Evaluating the impact of financial incentives on inequalities in smoking cessation in primary care

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Abbreviations

AOR	Adjusted Odds Ratio
APHO	Association of Public Health Observatories
APPG	All Party Parliamentary Group
ASH	Action on Smoking and Health
BMA	British Medical Association
BP	Blood Pressure
BMI	Body Mass Index
CDSR	Cochrane Database of Systematic Reviews
CENTRAL	Cochrane Central Register of Controlled Trials
CI	Confidence Interval
CVA	Cerebrovascular Accident
CHD	Coronary Heart Disease
CKD	Chronic Kidney Disease
CVD	Cardiovascular Disease
DARE	Database of Abstracts and Reviews of Effectiveness
DM	Diabetes Mellitus
DNA	Deoxyribonucleic Acid
EMIS	Egton Medical Information Systems
EMR	Electronic Medical Record
EPOC	Effective Practice and Organisation of Care
ETS	Environmental Tobacco Smoke
FCTC	Framework Convention on Tobacco Control
GLA	Greater London Authority
GHS	General Household Survey
GLS	General Lifestyle Survey
GMS	General Medical Services
GP	General Practitioner
HBM	Health Belief Model
HES	Hospital Episode Statistics
HMO	Health Maintenance Organisation
HR	Hazard ratio
HSRG	Health Services Research Group
IMD	Index of Multiple Deprivation
IOM	Institute of Medicine
LES	Locally Enhanced Service
LHO	London Health Observatory
LREC	Local Research Ethics Committee
MNAR	Missing Not At Random
NHS	National Health Service
NHS IC	NHS Information Centre
NI	Northern Ireland
NICE	National Institute for Health and Clinical Excellence
NRT	Nicotine Replacement Therapy
NSF	National Service Framework
NS-SeC	National Statistics Socio-economic Classification
ONS	Office for National Statistics
OR	Odds Ratio
PAD	Peripheral Arterial Disease

PAH	Polynuclear Aromatic Hydrocarbons
PCT	Primary Care Trust
PMT	Protection Motivation Theory
PSA	Public Service Agreement
P4P	Payment for Performance
QMAS	Quality Management and Analysis System
QOF	Quality and Outcomes Framework
QOF+	Quality and Outcomes Framework Plus
SDDU	Smoking, Drinking and Drug Use (Survey)
SMR	Standardised Mortality Ratio
THIN	The Health Improvement Network
TIA	Transient Ischaemic Attack
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
RCP	Royal Society of Physicians
RCT	Randomised controlled trial
RGSC	Registrar General's Social Classes
RoI	Republic of Ireland
RR	Relative Risk
SES	Socio-Economic Status
UK	United Kingdom
USA	United States of America
WHO	World Health Organisation

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Statement of contribution

The work presented in this thesis is my own but I received direction from my supervisors, Dr Chris Millett and Professor Azeem Majeed. All else is appropriately referenced.

Copyright declaration

Abstract

Background

Smoking cessation interventions are underprovided in primary care. This thesis examines the impact of financial incentives on the provision of smoking cessation interventions, and inequalities in provision, in primary care.

Methods

- Systematic review of financial incentives for smoking cessation in healthcare.
- Cross sectional study using general practice data from Wandsworth, London, using logistic regression to examine associations between ethnicity and disease group with ascertainment of smoking status and provision of cessation advice following the introduction of the UK's Quality and Outcomes Framework (QOF).
- Before-and-after studies using general practice data from Hammersmith & Fulham, London, looking at the impact of a local financial incentive scheme (QOF+) on smoking outcomes for patients without smoking-related diseases (primary prevention), and antenatal patients, using logistic regression to examine inequalities.

Results

Introduction of financial incentives was associated with increased recording of smoking status and advice to smokers, most evident for patients with smoking-related diseases compared with patients without smoking-related diseases, for whom there were much smaller incentives for recording smoking status and none for offering stop smoking advice. However,

when specific incentives were provided for primary prevention large improvements in smoking outcomes were seen.

The youngest and oldest groups of patients were less likely to be asked about smoking. White British patients were more likely to smoke than other ethnic groups, except Black Caribbean men with depression, 62% of whom smoked. Smoking advice was provided relatively equitably, but Black Caribbean men with depression were less likely to receive advice than White British men with depression (59% vs 81%). Disparities in smoking outcomes with respect to age and ethnicity persisted after the financial incentives were introduced.

Conclusions

Introduction of financial incentives was associated with increases in recording smoking status and largely equitable provision of cessation advice, but variations in smoking outcomes between groups persisted. Extending financial incentives to include recording of ethnicity and rewarding quit rates may further improve smoking outcomes in primary care.

