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Steve Parrott and Christine Godfrey

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ABC of smoking cessation

Economics of smoking cessation

Steve Parrott, Christine Godfrey

Smoking imposes a huge economic burden on society—currently up to 15% of total healthcare costs in developed countries. Smoking cessation can save years of life, at a very low cost compared with alternative interventions. This chapter reviews some of the economic aspects of smoking cessation.

Who benefits from cessation?

The most obvious benefits of smoking cessation are improvements in life expectancy and prevention of disease. However, cessation also improves individuals' quality of life as smokers tend to have a lower self reported health status than non-smokers, and this improves after stopping smoking.

There are also wider economic benefits to individuals and society, arising from reductions in the effects of passive smoking in non-smokers and savings to the health service and the employer. These wider benefits are often omitted from economic evaluations of cessation interventions, which consequently tend to underestimate the true value for money afforded by such programmes.

Economic burden of smoking

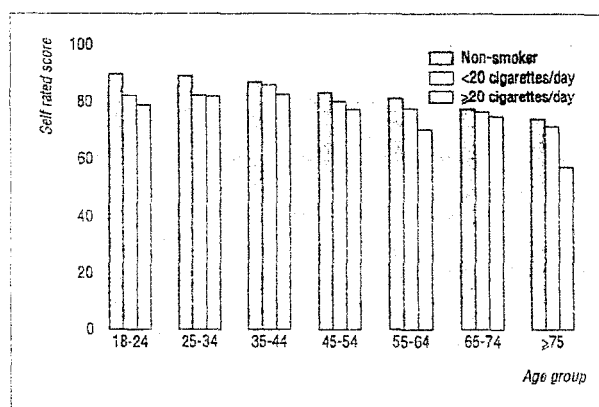
Many estimates have been made of the economic cost of smoking in terms of health resources. For the United States they typically range from about 0.6% to 0.85% of gross domestic product. In absolute terms, the US public health service estimates a total cost of \$50bn (£29bn; €42bn) a year for the treatment of smoking related diseases, in addition to an annual \$47bn in lost earnings and productivity. Estimated total costs in Australia and Canada, as a proportion of their gross domestic product, are 0.4% and 0.56% respectively. In the United Kingdom, the treatment of smoking related disease has been estimated to cost the NHS £1.4bn-£1.5bn a year (about 0.16% of the gross domestic product)—including £127m to treat lung cancer alone.

When expressed as a percentage of gross domestic product, the economic burden of smoking seems to be rising. In reality, however, the burden may not be increasing, but instead, as more diseases are known to be attributable to smoking, the burden attributed to smoking increases. Earlier estimates may simply have underestimated the true cost.

Passive smoking

In the United States, passive smoking has been estimated to be responsible for 19% of total expenditure on childhood respiratory conditions, and maternal smoking has been shown to increase healthcare expenditure by \$120 a year for children under age 5 years and \$175 for children under age 2 years.

In the United Kingdom an estimated £410m a year is spent treating childhood illness related to passive smoking; in adults, passive smoking accounts for at least 1000 deaths in non-smokers, at an estimated cost of about £12.8m a year at 2002 prices.



Self rated health status (100 = best imaginable health state), by age and smoking status. Data from Kind et al. *UK population norms for EQ-5D*. York: Centre for Health Economics (Discussion paper: 172)

Benefits of smoking cessation

Smokers and their families

- Improved quality and quantity of life for those stopping smoking
- Improved quality and quantity of life for those living with smokers through a reduction in the harm from passive smoking

Society

- Lower healthcare expenditure on treatment of smoking induced disease
- Less workplace absenteeism due to smoking related disease
- Less harm from passive smoking in public places
- Reduction in costs related to cleaning up after smokers (cigarette ends, ash, etc and damage from these to floors and furnishings)



In Puerto Rico, China (above), and Venezuela, the cost of smoking has been estimated as 0.3%-0.43% of the gross domestic product

Passive smoking causes illness and premature loss of life, at all ages from the prenatal period to late adult life

Cost of absenteeism

Absenteeism arising from smoking related disease is also a major cause of lost productivity, a cost incurred by employers. An annual estimated 34 million days are lost in England and Wales through sickness absence resulting from smoking related illness, and in Scotland the cost of this productivity loss is about £400m.

