

Effect on smoking quit rate of telling patients their lung age: the Step2quit randomised controlled trial

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ABSTRACT

Objective To evaluate the impact of telling patients their estimated spirometric lung age as an incentive to quit smoking.

Design Randomised controlled trial.

Setting Five general practices in Hertfordshire, England.

Participants 561 current smokers aged over 35.

Intervention All participants were offered spirometric assessment of lung function. Participants in intervention group received their results in terms of "lung age" (the age of the average healthy individual who would perform similar to them on spirometry). Those in the control group received a raw figure for forced expiratory volume at one second (FEV₁). Both groups were advised to quit and offered referral to local NHS smoking cessation services.

Main outcome measures The primary outcome measure was verified cessation of smoking by salivary cotinine testing 12 months after recruitment. Secondary outcomes were reported changes in daily consumption of cigarettes and identification of new diagnoses of chronic obstructive lung disease.

Results Follow-up was 89%. Independently verified quit rates at 12 months in the intervention and control groups, respectively, were 13.6% and 6.4% (difference 7.2%, P=0.005, 95% confidence interval 2.2% to 12.1%; number needed to treat 14). People with worse spirometric lung age were no more likely to have quit than those with normal lung age in either group. Cost per successful quitter was estimated at £280 (€365, \$556). A new diagnosis of obstructive lung disease was made in 17% in the intervention group and 14% in the control group; a total of 16% (89/561) of participants.

Conclusion Telling smokers their lung age significantly improves the likelihood of them quitting smoking, but the mechanism by which this intervention achieves its effect is unclear.

Trial registration National Research Register
N0096173751.

INTRODUCTION

Early diagnosis of chronic obstructive pulmonary disease with communication of lung damage to patients could improve targeting of smoking cessation programmes and improve quit rates in individuals most vulnerable to lung damage.¹ A Cochrane review of the use of personal biomarkers for the harmful effects of smoking, however, failed to find firm evidence that such markers could be used to increase the quit rate.² A recent non-randomised observational study on the

effect of communicating spirometry findings on smoking cessation concluded that "a large randomised clinical trial is needed to answer this important question more conclusively."³

The concept of "lung age" (the age of the average person who has an FEV₁ equal to the individual) was developed as a way of making spirometry data easier to understand and also as a potential psychological tool to show smokers the apparent premature ageing of their lungs.¹ We tested the hypothesis that telling smokers their lung age would lead to successful smoking cessation.

METHOD

Sampling and recruitment—We searched patient records from five general practices in Hertfordshire to identify people aged 35 and over who had been recorded as a smoker in the previous 12 months. We excluded those receiving oxygen and those with a history of lung cancer, tuberculosis, asbestosis, silicosis, bronchiectasis, or pneumonectomy. We sent a letter of invitation to patients to participate in the study. Recruitment started in February 2004 and follow-up was completed in March 2007.

Assessment interview—Baseline data included age, smoking history in pack years, medical history, medication, and comorbidity. All participants underwent standard measurements of lung function (FEV₁, FVC (forced vital capacity), FEV₁/FVC) with a spirometer. Reversibility of airways obstruction was measured according to standard British Thoracic Society guidelines.⁴ After spirometry participants were randomised to either the intervention or control group. Both groups were told that their lung function would be measured again after 12 months to see whether it had deteriorated. We used two instruments to confirm baseline comparability of groups: the St George's respiratory questionnaire which measures the impact of respiratory diseases on an individual's life;⁵ and adapted stage of change questions in relation to smoking from Prochaska and DiClemente's model.

Instruments and tests—Smoking cessation at follow-up was initially assessed by measuring carbon monoxide concentrations. A nurse blinded to allocation group collected saliva samples for cotinine testing. The optimum cut-off point to distinguish smokers from non-smokers is 14.2 ng/ml, which correctly classifies 99% of non-smokers and 96% of smokers.

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Estimation of lung age—Estimated lung age was generated by adjustment of the settings of the spirometer.

Information given to participants—Participants in the intervention group were given their results verbally, immediately after randomisation, in the form of “lung age” with a graphic display. Graphs were used as a visual aid to explain how smoking can damage lungs as if they are ageing more rapidly than normal (see bmj.com). Participants were told that smoking cessation would slow down the rate of deterioration of the lung function back to normal but would not repair the damage already done. In the intervention group, if the lung age was equal to or less than the individual’s chronological age, he or she was informed that test result was normal. If lung age was greater than chronological age, we gave them the “lung age” in years. We did not tell those in the control group their results but informed them that they would be invited for a second test after 12 months to “see if there had been any change in lung function.” All participants were encouraged to quit smoking and given written contact details of the local NHS smoking cessation services.

Outcome measures—The primary outcome measure was verified cessation of smoking 12 months after initial recruitment. Secondary outcomes were changes in daily consumption of cigarettes and the identification of new diagnoses.

Follow-up and confirmation of cessation—Participants underwent follow-up examination with repeat spirometry after 12 months. Self reported quitters had carbon monoxide breath testing for confirmation of smoking cessation, and contacted for a saliva test for cotinine measurement.

Data analysis—We analysed data on an intention to treat basis. To test the hypothesis that severity of lung damage predicts quit success, we compared the mean “lung age deficit” (difference of lung age minus chronological age) between quitters and non-quitters within the intervention group.

Assessment of costs—We calculated costs in terms of the time spent per patient processed and also per successful quitter.

RESULTS

Baseline characteristics

We recruited 561 participants. There were few significant differences between the groups at baseline, groups did not differ in their quality of life score or stage of change. There were, however, significantly more people with a history of stroke in the control group. The incidence of comorbidity was high (around 20% of all participants).