Chapter 1: Smoking

Introduction

Currently 20% of people in the United Kingdom (UK) smoke,[1] markedly reduced from around 70% for men and around 40% of women in the 1960s.[2] Globally, approximately one billion people smoke cigarettes or other tobacco products, 80% of whom live in low or middle income countries.[3]

In the UK in 2010/11, amongst people aged 35 years and over, there were approximately 1.5 million hospital admissions with a primary diagnosis of a disease that can be caused by smoking, and 460,000 admissions directly attributable to smoking,[1] representing around 5% of all admissions to hospital. For the same age group there were 79,100 deaths attributable to smoking, around 6% of all deaths.[1] These figures give a strong indication of the impact of smoking both on individuals and on the NHS. Smoking is also a major cause of health inequalities, since people from more deprived circumstances are more likely to smoke than those who are affluent,[4] and find it more difficult to stop smoking.[5 6]

Brief history of tobacco

Discovery of tobacco

The cultivated species of tobacco plants are *Nicotiana tabacum and Nicotiana rusticus,* of which *tabacum* is more commonly smoked. Both are native to North and South America and are from the same *Nicotiana* genus as potato, peppers and deadly nightshade. It is believed that tobacco may have grown in the Americas since around 5,000 BC but its earliest use is estimated to be around 1 BC by American Indians who smoked it in pipes for religious ceremonies and as a pain-relieving medicine.[7]

In 1492 the explorer Christopher Columbus landed in San Salvador and was given dried tobacco leaves by American Indians. He is credited with first bringing tobacco back to Europe but it wasn't until the mid-16th Century that it started to become popular due to its supposed medicinal properties. In 1560 Sir Frances Drake introduced Sir Walter Raleigh to pipe smoking and he in turn brought the habit to England in 1600. In 1604 King James I was the first to impose taxes on tobacco use in England and wrote a scathing criticism of tobacco and its users in a pamphlet entitled *A Counterblaste to Tobacco*, cited in Gately.[7] Nevertheless, by the beginning of the 17th century tobacco was being regularly imported into the UK

Key milestones in the UK smoking epidemic

By the mid-1800s cigars and cigarettes were introduced as a more convenient way of using tobacco than smoking a pipe, snorting it nasally (snuff) or chewing it. Industrialisation meant that cigarettes were easily and cheaply manufactured, and cigarettes became popular amongst soldiers during the First World War.[8] Between the wars competition between cigarette manufacturers increased and advertising was used to target women. During the Second World

War cigarettes were provided free to soldiers and smoking was heavily promoted in films as a desirable and glamorous habit, with a consequent surge in popularity with women. Smoking rates peaked in the USA and Europe between the end of the Second World War and the mid-1960s and prevalence started to decline with the emergence of links between smoking and lung cancer.[9] Since then, tobacco use, including passive smoking, has now been established as the foremost preventable health risk in the developed world, and an important cause of premature death worldwide.[10]

Health risks of smoking

Morbidity

Epidemiological studies from the 1700s described an association of tobacco with nasal cancer among snuff workers, and oral cancers among pipe smokers, but the strongest evidence linking tobacco use with lung cancer came from 20th century epidemiologic studies.[11] In 1940 a case-control study by Müller in Germany concluded, 'the extraordinary rise in tobacco use was the single most important cause of the rising incidence of lung cancer.'[8] By 1944, the American Cancer Society began to warn about health effects of smoking, but with the caveat that no definite evidence existed to link cigarettes and lung cancer. By the 1950s the link with lung cancer started to become apparent, following publications by Doll and Hill in the UK and Hammond and Wynder in the USA.[8]

Landmark retrospective studies published in the USA and the UK in the 1950s showed definitively that smoking and lung cancer were linked. Levin in a case control study of 236 lung cancer patients showed the risk of lung cancer to be ten times greater for heavy smokers than that for non-smokers.[12] Doll and Hill compared the smoking habits of 1732 lung cancer

patients with 743 patients without lung cancer and found that those with cancer were fifty times as likely to be heavy smokers than non-smokers.[13]

These studies were followed by prospective cohort studies, notably those by Doll and Hill in 1956, Hammond and Horn in 1959 and Dorn in 1959[9] which all showed a strong association between smoking and lung cancer and a significant increase in mortality rates for smokers. These studies suggest that in men the risk of smokers developing lung cancer is 10 times the risk for non-smokers, with a slightly reduced excess risk for women. Approximately 85-90% of lung cancer in men is attributable to smoking and around 66% for women. In summarising the evidence, the US Surgeon General Leroy E Burney in 1958 concluded that 'excessive cigarette smoking is one of the causative factors in lung cancer.'[14]