Cost effectiveness of cessation programmes

Clear evidence exists that smoking cessation interventions are effective. However, to show value for money, the costs as well as the effectiveness of such programmes have to be examined. The overwhelming evidence is that face to face cessation interventions provide excellent value for money compared with the great majority of other medical interventions.

Several complex factors influence cost effectiveness. For example, although a cessation programme tends to be more effective as its intensity increases, increased intensity is associated with increased costs, therefore increasing both sides of the cost effectiveness ratio. This was illustrated in a study by Parrott et al (1998) of the range of intensities of smoking cessation interventions in the United Kingdom. The researchers examined these interventions using local cost data and life years saved as predicted from the PREVENT simulation model. They looked at four interventions: a basic intervention of three minutes of opportunistic brief advice; brief advice plus self help material; brief advice plus self help material and nicotine replacement products; and brief advice plus self help material, nicotine replacement products, and a recommendation to attend a smoking cessation clinic. The most cost effective intervention was the brief advice alone (cost £159 per life year saved, £248 when discounted at 6%), although the most intensive clinical interventions still represent good value for money at £1002 per life year saved when discounted at 6%.

The cost effectiveness of putting the US Agency for Healthcare Research and Quality's clinical guidelines on smoking cessation into practice has also been estimated, for combined interventions based on smokers' preferences for different types of the five basic recommended interventions. The cost of implementation was estimated at \$6.3bn in the first year, as a result of which society would gain 1.7 million new quitters at an average cost of \$3779 per quitter, \$2587 per life year saved, and \$1915 per quality adjusted life year (QALY). In this study the most intensive interventions were calculated to be more cost effective than the briefer therapies.

Care should be taken when extrapolating the results of these evaluations, as cost effectiveness estimates are likely to be time and country specific and highly dependent on the healthcare system in question. In a system of fee for service, as in the United States, monetary rewards may be necessary to encourage provision. On the other hand, if patients who stop smoking place a reduced burden on the primary care budget in future years, the incentives to provide such services may be inherent in the system.

Pharmacological interventions

The National Institute for Clinical Excellence (NICE) has recently estimated the cost effectiveness of using nicotine replacement therapy (NRT) or bupropion therapy. These estimates projected life years saved over a shorter period than the PREVENT model and hence produced generally higher figures: £1000-£2400 per life year saved for advice and NRT.

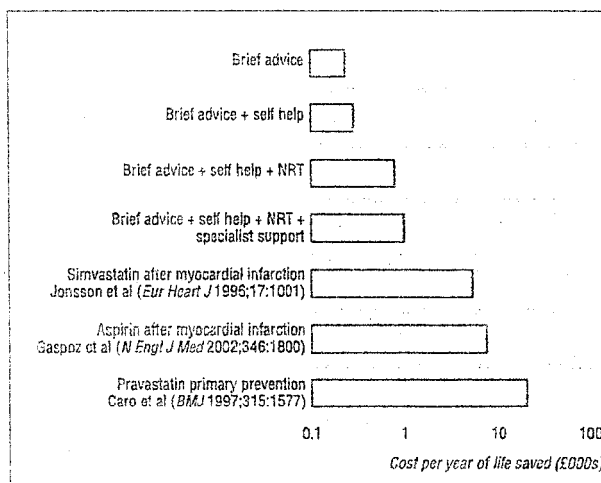
Smoking related fires cause about £151m of damage each year in England and Wales

Cost effectiveness estimates for healthcare providers

Type of intervention	Costs per life year saved (£)	
	Undiscounted	Discounted
Face to face		
Brief advice	159	248
Brief advice plus self help	195	303
Brief advice plus self help plus NRT	524	815
Brief advice plus self help plus NRT plus specialist cessation service	658	1022
Community		
"Quit and win" programme:		
Medium intensity	634	986
"No smoking" day	26	40
Broader community health promotion interventions (medium intensity)	192	295

NRT = nicotine replacement therapy. Data from Parrott et al, 1998 (see Further Reading box), revised to reflect 2001-2 prices.

