

Cost effectiveness of computer tailored and non-tailored smoking cessation letters in general practice: randomised controlled trial

A Scott Lennox, Liesl M Osman, Ehud Reiter, Roma Robertson, James Friend, Ian McCann, Diane Skatun, Peter T Donnan

Department of
General Practice
and Primary Care,
University of
Aberdeen,
Aberdeen
AB25 2AY
A Scott Lennox
clinical research fellow
Ian McCann
research assistant

Department of
Medicine and
Therapeutics,
University of
Aberdeen
Liesl M Osman
senior research fellow
James Friend
*professor of
respiratory medicine*

Department of
Computing Science,
University of
Aberdeen
Ehud Reiter
lecturer
Roma Robertson
research assistant
Health Economics
Research Unit,
University of
Aberdeen
Diane Skatun
research fellow

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Abstract

Objectives To develop and evaluate, in a primary care setting, a computerised system for generating tailored letters about smoking cessation.

Design Randomised controlled trial.

Setting Six general practices in Aberdeen, Scotland.

Participants 2553 smokers aged 17 to 65.

Interventions All participants received a questionnaire asking about their smoking. Participants subsequently received either a computer tailored or a non-tailored, standard letter on smoking cessation, or no letter.

Main outcome measures Prevalence of validated abstinence at six months; change in intention to stop smoking in the next six months.

Results The validated cessation rate at six months was 3.5% (30/857) (95% confidence interval 2.3% to 4.7%) for the tailored letter group, 4.4% (37/846) (3.0% to 5.8%) for the non-tailored letter group, and 2.6% (22/850) (1.5% to 3.7%) for the control (no letter) group. After adjustment for significant covariates, the cessation rate was 66% greater (-4% to 186%; $P=0.07$) in the non-tailored letter group than that in the no letter group. Among participants who smoked <20 cigarettes per day, the cessation rate in the non-tailored letter group was 87% greater (0% to 246%; $P=0.05$) than that in the no letter group. Among heavy smokers who did not quit, a 76% higher rate of positive shift in "stage of change" (intention to quit within a particular period of time) was seen compared with those who received no letter (11% to 180%; $P=0.02$). The increase in cost for each additional quitter in the non-tailored letter group compared with the no letter group was £89.

Conclusions In a large general practice, a brief non-tailored letter effectively increased cessation rates among smokers. A tailored letter was not effective in increasing cessation rates but promoted shift in movement towards cessation ("stage of change") in heavy smokers. As a pragmatic tool to encourage cessation of smoking, a mass mailing of non-tailored letters from general practices is more cost effective than computer tailored letters or no letters.

Introduction

Cigarette smoking continues to be a major preventable source of illness and premature death in Scotland. Intensive, expert-led interventions have relatively high success rates but reach only a small proportion of smokers. The real potential for reducing the national prevalence of smoking lies in the widespread implementation of brief interventions.^{1 2}

Two studies in North America investigated computer generated personalised letters as a method of encouraging smoking cessation.^{3 4} The numbers of participants, however, were small, and in neither study were smokers' claims to have stopped smoking validated biochemically. We believed that a larger study, with biochemical validation, was needed on a population with a wider socioeconomic range.

Methods

Our randomised controlled trial compared the effect on smoking cessation of a computer tailored letter, a non-tailored letter, and no letter. Ethical approval was obtained from the Grampian joint ethical committee.

Interventions

At the start of the study we sent all participants a questionnaire asking about their current smoking behaviour, attitudes to smoking, perception of barriers to quitting, and intention to quit in the next six months or in one month. After we received their questionnaire, we sent each participant a computer tailored letter, a non-tailored letter, or just a letter thanking them for participating in the study ("no letter").

Tailored letter—We developed a computerised system for generating tailored letters. The system determined the text to be included in each participant's letter, based on the answers given in the questionnaire. The phrases and decision rules were devised by experts on smoking cessation and on patient information, in collaboration with the developers of the software. The experts were informed by their clinical experience and their knowledge of various models of behaviour change,⁵ in particular the "stage of change" model of smoking cessation.⁶ How the letters were tailored is given in more detail on the BMJ's website.

Non-tailored letter—This was essentially a default tailored letter produced by scanning a blank questionnaire. To this extent, both interventions were expert interventions, based on a considerable input of time, knowledge, and experience.