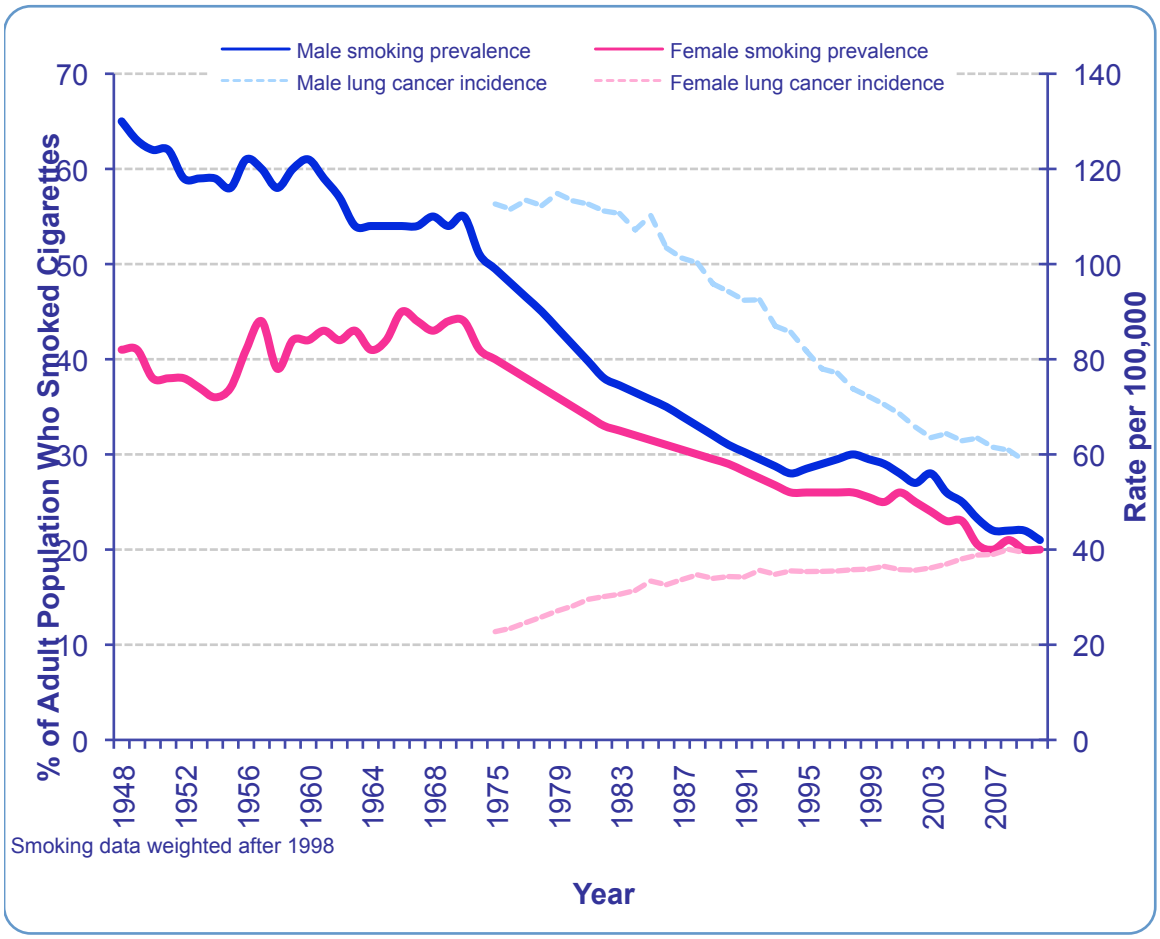
The accumulated evidence indeed shows that tobacco fulfills all the requirements for a causative agent including biological plausibility (presence in tobacco smoke of substances known to cause cancer in experimental studies), consistency and strength of the relationship across studies, specificity, prior exposure and a dose-response relationship.[15]

The increased risk of lung cancer in non-smokers through passive smoking has also been demonstrated, for instance through a case-control study by Brownson et al in 1992[16].This study compared non-smokers living with smokers with controls with no such exposure and found a 30% increased risk of lung cancer for subjects with the highest smoking exposure at home. A systematic review of 14 case-control or cohort studies examining the risk of lung cancer through workplace exposure to smoke found around a 40% increase in risk compared to people not exposed to smoke in the workplace.[17]

Following the publication of the RCP and US Surgeon General reports, and strengthened tobacco control measures since, smoking rates have gradually reduced to current levels of

about 20% of adults. Lung cancer rates also began to fall for men in the UK following these reductions in smoking prevalence (see Figure 1), and rates for women are stabilising.

Figure 1: Smoking Prevalence and Lung Cancer Incidence, by Sex, Great Britain, 1948-2010



Source: Cancer Research UK using ONS data

Tobacco use has been also been shown to be a major cause of other cancers including laryngeal, oral cavity, pharyngeal, and oesophageal cancer. It is also a contributory factor in the development of cancers of the pancreas, bladder and kidney, cervix, ovary, endometrium, gut, prostate, liver, brain and breast and in the development of adult leukaemia.[18] Tobacco

smoking is estimated to have caused 20% of cancer cases (60,000 cases) in the UK[19] and caused more than a quarter of cancer deaths in the UK, around 43,000 deaths in 2009.[20]

Cigarette smoking has been shown to be a major cause of cardiovascular disease, including coronary heart disease (CHD), stroke or transient ischaemic attack (TIA), aortic aneurysm, and peripheral vascular disease. CHD is the most common cause of death in developed countries and the population attributable risk fraction for smoking in CHD deaths is estimated to be around 30%.[21]

There is also strong evidence for the increased risk of cardiovascular disease with passive smoking, estimated to be between 30-60%, similar to that of light smokers.[22] The risk of stroke for the wives of smokers has been found to be twice as high as those whose husbands did not smoke.[23]

Smoking is a major cause of chronic lung diseases, particularly chronic obstructive pulmonary disease (COPD) and a range of other conditions such as peptic ulcer disease, osteoporosis and infertility.[18] Smoking while pregnant is a cause of placental abruption and miscarriage,[24] low birth weight and prematurity[25] and adversely affects a child's health throughout the life course.[26 27]