Discounting is a method of adjusting for the fact that individuals prefer to incur costs in later periods and enjoy benefits in the current period. Applying a discount rate transforms future values into current values, taking this preference into account



Cost effectiveness of smoking cessation interventions compared with that of routine strategies for preventing myocardial infarction

The National Institute for Clinical Excellence is part of the NHS in England and Wales; it issues guidance on current "best practice"

£645-£1500 for advice plus bupropion, and £890-£1970 for advice, nicotine replacement, and bupropion. When QALYs are used, the ranges are £741-£1780, £479-£1100, and £660-£1400 respectively. These costs again compare favourably with a range of other healthcare interventions. Bupropion does seem more cost effective than NRT, although the evidence base for the effectiveness of bupropion is much less extensive than for NRT, and results should therefore be treated with caution.

The cost effectiveness of bupropion has been investigated in Spain with a decision model (Musin et al, eighth meeting of the Society for Research on Nicotine and Tobacco, Savannah, 2002). The model presents results in an incremental analysis over and above opportunistic advice in primary care. The findings show that if all motivated smokers in Spain were to use the therapy, over a 20 year period 44 235 smoking related deaths would be averted at a saving to the healthcare system of €1.25bn. In the United States, studies have predicted savings of between \$8.8m and \$14m over 20 years when bupropion is added to an insurance plan. In a UK study, Stapleton et al (1999) used data from a randomised placebo controlled trial of nicotine patches and a survey of resource use to show that if general practitioners were allowed to prescribe transdermal nicotine patches on the NHS for 12 weeks, the cost per life year saved would be £398 for people aged under 35, £345 for those aged 35-44, £432 for those aged 45-54, and £785 for those aged 55-65. Since Stapleton's study was published, NRT has been made available in Britain through NHS prescription. However, studies have tended to exclude potential side effects of bupropion and are again based on a more limited effectiveness database than the evidence for the effectiveness of NRT products.

The means by which the provision is financed is a crucial determinant of the effectiveness of smoking cessation products. Evidence shows that smokers are more likely to take up smoking cessation interventions if they are provided by their insurance scheme or health service than if they have to pay for them themselves. In the United Kingdom, NHS provision can reduce costs through bulk buying and discounts from pharmaceutical manufacturers. The price for a packet of seven 15 mg Nicorette patches, for example, costs £15.99 through retail outlets, compared with an NHS purchase price of only £9.07, a reduction of about 43%. It is also clear that decreases in the price of NRT products and increases in the price of cigarettes would lead to substantial increases in per capita sales of NRT products.

The photograph of the Marlboro advertisement in China is published with permission from Mark Henley/Panos.

Steve Parrott is a research fellow at the Centre for Health Economics and Christine Godfrey is professor at the Department of Health Sciences at the University of York. The ABC of smoking cessation is edited by John Britton, professor of epidemiology at the University of Nottingham in the division of epidemiology and public health at City Hospital, Nottingham. The series will be published as a book in the late spring.

Competing interests: See first article in this series (24 January 2004) for the series editor's competing interests.

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Comparative costs of other common healthcare treatments (analysis of guidance of the National Institute for Clinical Excellence)

Intervention	Incremental cost (£)	
	Per quality adjusted life year	Per life year gained
Zanamivir in managing influenza	9300-31 500	
Taxanes for ovarian cancer		6500-10 000
Taxanes for breast cancer		7000-24 000
Implantable cardioverter defibrillators for arrhythmias		26 000-31 000
Glycoprotein IIb/IIIa inhibitors for acute coronary syndromes		7000-12 000
Methylphenidate for attention-deficit/hyperactivity disorder in children	10 000-15 000	
Tribavirin and interferon alfa for hepatitis C:		
First six months' treatment	3000-7000	
Second six months' treatment	5000-36 000	
Laparoscopic surgery for inguinal hernias	50 000	
Riluzole for motor neurone disease	34 000-43 000	
Orlistat for obesity in adults		20 000-30 000

Adapted from Raftery (*BMJ* 2001;323:1300-3).