No letter—We sent control participants a letter thanking them for their participation and informing them that they would receive material at the end of the study (either a tailored or a non-tailored letter, should either have been shown to be effective).

Recruitment

We recruited participants from smokers aged 17 to 65 years registered at six general practices in Aberdeen. From the computerised records of the practices we identified 7427 patients, who were sent a consent form and a questionnaire to collect information to form the basis of the tailoring. We sent two reminders at intervals of three weeks.

Assignment and mailing of the letters

After the questionnaires and consent forms were returned, we randomised the participants individually to the groups using computer generated random numbers. We mailed materials appropriate to each group immediately after randomisation.

Follow up

Follow up at six months was by postal questionnaire, with two reminders at intervals of three weeks. We attempted telephone follow up of non-respondents.

Outcome measures

The main outcome measure was point abstinence at six months. We validated self reports of smoking cessation by salivary cotinine assay.⁷ Participants lost to follow up and those whose report of cessation could not be confirmed biochemically were classed as continuing smokers.

We also measured movement in “stage of change” with respect to smoking, analysed as either a positive shift or null shift (no change or negative shift). Participants’ initial stage of change was obtained from the postal questionnaire and classified as “pre-

contemplator” (no intention to quit in the next six months), “contemplator” (intending to quit in the next six months), or “preparer” (intending to quit in the next month). The main economic outcome measure was cost effectiveness, expressed as the cost for each additional non-smoker at six months.

We estimated the abstinence rate at six months in the control group at 8%, based on reported rates of 7-11% in randomised controlled trials.⁸⁻¹⁰ Even a modest increase in the cessation rate would be clinically worthwhile. We therefore chose an increase from 8% to 13%. To detect this difference with a power of 80% at the 95% significance level required 590 participants in each group.

Methods of analysis

We used χ^2 tests to analyse categorical variables. Differences between groups were assessed by using analysis of variance. We used multiple logistic regression to assess relations between outcomes and group membership.¹¹ Analyses were adjusted for age, sex, level of social deprivation, heaviness of smoking, time to first cigarette of the day, and initial stage of change.

Results

Response rates and overall cessation rates

Of the 6155 valid mailings, 2612 responses were valid (42.4%). A total of 2553 participants did not withdraw, and the follow up rate was 78.1% (1995/2553). A total of 154 (6.0%) participants claimed to have stopped smoking after the intervention. Salivary samples for biochemical validation were obtained from 99 participants. Eighty nine participants were validated as having stopped smoking, giving an overall validated cessation rate of 3.5% (89/2553).

Characteristics of respondents

The groups were similar in age, sex, level of social deprivation, and initial stage of change. The percentage of heavy smokers was higher in the tailored letter group than in the non-tailored letter group.

Medicines
Monitoring Unit,
Department of
Clinical
Pharmacology,
University of
Dundee, Dundee
DD1 9SY

Peter T Donnan
medical statistician

Correspondence to:
A Scott Lennox
s.lennox@abdn.
ac.uk

Table 1 Results of logistic modelling of validated smoking cessation (n=2553)

	Unadjusted		Adjusted	
	Regression ratio (95% CI)	P value	Regression ratio (95% CI)	P value
Intervention:				
Tailored letter v no letter	1.37 (0.78 to 2.39)	0.28	1.39 (0.79 to 2.46)	0.25
Non-tailored letter v no letter	1.72 (1.01 to 2.94)	0.05	1.66 (0.96 to 2.86)	0.07
Age (v +10 years)*	1.05 (0.88 to 1.24)	0.62	1.12 (0.94 to 1.34)	0.20
Males v females	1.35 (0.88 to 2.06)	0.17	1.46 (0.94 to 2.27)	0.09
Level of social deprivation:				
1 v 5	2.53 (1.20 to 5.34)	0.02	2.07 (0.97 to 4.44)	0.06
2 v 5	1.93 (1.02 to 3.66)	0.04	1.63 (0.85 to 3.14)	0.14
3 v 5	0.55 (0.07 to 4.24)	0.56	0.49 (0.06 to 3.84)	0.50
4 v 5	1.32 (0.66 to 2.64)	0.43	1.17 (0.58 to 2.36)	0.67
Time to first cigarette (minutes):				
6-30 v <5	1.32 (0.74 to 2.34)	0.34	1.02 (0.56 to 1.85)	0.95
31-60 v <5	1.24 (0.55 to 2.78)	0.61	0.78 (0.33 to 1.84)	0.57
>60 v <5	3.60 (1.94 to 6.66)	0.0001	2.40 (1.21 to 4.76)	0.01
Heaviness of smoking:				
<20 v ≥20/day	0.59 (0.35 to 1.01)	0.05	0.74 (0.41 to 1.34)	0.32
Initial stage of change:				
Contemplator or preparer v pre-contemplator	3.49 (2.26 to 5.40)	0.0001	3.22 (2.06 to 5.02)	0.0001