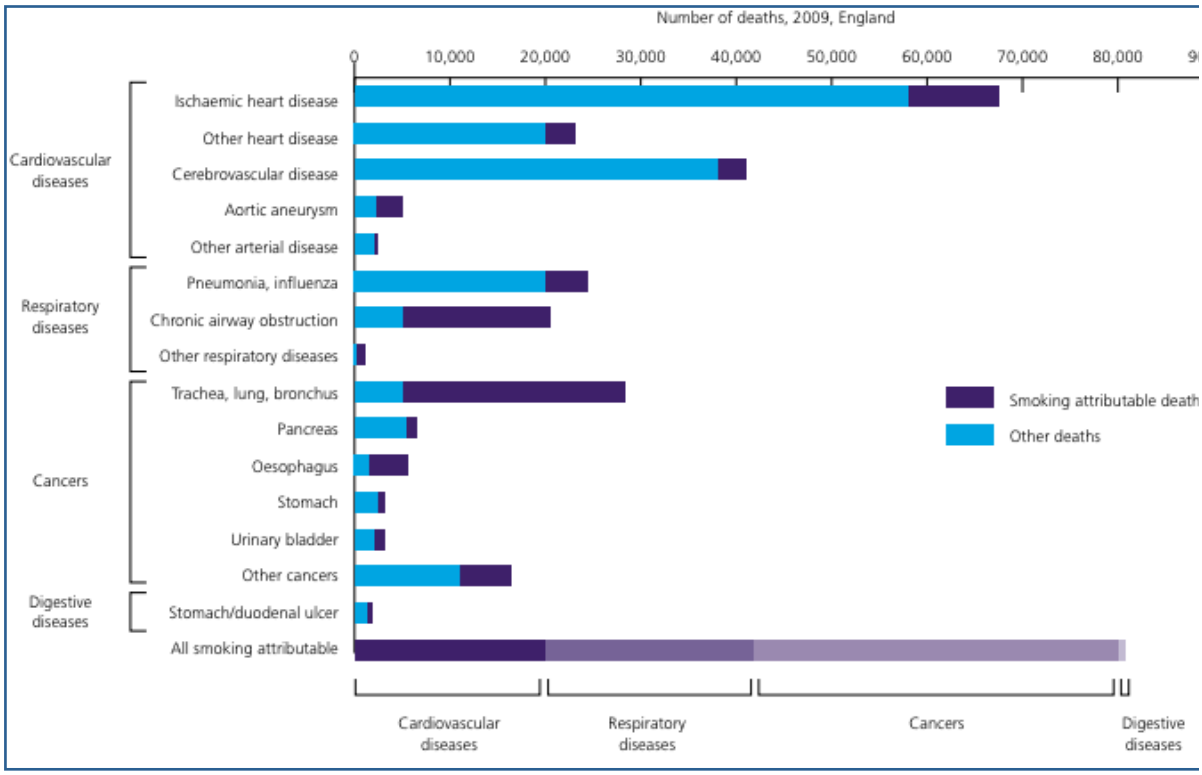
Premature mortality

Tobacco kills up to half of its users. Nearly six million people die globally each year from smoking related diseases. Of these people, more than 5 million are users and ex users and more than 600 000 are non-smokers exposed to second-hand smoke.[3]

Evidence from large prospective studies linking smoking with premature mortality has been well documented. One of the most compelling mortality studies was a prospective study of

34440 British doctors conducted by Richard Doll and Richard Peto.[28] This showed that the ratio of death rates from any cause for smokers versus non-smokers was 2:1 for men under-70 years and 1.5:1 for men over-70 years. The most common cause of death was cardiovascular disease, followed by lung cancer, followed by chronic respiratory disease. Ischaemic heart disease is today the most common cause of death caused by smoking (see Figure 2). The cohort was followed up for further 30 years and Doll and Peto published reports in 1994[29] and 2004.[30] The authors concluded that one in two long-term smokers die from the habit, a quarter of these between the ages of 35-69. On average, smokers die around 10 years earlier than non-smokers. However, the authors found (page 9) 'stopping smoking at age 60, 50, 40 or 30 gains, respectively, about 3, 6, 9, or 10 years of life expectancy.'

Figure 2: Mortality attributable to smoking by disease area in England, 2009

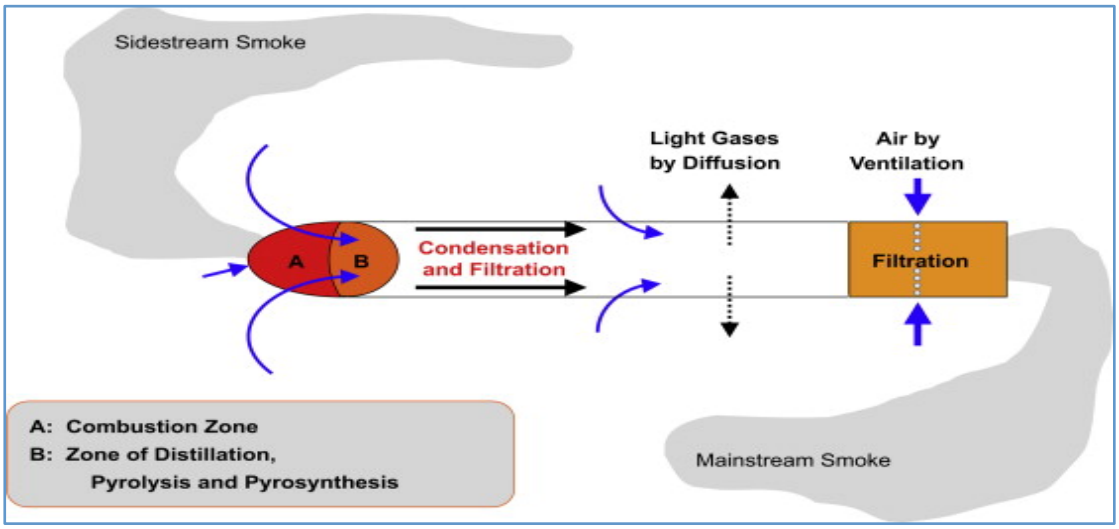


Source: Department of Health 'Healthy Lives, Healthy People: A Tobacco Control Plan for England 2010'

