce smoking, perceived general health, presence of co-morbidities or depression.

**TSR intervention acceptance**

Sixteen of 17 intervention participants remaining at 3 months said their telephone support person had been friendly, helpful, understanding, credible, knowledgeable, a good listener and supportive. The number of counseling calls was perceived as about right (mean 3.2, CI 2.9–3.5; 3 = about right, 4 = one or two too few). Participants read most of each newsletter (mean 1.6, CI 1.2–2.0; 1 = all of it, 2 = over half), and newsletters were perceived as quite personal (mean 4.1, CI 3.5–4.6; 5 = very personalized, 1 = not personalized).

**Smoking reduction**

At 3 months, intervention participants reported smoking significantly fewer mean CPD than at baseline and than control participants (Table II). Reduction in CPD was three times greater in the intervention group than in the control group.

<table>
<thead>
<tr>
<th>Table I. Study participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline characteristic</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Mean age (years)</td>
</tr>
<tr>
<td>Female (%)</td>
</tr>
<tr>
<td>White non-Hispanic (%)</td>
</tr>
<tr>
<td>High school graduation or less (%)</td>
</tr>
<tr>
<td>Age started smoking (years)</td>
</tr>
<tr>
<td>CPD</td>
</tr>
<tr>
<td>Smoking-related health problem (%)</td>
</tr>
<tr>
<td>Attempted to quit, past year (%)</td>
</tr>
<tr>
<td>Clinician advised to quit, past year (%)</td>
</tr>
<tr>
<td>Considering quitting in next month (%)</td>
</tr>
<tr>
<td>Mean confidence in ability to quita</td>
</tr>
<tr>
<td>Attempted to reduce, past year (%)</td>
</tr>
<tr>
<td>Mean confidence to reduce by one-thirda</td>
</tr>
<tr>
<td>Completed 3-month assessment (%)</td>
</tr>
<tr>
<td>Received first counseling session (%)</td>
</tr>
<tr>
<td>Received second counseling session (%)</td>
</tr>
<tr>
<td>Received third counseling session (%)</td>
</tr>
</tbody>
</table>

\*0 = not at all confident, 100 = very confident. *P < 0.05, **P = 0.01.

<table>
<thead>
<tr>
<th>Table II. Changes in measures of smoking, difference from baseline at 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in CPD (self-reported)</td>
</tr>
<tr>
<td>Complete case analysis</td>
</tr>
<tr>
<td>Intent-to-treat analysis</td>
</tr>
<tr>
<td>&gt;=50% CPD reduction</td>
</tr>
<tr>
<td>Complete case analysis</td>
</tr>
<tr>
<td>Intent-to-treat analysis</td>
</tr>
<tr>
<td>Reduction in cotinine (ng/ml)</td>
</tr>
<tr>
<td>Complete case analysis</td>
</tr>
<tr>
<td>Intent-to-treat analysis</td>
</tr>
</tbody>
</table>

Significant difference between groups *P < 0.01, **P = 0.1.
A non-significant trend toward ≥50% reduction favored the intervention group. Although self-efficacy was imbalanced between conditions, including self-efficacy as a covariate did not change outcome comparisons (data not shown). Using intent-to-treat analysis, change from baseline, comparison between study groups at 3 months and relative reduction were non-significant.

Mean cotinine levels were slightly lower at 3 months than at baseline, with greater mean reduction for intervention than control participants (−35.6 versus −4.4 ng ml⁻¹) but large variability in both groups; the reductions and the difference between study groups were non-significant, as were CO comparisons.

‘Self-efficacy for smoking reduction’ was slightly lower at 3 months (mean 41.8) than at baseline (47.5); the difference was not significant. At 3 months, intervention participants had higher mean self-efficacy than control participants (53 versus 34, \( P < 0.05 \)).

**Discussion**

A combination of telephone counseling and tailored print materials was well received by surgical and screening outpatients who were not ready to quit smoking but wanted to reduce cigarette consumption. A much larger, ongoing controlled trial will evaluate the intervention’s efficacy, cost and relationship to eventual cessation.

All intervention patients but one said non-professional counselors were knowledgeable and compassionate. This level of acceptance is notable in light of the counselors’ total absence of prior training in counseling and smoking cessation. The finding is consistent with the view that a computer-based ‘expert system’ is sufficient to support lay workers providing telephonic counseling for smoking reduction. The main study will provide stronger information on this point, by asking participants to rate counselor attributes along a five-point scale (1 = not at all, 5 = extremely). Pilot study items asked only whether an attribute was present or absent (e.g. the counselor was ‘knowledgeable or not knowledgeable’), and respondents may have been loathe to say their counselor flatly lacked an attribute.

TSR intervention participants, but not control participants, reported significant reductions in daily smoking amounts 3 months after the study began. Mean cotinine levels were not significantly different across time points or between study groups. The null finding may be due to small sample sizes with large variability, or to intervention participants either underreporting CPD or engaging in compensatory smoking (i.e. deeper inhalation, lengthier burning of each cigarette) [59]. To explore compensatory smoking, we (i) estimated the ratio of cotinine to self-reported numeric CPD and (ii) projected hypothetical CPD reduction using cotinine-to-CPD ratios, for 16 intervention participants who provided saliva samples at both time points. Results suggest that intervention participants reduced their smoke intake, although maybe not by as much as CPD alone might suggest.

Nicotine replacement therapy (NRT) was excluded from the intervention because of grant-review concerns about safety among individuals who concurrently smoke. Since the project was awarded, cessation research has become more accepting of studies that involve NRT with concurrent smoking. For example, at least two recent studies [67, 68] found that quit-attempting smokers increased abstinence rates at 6 months while tolerating NRT patches that were administered starting 2 weeks before initial cessation dates. Future studies of smoking reduction should evaluate the inclusion of NRT as an adjunct to behavioral counseling.

Intervention-linked attrition is often encountered when the treatment condition increases opportunities to reconsider participation [69]. As Eysenbach notes, ‘in studies involving information and communication technology, usage of the intervention is mostly at the discretion of the participant, and the participant has the option to discontinue usage very easily. In any longitudinal study where the intervention is neither mandatory nor critical to the participants’ well-being, trial participants will be lost’[70]. This may well explain our attrition results. At the same time, a previous smoking cessation intervention study, like our pilot, also found an association
between attrition and higher cigarette consumption [71]. The possibility of such an association will be further explored in the main study.

In conclusion, the TSR intervention appears to be well received by smokers who are unwilling or unable to quit, and is feasible to implement by staff without experience in health education or smoking cessation counseling. Although the pilot study was not powered to evaluate efficacy, the intervention is currently undergoing such an evaluation in a randomized controlled trial.

Funding

National Cancer Institute (1R01CA90974-01).

Acknowledgements

Ed Lichtenstein provided helpful feedback to an earlier draft of this report.

Conflict of interest statement

None declared.

References

27. Zhu S-H, Rosbrook B, Anderson C et al. The demographics of help-seeking for smoking cessation in California and the
Tailored behavioral support for smoking reduction


Received on November 11, 2005; accepted on July 9, 2007