*Age was modelled as a continuous variable, the relative risk being calculated for an increase in age of 10 years.

Table 2 Results of logistic modelling of rates of validated smoking cessation according to heaviness of smoking and initial stage of change

Intervention	Heaviness of smoking				Initial stage of change			
	<20 cigarettes per day		≥20 cigarettes per day		Pre-contemplator		Contemplator or preparer	
	Regression ratio (95% CI)	P value	Regression ratio (95% CI)	P value	Regression ratio (95% CI)	P value	Regression ratio (95% CI)	P value
Tailored letter v control	1.69 (0.89 to 3.22)	0.11	0.80 (0.24 to 2.67)	0.72	1.78 (0.73 to 4.30)	0.20	1.17 (0.55 to 2.46)	0.69
Non-tailored letter v control	1.87 (1.00 to 3.46)	0.05	1.16 (0.36 to 3.69)	0.81	1.47 (0.59 to 3.66)	0.41	1.85 (0.93 to 3.66)	0.08

Outcomes

Sex, age, and heaviness of smoking were not associated with cessation, but there was a significant inverse association with level of social deprivation. Participants whose initial stage of change was contemplator or preparer were more likely to have stopped than pre-contemplators, as were participants who had their first cigarette later in the day (table 1). Validated cessation rates were 3.5% (30/857; 95% confidence interval 2.3% to 4.7%) in the tailored letter group, 4.4% (37/846; 3.0% to 5.8%) in the non-tailored letter group, and 2.6% (22/850; 1.5% to 3.7%) in the control group. After adjusting for confounding variables, we found that participants receiving a non-tailored letter were 66% more likely to have quit than those receiving no letter. After adjustment for confounding variables, participants who received either a tailored or non-tailored letter were 53% more likely to have quit than those receiving no letter.

Among participants who smoked <20 cigarettes a day, those who received a non-tailored letter were 87% more likely to have quit than those who received no letter (table 2). Among participants who smoked ≥20 cigarettes a day and among pre-contemplators there were no differences between either the tailored letter group or the non-tailored letter group and the no letter group. On the other hand, contemplators or preparers who received the non-tailored letter had a higher cessation rate than those who received no letter.

Among participants who did not stop smoking, heavy smokers who received the tailored letter were 76% more likely (11% to 180%) to have made a positive shift in stage of change compared with those who received no letter.

Economic evaluation

Cost effectiveness of the non-tailored letter intervention

Thirty seven of the 846 participants who received a non-tailored letter stopped smoking, compared with 22 of the 850 participants who received no letter. Costs based on the actual number of participants recruited indicate that these 15 additional quitters were gained at a total cost of £464.

Although the analysis was based on only the 846 smokers who responded to the initial contact, cost effectiveness analysis should also consider the potential benefits of the intervention to people who did not respond to the experimental intervention, because in real life the non-tailored letter would be distributed to everyone in the target population. The worst case scenario assumes that only the 846 participants were smokers, giving a cost effectiveness ratio of £89 per additional quitter. The best case scenario assumes that all mistargeted participants (that is, those responding to the initial contact as non-smokers or those who received wrongly addressed letters) had declared

themselves, leaving the remaining 1219 participants as smokers. Assuming they behave in a similar manner to the 846 who received the non-tailored letter, this gives a cost effectiveness ratio of £37 per quitter. Using a discount rate of 5% gives a cost per life year gained of between £50 and £122.¹²

Discussion

The cessation rate of 4.4% is low compared with rates of 19% and 25% in two previous studies of computer generated letters and 21% in a mass media intervention by the Health Education Board for Scotland.^{3 4 13} However, our study had methodological strengths: it was carried out on a randomly chosen population who had not actively volunteered to take part in the intervention and had no special motivation to quit; it used an intention to treat analysis, with all participants lost to follow up being classed as continuing smokers; claims of participants to have stopped smoking were biochemically validated; and the tailored and non-tailored letters were created from the same text base.