How smoking causes disease

Nicotine is the main pharmacologically active compound in tobacco smoke and produces its effects through binding to nicotinic acetylcholine receptors. Scientists have known since the early 19th Century that the pure form of nicotine is a dangerous poison. Now over 4,000 components have been identified in smoke, and these differ in the smoke inhaled (mainstream smoke) and the smoke issued from the lit end of the cigarette (side stream smoke), see Figure 3 from Thielen et al.[31]

Figure 3: The burning cigarette



Source: Thielen et al, 2008[31]

Exhaled mainstream smoke and side stream smoke together are referred to as environmental tobacco smoke (ETS). Tobacco smoke is composed of an aerosol of liquid droplets suspended in gases and semi-volatile molecules. The droplets are filtered through the cigarette filter and the gaseous products are inhaled, and include carbon monoxide, carbon dioxide, nitric oxide, and other compounds such as 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, benzene and hydrogen cyanide which are known toxins and carcinogens such as polynuclear aromatic hydrocarbons (PAHs).[31] Much of the analysis of

tobacco smoke was undertaken by Dietrick Hoffman and his colleagues since the 1980s who produced lists of compounds with biological or toxic effects (the 'Hoffman analytes').

The carcinogens in smoke cause cancer principally through the formation of bonds between carcinogens in smoke and deoxyribonucleic acid (DNA) in cells, leading to genetic damage and tumour formation. Components in smoke also interfere with the body's repair mechanisms leading to tumour growth and spread.

Smoking causes COPD through damage to the lining of the airway directly by noxious components present in tobacco smoke[32] and through the lungs' own repair processes. The resulting inflammation leads to thickening of the walls of the bronchi and bronchioles, and in some individuals the repair processes are inadequate even after stopping smoking. Tobacco smoke also paralyses the cilia in the bronchi, which are responsible for clearing debris and mucus from the lungs, predisposing to infection. These processes lead restricted airflow and accumulation of mucus.

Components of smoke cause cardiovascular disease through vasomotor dysfunction, inflammation, and modification of lipids. This leads to atherosclerosis, narrowing of vessels and subsequently to thrombosis in those vessels from endothelial damage, platelet dysfunction and alterations in the balance of antithrombotic/prothrombotic factors and fibrinolytic factors. These risks increase with the number of cigarettes smoked and the length of time smoking.[33]

Tobacco Industry response to the evidence

When the first studies linking tobacco with lung cancer were published in the 1950s, followed by the RCP and US Surgeon General's reports in the 1960s, the major US tobacco

companies were quick to discredit the research. Despite privately acknowledging the link, they responded with a statement that 'statistics purporting to link cigarette smoking with [lung cancer] could apply with equal force to any one of many other aspects of modern life' and formed the Tobacco Industry Research Council to help 'the research effort into all phases of tobacco use and health.' They focused their public relations efforts on reassuring the public whilst developing alternative 'healthier' cigarettes, with filters and low-tar options. Victims of lung cancer tried to take tobacco manufacturers to court for compensation without success as cases failed through the difficulty of proving causation. Tobacco manufacturers even in the 21st Century continue to cast doubt on the scientific techniques employed in proving the links between smoking and disease.[34]

Why people smoke

In order to develop successful smoking cessation strategies we need to understand both the addictive nature of tobacco and also smokers' beliefs about their ability to stop smoking.

Nicotine addiction

Nicotine is the major component of tobacco responsible for addiction. A third of people who try smoking progress to daily smoking, illustrating how highly addictive nicotine is, comparable with heroin and cocaine.[35]

Several factors contribute to nicotine addiction. These include tolerance, whereby the smoker requires more cigarettes to achieve the same effects as previously, due to up regulation of nicotine receptors. Nicotine acts on the midbrain causing chemical changes which lead to 'nicotine hunger' if the smoker stops smoking, in addition to other withdrawal symptoms (irritability, anxiety, depression). Positive reinforcement (reward effects from the psychoactive or stimulant effects of nicotine), and avoidance or reduction of negative states

(e.g. stress), also play a strong role in addiction. In addition, the behaviour becomes a learned response, subject to environmental cues, which makes relapse very likely when the smoker is presented with those cues, for example the association between having a cup of coffee or reading the paper and having a cigarette. Nicotine dependence is so strong that most quit attempts fail within a week, unless the smoker has pharmacological or other support to stop.[36] Despite this, up to 75% of ex-smokers stop without such support.[37] However, most will have made repeated attempts in order to do so. In a paper reporting results from the International Tobacco Control Four Country cohort survey published in 2011, Borland and colleagues found 40.1% (95% CI: 39.6–40.6) of 21 613 smokers surveyed tried to quit in a given year and reported an average of 2.1 attempts. The authors suggest (page 678), 'the average 40-year-old smoker who started in their teens will have made more than 20 failed quit attempts. This speaks clearly to the difficulty of quitting successfully, even when most smokers have at some time abstained for at least a month before relapsing.'[38]

Evidence from twin studies and molecular genetic research suggests there are both genetic and environmental influences on smoking initiation and persistence.[35] Social factors such as familial and peer modeling may influence experimentation with smoking in adolescence, whereas other factors such as genetics, psychiatric co-morbidity, tendency to externalizing disorders (e.g. attention deficit/hyperactivity disorder or conduct disorder) rather than internalizing disorders (anxiety or depression), and propensity to develop tolerance to nicotine may be more important in persistent smoking in adolescence and adulthood.[35] Other external influences are availability, packaging and price.[39]

Health beliefs about smoking

Health psychologists have examined health beliefs about health-impairing behaviours such as smoking since the 1970s. Models such as the following were developed to explain such behaviours and to devise behavioural means for addressing them.[40]

Early models developed from Attribution Theory, developed by Heider in the 1940s and 1950s suggested that individuals need to understand cause and effect, and the influence of self or others to explain events. For example people may attribute illness to internal causes (e.g. my developing a smoking-related illness is due to my choosing to smoke) or external causes (my developing a smoking-related illness is due to the tobacco companies encouraging me to smoke). These attributions also affect an individual's view of the solutions to the problems. People may attribute internal (self) or external (doctor) solutions to the illness, otherwise known as having an internal or external health locus of control.