Key points

- Savings to the healthcare system, a reduction in the harm caused by passive smoking, and savings to employers are all relevant in evaluations of cessation interventions
- The economic cost of smoking in the United States may be as high as 1.15% of gross domestic product in terms of healthcare costs alone
- The estimated cost to the NHS is £1.4bn-£1.5bn
- Cessation interventions offer excellent value for money when compared with some other healthcare interventions
- Some studies have quantified outcomes in life years saved, not allowing for changes in quality of life, thereby underestimating the cost effectiveness of smoking cessation by almost half

Further reading

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Nicotine Addiction in Britain

A report of the Tobacco Advisory Group of The Royal College of Physicians

ROYAL COLLEGE OF PHYSICIANS OF LONDON

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Foreword

In 1962, the Royal College of Physicians published its first report on the effects of smoking on health, drawing attention to the strong relationship between cigarette smoking and lung cancer. The report concluded that this association was probably causal, that smoking may also cause other diseases including chronic bronchitis and coronary heart disease, and that smokers may be addicted to nicotine.

In the years since that report was published, the true scale of the harm caused by smoking has become apparent. Smoking is now recognised as the single largest avoidable cause of premature death and disability in Britain and in most other economically developed countries, and probably the greatest avoidable threat to public health worldwide.

Public recognition of the health risks of smoking was probably one of the major factors underlying the progressive fall in smoking prevalence that occurred in Britain between the early 1960s and mid-1990s. However, recent data suggest that it is now beginning to stabilise in Britain at approximately one in four adults, whilst smoking in younger people is becoming more common. To achieve further marked reductions in smoking prevalence, it is therefore necessary to look in more detail at the factors that cause individuals to smoke, and to consider new methods of primary and secondary prevention.

This report addresses the fundamental role of nicotine addiction in smoking. It is now recognised that nicotine addiction is one of the major reasons why people continue to smoke cigarettes, and that cigarettes are in reality extremely effective and closely controlled nicotine delivery devices. Recognition of this central role of nicotine addiction is important because it has major implications for the way that smoking is managed by doctors and other health professionals, and for the way in which harmful nicotine delivery products such as cigarettes should be regulated and controlled in society. At a time when smoking still causes one in every five deaths in Britain, measures designed to achieve further reductions in smoking are clearly important and, if successful, will realise substantial public health benefits. It is time for nicotine addiction to become a major health priority in Britain. This report explains why.

February 2000 KGMM ALBERTI
President, Royal College of Physicians

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Key points

Tobacco smoking in Britain

- Smoking prevalence in Britain has declined during the past 50 years; this trend now appears to be stabilising
- In 1997 in Britain approximately one in four adults were cigarette smokers
- By age 15, one in four British children are regular smokers
- Smoking causes one in every five deaths in Britain, and the loss of more than 550,000 years of life before age 75
- The greatest impact of smoking on mortality is on deaths from lung cancer, ischaemic heart disease and chronic obstructive airways disease
- Passive smoking damages children before and after birth
- Thirty percent of pregnant women in Britain smoke
- Smoking is strongly related to poverty and deprivation
- Smoking costs the NHS an estimated £1.5 billion per year
- No other single avoidable factor accounts for such a high proportion of deaths, hospital admissions or general practitioner consultations
- Smoking is the single most important public health problem in Britain

Physical and pharmacological effects of nicotine

- Nicotine receptors are present in the brain and many other organs vary markedly in their binding, activation and desensitisation characteristics
- Cigarettes deliver rapid doses of nicotine to receptors in the brain
- Animal studies provide strong and consistent evidence that nicotine is addictive
- The addictive effect of nicotine is mediated at least in part by stimulation of dopamine release in the nucleus accumbens
- Pure nicotine has potential adverse effects on the human body but unlike cigarettes does not appear to cause cancer or significant cardiovascular disease
- Pure nicotine may be harmful to the fetus in pregnancy but is likely to be far less hazardous than the effects of smoking.

Psychological effects of nicotine and smoking

- Smoking is widely believed to have positive effects on mood
- Objective evidence suggests that the only improvements in mood resulting from smoking are those arising from the relief of withdrawal symptoms
- Smoking withdrawal symptoms are relieved by nicotine
- Nicotine intake in smokers is stable and consistent over time
- There is strong evidence of psychological dependence on cigarettes
- The major psychological motivation to smoke is the avoidance of negative mood states caused by withdrawal of nicotine

Is nicotine a drug of addiction?