Despite an average of 33 pack years of smoking, most participants in this study had “normal” results on spirometry at baseline.⁶ Only 23.5% of the control group and 26.8% of the intervention group had baseline lung function in the “abnormal” range.

Progress and outcome

All recruited participants were included in the final data analysis. We analysed those who did not return for follow-up (32 and 31, respectively, in the control and intervention group) as if they continued to smoke. Verified quit rates were 6.4% (18/281) in the control group and 13.6% (38/280) in the intervention group (difference 7.2%, $P=0.005$, 95% confidence interval 2.2% to 12.1%). Telling participants their lung age was thus associated with an absolute reduction of 7.2% in the smoking rate compared with giving them their lung function tests results as raw FEV₁ data. The number needed to treat (NNT) for the intervention to achieve one additional sustained quitter is 14. Both groups reduced their average self reported consumption of cigarettes (table); average consumption at follow-up was significantly lower in the intervention group than in the control group (11.7 (SD 9.7) v 13.7 (SD 10.5) per day, $P=0.03$).

We recorded the numbers of smokers in both groups who used additional help to quit: numbers were 22 (7.8%) in the control group and 30 (10.7%) in the intervention group ($P=0.2$). Within the intervention group we investigated the effect of lung age deficit (lung age minus actual age) on the likelihood of quitting. The mean lung age deficit was 8.7 years and 9.4 years in the quitters and non-quitters, respectively. This difference was not significant (difference in means -0.78 , 95% confidence interval -7.6 to 6.0 , $P=0.8$).

Costs

Using 2007 salary costs for the relevant staff, we estimate the cost of this intervention at £20 (€26, \$40) per patient processed and £280 (€365, \$556) per successful quitter.

DISCUSSION

This large randomised controlled trial with adequate follow-up and independent proof of cessation has shown that individualised feedback of “lung age” is effective in promoting smoking cessation. This study strongly supports the policy of giving patients their spirometry results expressed as “lung age” along with advice about the dangers of continuing to smoke and methods of quitting.

Results at 12 months. Figures are percentages (numbers) unless stated otherwise

	Control (n=281)	Intervention (n=280)	P value
Lost to follow-up	11.4 (32)	11.0 (31)	0.9
Smoking status			
Confirmed cessation*	6.4 (18)	13.6 (38)	0.01
Smoker at 12 months	90.4 (254)	84.6 (237)	
Unknown	3.2 (9)	1.8 (5)	
Mean (SD) daily cigarette consumption	13.7 (10.5)	11.7 (9.7)	0.03
Attended NHS smoking clinics	1.4 (4)	1.7 (5)	
Used smoking cessation help (clinic, NRT, bupropion, acupuncture)	7.8 (22)	10.7 (30)	0.2†

NRT=nicotine replacement therapy.

*Cotinine and CO measurement.

† χ^2 test.

WHAT IS ALREADY KNOWN ON THIS TOPIC

There is insufficient evidence to make a definitive statement about the evidence for the effectiveness of biomarkers (including spirometry) in smoking cessation

WHAT THIS STUDY ADDS

Smoking cessation rates can be improved by reporting estimation of lung age with spirometry in primary care

Screening smokers over the age of 35 could reduce smoking and improve early diagnosis of chronic obstructive pulmonary disease

Comparison with other research

In 2001 a non-systematic overview analysed 12 studies that provided feedback on personal biomarkers as part of strategies to change behaviour in smokers.⁷ The authors concluded that success was likely to depend on how the information was conveyed and understood. They also suggested that success might depend on graphic displays or written individualised information as well as the prospect of gain rather than negative messages about costs or disadvantage.

A Cochrane review of the evidence for the effectiveness of biomarkers in smoking cessation was published in October 2005.² Only randomised controlled trials were included in the analysis, which concluded that because of limited evidence no definitive statements could be made about the effectiveness of assessment of biomarkers as an aid for smoking cessation.² None of the primary studies included in the Cochrane review had used “lung age” in the intervention.

A large non-randomised observational study of 4494 smokers from Poland indicated that spirometry promoted cessation.³ Those with airways obstruction were more likely to quit, but even the group with normal lungs on spirometry had a higher quit rate (12%) than would normally be expected after simple advice from a physician (4-6%).⁸ These authors did not have a control group but attributed the high quit rates in those with normal lung function to a “healthy volunteer” effect (those who had opted for the programme were seen as more motivated to quit).

We found no evidence that successful quitting depends on the severity of lung damage as demonstrated by spirometry. Our study, however, was not powered to detect this difference. Presentation of information in an understandable and visual way seems to encourage higher levels of successful smoking cessation than when patients are given feedback that is not easily understandable.

What makes people quit

Clinical experience suggests that deterioration in health does not necessarily lead to altered behaviour. The high rate of comorbidity (20%) in our participants confirms that many people who are likely to exacerbate a chronic health problem by smoking continue to smoke.

If lung age is normal there is an incentive to stop before it is too late. If lung age is abnormal then this is a clear message that the lungs are undergoing accelerated deterioration that would be slowed if the smoker stopped. Further research is needed to elucidate the psychological forces that are active in successful quitting in different circumstances.

We recommend that the new UK NHS general practitioner contract should include incentives for spirometric assessment accompanied by individualised communication of lung age in smokers. We also recommend that the NICE guidelines for brief interventions for smoking cessation include this new evidence. Our cost estimates, which assume that spirometry is carried out in UK general practice, suggest that estimation and communication of lung age is of comparable effectiveness to, and potentially cheaper than, other currently available treatments on the NHS, including nicotine replacement therapy,⁹ bupropion,¹⁰ face to face counselling,¹¹ and telephone counselling.¹²

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