The most commonly used health belief model for smoking cessation support is the Stages of Change, or Transtheoretical model by Prochaska and Diclemente, developed in 1982:

1. Pre-contemplation (not intending to make a change)
2. Contemplation (considering a change, weighing up pros and cons)
3. Preparation (making small changes)
4. Action (actively changing behaviour)
5. Maintenance (continuing the change over time) or Relapse.

Health belief models continued to be developed during the 20th Century, incorporating cognitive elements into the models to predict behaviour and behaviour change. These

constructs include individual perception of susceptibility and risk of disease, costs and benefits of changing behaviour and cues to action (for example, the Health Belief Model, HBM, Rosenstock, 1966); self-efficacy (for example, Protection Motivation Theory, PMT, Rogers, 1975, 1983, 1985); social norms and the influence of important others (Theory of Reasoned Action, TRA, Fishbein 1967; Ajzen and Fishbein, 1970); and beliefs about one's own capacity to change unhealthy behaviour (Theory of Planned Behaviour, TPB, Ajzen et al, 1986). More recently the Health Action Process Approach was developed, incorporating elements from the earlier theories (Schwarzer, 1992).

Smoking cessation support has drawn upon these health belief models and proposed a stage model approach, suggesting that cessation is influenced by action plans, goal setting and transition through stages.[40] Research has also used these models to examine success in quitting. For example, one study by Normal and colleagues published in 1999 examined the ability of the TPB to predict intentions to quit smoking, and quit attempts, in smokers attending primary care health promotions clinics. They found that cognitions of susceptibility and perceived control are associated with intentions to quit, and intentions to quit predicted quit attempts and the number of attempts.

Contrary to theories of planned behaviour more recent evidence suggests people are more likely to quit spontaneously. West and Sohal in their 2006 cross-sectional study of quit attempts made by around 2000 smokers and ex-smokers found that almost half had made unplanned quit attempts and that unplanned attempts were more likely to be successful than planned attempts.[41] They suggest that long-term smoking cessation may be the result of 'catastrophes', in which a person's beliefs, past experiences and current situation create tension, so a relatively small trigger can spontaneously motivate cessation.

Healthcare and social costs of smoking

The annual cost to the NHS of treating smoking-related diseases is estimated at around £3.3 billion[42] but these are not the only costs to take into account. Costs to the UK due to smoking-cessation efforts and reduced taxes due to premature mortality, absenteeism and costs of disability benefit in addition to NHS costs are given in Figures 4 and 5, taken from the all party parliamentary group on smoking and health: inquiry into the effectiveness and cost-effectiveness of tobacco control. As can be seen for the tables, the total costs of tobacco use (almost £14 billion) far outweigh the costs gained through taxation on tobacco, estimated to be around £10.5 billion in 2009/10.[43]

Figure 4: Annual costs of tobacco control measures

Measure	Estimated cost	Year of estimate	Graphical scope
NHS Stop Smoking Services	£74m	2008/09	England
NHS pharmacotherapies	£61m	2007/08	England
Anti-smuggling measures	£100m	2008/09	UK
Mass media campaigns	£20-£25m	Various	England & Wales
Enforcement of other restrictions (e.g. ban on sale of tobacco products to children)	Unknown	n/a	n/a

Source: APPG inquiry into the effectiveness and cost-effectiveness of tobacco control

Figure 5: Estimates of the overall annual cost of smoking to the public purse

Cost/benefit	Revenue loss/gain (2010)
Costs to the NHS for treating smoking-related diseases	£3.3 billion
Reduced tax revenue from premature mortality	£1.9 billion
Reduced tax revenue from workplace absenteeism	£1.5 billion
Increased disability benefit payments due to poor health	£3.2 billion
Reduced pensioner benefit payments as a result of premature mortality	-£0.9 billion
TOTAL	**£9.0 billion**

Source: APPG inquiry into the effectiveness and cost-effectiveness of tobacco control

Health inequalities and smoking

Inequalities in health

Health inequalities can be defined as 'differences in health experience and health outcomes between different population groups, according to socioeconomic status, geographical area, age, disability, gender or ethnic group.' (Health Development Agency self-assessment tool for local authorities, page 3[44]). Dimensions of inequality include: inequality due to the wider determinants of health (housing, education, transport, employment, food); financial and geographical inequality (whereby different areas receive different financial resources based on historical provision rather than need); inequality of service provision or access to services; inequality of service uptake (either due to lack of awareness of services, or due to services being, or seeming, inappropriate to some groups); and inequality of heath and illness between individuals and groups due to biology or behaviour.[45]

The major focus for research and policy addressing inequalities in health has been mainly on the effects of socio-economic status. Health outcomes evaluated include morbidity, mortality, years of life lost or quality of life measures.