- Nicotine obtained from cigarettes meets all the standard criteria used to define a drug of dependence or addiction
- Historically, and in contrast to addiction to opiates or alcohol, addiction to nicotine has not been recognised as a medical or social problem in Britain
- Nicotine is highly addictive, to a degree similar or in some respects exceeding addiction to 'hard' drugs such as heroin or cocaine
- Most smokers do not smoke out of choice, but because they are addicted to nicotine

The natural history of smoking: the smoker's career

- Addiction to nicotine is established in most smokers during teenage years, in many cases before reaching the age at which it is legal to buy cigarettes
- Teenagers who smoke one or more cigarettes per day demonstrate evidence of addiction similar to that seen in addicted adults, but addiction can be evident at lower levels of smoking
- Addiction to nicotine is usually established in young smokers within about a year of first experimenting with cigarettes
- A small proportion of smokers, approximately 5%, do not appear to be addicted to nicotine
- Once addicted, most smokers are unable to give up smoking even when they develop disease caused by smoking and made worse by continued smoking
- Only about 2% of smokers succeed in giving up in any year
- About 50% of young adult smokers will still be smoking when they are 60

Regulation of nicotine intake for smokers, and implications for health

- Smokers tend to regulate or titrate their nicotine intake to maintain body levels within a preferred range
- Smokers who switch to cigarettes which on machine smoking deliver less nicotine and tar tend to compensate for this by smoking the cigarette more deeply or more intensively
- Smokers of low yield cigarettes actually achieve little, if any, reduction in intake of nicotine and tar, and the health benefit accrued from switching to such cigarettes is, if anything, small
- The availability of low yield cigarettes may actually be counter productive in public health terms if they encourage health conscious smokers to switch to low yield brands instead of giving up completely

Management of nicotine addiction

- Effective interventions to reduce nicotine addiction are available at both population and individual levels
- The fact that smoking is so common in Britain means that even interventions that have small effects on smoking prevalence can, if widely applied, yield substantial returns in terms of the numbers of people who give up smoking
- Nicotine replacement therapy approximately doubles the effectiveness of most other currently available smoking cessation interventions
- Smoking cessation interventions, including nicotine replacement therapy, are extremely cost effective, costing society between £212 and £873 per year of life saved in 1996 prices
- The cost-effectiveness of smoking cessation interventions using nicotine replacement therapy compares very favourably with most other medical intervention.
- Effective smoking cessation services should therefore be universally available to smokers through the NHS
- Smoking cessation services must be able to adapt to accommodate new effective therapies and interventions in the future
- Further research into the use and safety of nicotine replacement therapy relative to continued smoking during pregnancy is needed Regulatory approaches to tobacco products in Britain
- Cigarettes are extremely damaging to consumers and yet have enjoyed unparalleled freedom from consumer protection regulation
- Much of the regulation applying to tobacco in Britain has been in the form of 'voluntary agreements' with the tobacco industry
- The use of additives in cigarettes has not been subject to appropriate assessments of public health impact
- The policy of progressively reducing tar yields from cigarettes, and of printing tar yields on cigarette packs, is based on flawed measurement methodology and may be ineffective in terms of achieving public health benefits
- Pharmaceutical nicotine delivery products (eg nicotine replacement therapy) are subject to regulation by the Medicines Control Agency and are required to meet the same safety standards as any other drug; however, cigarettes are exempt from these controls
- Cigarettes are tobacco-based nicotine delivery products and should be subject to the same safety standards as any other drug.
- A co-ordinated nicotine regulation framework needs to be established in Britain to resolve anomalies in the sale and promotion of nicotine delivery products, to maximise current and future public health

Main conclusions

- Most smokers do not continue to smoke cigarettes out of choice, but because they are addicted to nicotine
- Nicotine addiction is the underlying cause of the massive burden of premature death and disability caused by smoking in Britain
- Doctors, other health professionals and indeed society as a whole, need to acknowledge nicotine addiction as a major medical and social problem
- Treatment for nicotine addiction should be universally available for all smokers as a routine facility of the National Health Service
- Tobacco products must be made subject to safety regulations that are consistent with the controls that apply to all other drugs available in Britain, and so that they are commensurate with the extent of the damage to individuals and society that smoking causes

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