In contrast, the high rates of cessation in the other studies were based on self reported cessation, and subjects who dropped out were omitted from the calculations of rates of continuing smoking. In some studies the form of the materials used for the control group was very different from that in the tailored intervention. None of these studies used biochemical validation of non-smoking. Contrary to the argument that biochemical validation is unnecessary in brief intervention studies,¹⁴ our findings indicate that not validating cessation results in an overestimate of cessation. Furthermore, one study based its success rate on a subgroup of light smokers who had intended to quit smoking.³ If we had used these methods, our rate of cessation would have been 20% or more.

Raw et al summarised evidence on the validated effect of different types of cessation intervention.¹⁵ The most effective is nicotine replacement therapy, which increases the rate of cessation by 8% at six months. Brief advice from a doctor increases abstinence at six months by 2-3%. Two validated studies by the British Thoracic Society found that up to three personalised but non-tailored letters, from doctors to outpatients in chest clinics, increased cessation by 2-3%.¹⁶ The present study has found that even one short non-tailored letter from a patient's general practice is as effective as these last two brief interventions.

Can we conclude that tailored letters are not effective?

Our hypothesis that tailored letters would be more effective than non-tailored letters was not supported by the findings. However, we might consider that our non-tailored letter was in fact tailored—or at least

personalised—to some extent. Although the non-tailored letter was not tailored to individuals, it was more personal than a general leaflet giving advice on smoking cessation: it was in a letter format, with the crest of the local university and the logo of the patient's general practice, and was ostensibly from "the practice." This degree of personalisation may account for some of its effect.¹⁶

The tailored letter was effective in increasing heavy smokers' readiness to stop smoking, whereas the non-tailored letter was ineffective. Although this finding was from a subanalysis done after the main analysis, it was significant at the level of $P = 0.02$. The finding needs to be confirmed by further investigation but is reported here because it is potentially important for this group of smokers, which is held to be little affected by brief interventions.

The greater effectiveness of the non-tailored letter among smokers intending to quit in the next six months may be due to the fact that all participants in the non-tailored letter group received specific advice on how to prepare for and cope with difficulties during an attempt to quit, whereas many smokers in the tailored letter group did not receive this behavioural information. Instead they received more cognitive input aimed at boosting motivation and confidence in achieving goals. Although both cognitive and behavioural input is appropriate for such smokers,⁶ letters may be better suited to conveying behavioural than cognitive interventions.

The evidence from other studies of tailored interventions is equivocal. A recent review drew overly positive conclusions: a critical reading of the source material shows that, of eight methodologically sound studies, three showed no effect of tailoring.¹⁷ One of these three was the only trial to compare a one-off tailored letter with both a non-tailored letter and a control. Even in these five, as pointed out above, the lack of validation of self reported cessation brings into question the reliability of their results. However, it would be premature to conclude that tailoring is ineffective.

Cost effectiveness of the non-tailored letter

The cost per quitter of the non-tailored letter is estimated at between £37 and £89, which compares very favourably with other cessation interventions.^{13 18–20} The cost effectiveness ratio of the Health Education Board for Scotland's mass media intervention was between £168 and £369, corresponding to a cost per discounted life year saved of between £304 and £656 (1993 prices).¹³ However, as pointed out above, this intervention used self reported quitting. If the true rate of quitting were lower, the corresponding cost effectiveness would also have been lower.

The present intervention is highly cost effective because of the low cost of its delivery. Using existing data held in general practices means that the delivery of the information does not require the target groups to be persuaded to receive the intervention.