Smoking is the principal behaviour leading to health inequalities. In 'Fair Society, Healthy Lives,' published in 2010, Professor Sir Michael Marmot concluded (page 145) 'smoking accounts for approximately half of the difference in life expectancy between the lowest and highest income groups. Smoking-related death rates are two to three times higher in low-income groups than in wealthier social groups.'[46]

Classification of socio-economic status

The UK government has included questions about socio-economic status in the decennial national Census from the early 20th Century and this has allowed researchers to examine health outcomes by socio-economic status. Initially socio-economic status was classified using the 'Registrar General's social classes' (RGSC). These were introduced in 1913 and renamed in 1990 as 'Social class based on occupation'. Each category, as far as possible, represented similar levels of occupational skill, but did not use any validated sociological framework, rather the judgments of the staff in the Registrar General's Office.[47]

The RGSC did not take account of differences in individuals within each occupational category, such as educational level, or of social mobility. By the end of the 20th Century the 'National Statistics Socio-economic Classification' (NS-SeC) replaced the Registrar General's classification in 2001. This system took account of 'employment relations' characteristics that are widely recognised as significant in the literature (such as mode of payment, career prospects and autonomy,[47] the main distinction being between employers,

employees, the self-employed and those excluded from work. The categories used for both systems are shown in Figure 6.

Figure 6: Classifications for Socio-economic status in the UK

Registrar General

I	Professional
II	Managerial/Technical
IIIN	Skilled (non-manual)
IIIM	Skilled (manual)
IV	Partly Skilled
V	Unskilled

National Statistics Socio-economic Classification (NS-SeC)

Senior professionals / managers

Associate professionals /junior managers

Other clerical, administrative and sales workers

Self-employed

Supervisors / technicians

Intermediate workers (semi-routine)

Other workers

Never worked / other inactive

Source: www.ons.gov.uk/

Other socio-economic measures used in research include educational level and income, which both correlate well with health outcomes. However, where such individual level data

are not available, composite area-based measures were developed such as the Carstairs and Townsend scores and the Index of Material Deprivation (IMD)[48].

The Carstairs score[49] takes into account the proportion of households in the area that are overcrowded; the proportion of household in the area that are in social classes IV and V or unemployed and the proportion of households in the area that are in non-owner occupied properties. The Townsend score[49] includes the proportion of unemployed residents over 16; the proportion of households in the area with one person per room and over; the proportion of households with no car; and the proportion of households not owning their own home. IMD uses seven domains (income; employment; health and disability; educational skills and training; crime, housing and services; and living environment) and was designed to measure deprivation at ward level.[50]

One of the main limitations of using area-based measures to assign deprivation levels is 'ecological fallacy,'[51] making incorrect inferences about individuals from observations made about groups of people. For example, not all people living in deprived areas are deprived, and this is especially true of people living in cities. However, IMD based on individual-level and general practice postcodes has been extensively validated as proxies for resident's socio-economic status for researching associations between deprivation and health outcomes.[52]

Emergence of evidence for health inequalities: The Black Report

The welfare state and the NHS were set up in 1948 by the UK Labour Government with the intention of improving access to healthcare for people in lower socio-economic backgrounds and thus reduce inequalities in mortality rates and life expectancy between richest and poorest. However, by the late 1970s it had become apparent that socio-economic inequalities in health outcomes were actually increasing.

These findings led to the then Labour Government to commission a research working group in 1977 to look into health inequalities, chaired by Sir Douglas Black. The report was published in 1980[53] but the incoming Conservative government rejected its findings and tried to suppress the promotion of the report due to cost implications and lack of political interest. However this was not successful and the findings of the report proved to be highly influential in bringing health inequalities into the spotlight for research and policy.[54]

Using 1971 mortality statistics, the Black Report showed wide disparities in health between the richest and poorest. For example, the age standardized mortality ratio was far greater in unskilled workers compared with professionals (123 vs 79 per 100,000 aged 15-64) and showed a gradient through the intermediate classes. The report also found large class differences for infant mortality and mortality from specific diseases. Children from families in social class V were twice as likely to die as those in social class I. Black suggested four reasons why this might be the case:

1. Measurement artefact (e.g. measurement of 'social class'during census and on death certificate could differ);

2. Natural or social selection (e.g. health related social mobility – healthier people move up the social hierarchy and unhealthy people move down);

3. Cultural / behavioural (class differences in behaviours, such as smoking, diet, alcohol intake, physical activity);

4. Materialist (factors which contribute to inequalities are due to the way society is organised. Behaviours such as smoking occur in a social and economic context).

The report concluded that materialist factors were the most likely explanation for socio-economic health inequalities and made wide-ranging recommendations for policy and research (Figure 7), including for prevention (including banning of tobacco advertising) and health education.[55] The Committee considered (Davey Smith, page 1465) that the 'preventive way to attack [inequalities in health] is in childhood and, in the light of massive research, the first years of life.'[24] This hypothesis has been strengthened out by subsequent research examining the origins of disease in early life and across the life-course.[56-58]

Other authors proposed that a combination of all the proposed causes is more likely responsible than merely materialist factors, and also other mechanisms not considered by Black. For instance, Stringhini et al suggest in their 2011 paper (page 1) 'Health damaging behaviours are often strongly socially patterned; material constraints, lack of knowledge, and limited opportunities to take up health promoting messages may act as barriers for lower socioeconomic groups to adopt a healthy lifestyle.'[59] Graham proposed that smoking in women was seen a reward or compensation for the hardships resulting from material deprivation.[60]