The potential for implementation of the non-tailored letter intervention

Intervention by primary care professionals in the form of brief opportunistic advice increases smoking cessation by about 2–3% over control intervention,^{15 21} but its implementation is limited by various constraints

What is already known on this topic

Brief opportunistic advice on stopping smoking that is given face to face by health professionals increases rates of cessation by 2–3%

Intensive, expert-led interventions increase cessation rates by up to 20% or more but are expensive and reach only a small proportion of smokers

Written advice tailored to an individual's "stage of change" (intention to stop in a particular period of time) has been claimed to be as effective as intensive interventions, but previous studies of tailored written advice did not biochemically validate cessation

What this paper adds

A simple standard letter sent to patients of general practices that gave brief advice on stopping smoking increased the biochemically validated rate of cessation by 2%

A letter tailored to the individual's "stage of change" was not more effective than the non-tailored standard letter

Although the increase in cessation resulting from the non-tailored standard letter was small, this intervention was highly cost effective

on health professionals.²² In contrast, the 2% increase in cessation found in the present study could be widely and easily realised by using the computerised data now usually held by general practices. Indeed, the quantity and quality of data on smoking held in general practices are set to improve as computers become more user friendly. Soon most practices will be capable of implementing this type of intervention, which would be well suited to implementation at the level of primary care groups or local healthcare cooperatives, and which could be part of a national strategy on smoking cessation. Coordinators from the smoking cessation services that have recently been set up in all health authorities and boards could play a central role.

Other potential settings include smoking helplines and workplaces. The only conditions necessary for implementation are a political will, a database of current smokers, and an administrative structure capable of producing and sending the letters.

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the questionnaire, data collection, and data entry. DS contributed to the design of, carried out, and reported the economic evaluation. PTD advised on statistical aspects of the study design and carried out most of the analysis. ASL, LMO, and ER are the guarantors for the paper.

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A change of heart

His birth wasn't straightforward: I was induced because he was late, had an emergency caesarean section for failure to progress, and had a 2300 ml postpartum haemorrhage. "Typical doctor!" the obstetricians chuckled at me, "but he's worth it, isn't he?" I looked over at my baby son. Of course he was worth it. I was exhausted but felt elated and an immense love for him. We named him Will. He was perfect.

Except that he wasn't quite perfect after all. By the age of 6 days he had had his second echocardiogram, and my husband and I were being ushered into the consultant paediatric cardiologist's room. I was told to take a seat and offered a cup of tea. I knew we were to be the wrong side of a "breaking bad news" interview. There was little small talk: "There is a problem and he will need an operation. It can be fixed."

I was devastated. A layperson may have focused on the statement that things would "be fixed," may already have felt gratitude towards the God-like surgeon, and may have marvelled at the miracles of modern technology. I, on the other hand, had a true medic's ambivalence towards surgery. I thought of my medical school years: the blundering misogynists who "entertained" those on the ward round by making snide comments about their patients or junior staff, and the smells of blood and pus and burning flesh that had made me retch behind my surgical mask. As a surgical house officer I had struggled on the ward, managing desperately sick patients, while the rest of the team was busy operating. I thought of all the patients with postoperative complications who I'd reviewed while on-call as a medical senior house officer and then as a registrar; I remembered the pain, the wound infections, pneumonia, and confusion. The thought of handing my baby over to a surgeon filled me with horror.

Over the next few weeks, Will became more breathless. He was sweaty and struggled during feeding. My mother pointed innocently at his subcostal recession in the bath. The operation

was brought forward, and when he was five weeks old we travelled to the tertiary referral centre. When we arrived, I fought the urge to clutch him to my breast and take him straight home again. The surgeon came to talk to us within a few hours of our arrival. He spoke gently. Our baby's problem was straightforward and the operation would be curative. The complication rates were low. We signed the consent forms and for the first time I thought that things might be all right after all.

The first day after surgery in the intensive therapy unit was eventful. Although the medics and intensive care specialists took time to explain that Will's hypotension and poor urine output were nothing to worry about, I stared at the monitors in silent panic. The surgeon arrived, glanced at the charts, felt our baby's femoral pulse and said, "He'll be fine." So great and absolute was our confidence in him that with these few words we were reassured. The crisis passed. Three weeks later, we were home.

Now I look at my fat, gurgling, laughing baby with his neat sternotomy scar. My heart fills with gratitude towards the surgeon and his team, and I am awed by the miracle of my baby's operation.

Ruth Hubbard *clinical lecturer, geriatric medicine, Llandough Hospital, Penarth*

We welcome articles of up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.