The large-scale Whitehall studies, following up a cohort of 10,308 civil servants aged 35 to 55 years since 1985, suggested that some of the gradient in health outcomes, such as life expectancy, can be partially explained by the gradient in prevalence of behaviours such as smoking which vary with socio-economic status. For example, in Stringhini et al's longitudinal study of mortality in the Whitehall II study found that 32% of the age and sex-

adjusted excess all-cause mortality seen between highest and lowest socio-economic groups could be explained by smoking, which was more prevalence in the lower socio-economic group (Hazard ratio, HR, 1.60, CI 1.06 to 2.04, reduced to HR, CI 1.36 1.06 to 1.74 when adjusting for smoking). In the fully adjusted model, taking into account smoking (and the reduction in prevalence over the study period), alcohol, diet and physical activity the excess risk dropped by 72% (HR 1.14, CI 0.89 to 1.47),[61] showing how great an influence behaviour has on health inequalities.

Work by Marmot, Wilkinson and colleagues, suggests a large contribution to health inequalities comes from psychological stress resulting from an individual's awareness of their own level of deprivation in relation to others or from a feeling of lack of control in the workplace, which generate a stress response with increased cortisol levels and other neuroendocrine changes which affect blood lipid levels and clotting factors, predisposing individuals to cardiovascular disease.[62] Other contributory factors include differences in social capital (which includes community networks, relationships with friends and relatives, sense of belonging and safety, and reciprocity).[63]

Figure 7: Recommendations of the Black Report

For policy within the health sector the Black Report had three priorities:

1. For children to have a better start in life;
2. For disabled people bearing the brunt of cumulative ill health and deprivation;
3. For preventive and educational action to encourage good health.

For broader social policy it had two main priorities:

1. A comprehensive anti-poverty strategy;
2. Improving education.

For research it had six main priorities:

1. Surveillance of the development of children, especially in relation to accidents;
2. Better understanding of the health effects of such aspects of behaviour as smoking, diet, alcohol consumption and exercise;
3. The development of area social conditions and health indicators for use in resource allocation;
4. Study of health hazards in relation to occupational conditions and work;
5. Better measures of the prevalence and course of disability;
6. Study of the interaction of social factors implicated in ill health over time and within small areas.

Souce: Macintyre 1997[55]

Key policy responses to health inequalities

The Acheson Report

The Black Report, despite highlighting the importance of health inequalities, did not result in much change of policy whilst the Conservatives were in government and evidence for growing inequalities in health status as well as mortality grew over the next 10 years.[64] The Labour Government was elected in 1997 and commissioned an Independent Inquiry into Health Inequalities. The resulting Acheson report was published in 1998.[65] This documented further evidence for health inequalities being explained mainly by socio-economic differences between groups and recommended substantial changes in policy.

The report found an increasing gap between social classes despite an overall improvement in health outcomes such as life expectancy. This may be because initiatives to improve particular conditions, such as cardiovascular disease, are taken up more readily by affluent people than those from more deprived backgrounds.

The report made 39 recommendations, with the following three being described as crucial:

- All policies likely to have an impact on health should be evaluated in terms of their impact on health inequalities;
- A high priority should be given to the health of families with children;
- Further steps should be taken to reduce income inequalities and improve the living standards of poor households.

The report specifically mentioned the impact of smoking on health and emphasised that people from most deprived groups were more likely to smoke, and less likely to give up, than

those from the most affluent groups. It suggested that smoking was an important cause of differences in mortality between social classes and recommended restrictions on smoking in public places, banning of tobacco advertising and promotion and large-scale education about the dangers of smoking. It also recommended increasing the price of tobacco products, introducing smoking cessation programmes for pregnancy, focused on those less well off, and for nicotine replacement therapy to be prescribed on the NHS.

Only three of the recommendations addressed healthcare, illustrating the importance of socio-economic and societal influences on health. Despite receiving some criticism for the recommendations being vague, not being fully evidence-based or costed, and lacking a hierarchy of importance,[24] the government accepted the findings of the Acheson report and incorporated the recommendations into its policies (see Figure 8).

Figure 8: UK Policy Addressing Health Inequalities following the Acheson Report

Domains of Policy	**Examples**
Life-course approach: early childhood	Sure Start program Family Nurse Partnership
Area based initiatives: focus on disadvantaged communities	Health Action Zones
Redistributions: welfare to work	Tax credits
Healthcare	Organisational reform in the NHS Primary Care Trusts
Targets and performance culture	Public Service Agreements
Structures and processes: joined up government	Cross-cutting review of health inequalities

Source: Exworthy et al, 2003[66]

In particular, two key documents set out the government's plans to address health inequalities. The white paper *Our Healthier Nation* (published in 1998) which aimed to promote healthier living and reduce inequalities, including tackling the contribution of smoking to health inequalities through another white paper, *Smoking Kills* published in 1998, which proposed a ban on tobacco advertising and sponsorship. *Our Healthier Nation* focused on 'the main killers'; cancer; coronary heart disease and stroke; accidents; and mental illness, and set out targets for improvement by 2010 (see Figure 9):

Figure 9: Targets in Saving Lives Our Healthier Nation

- Cancer: to reduce the death rate in people under 75 by at least a fifth;
- Coronary heart disease and stroke: to reduce the death rate in people under 75 by at least two fifths;
- Accidents: to reduce the death rate by at least a fifth and serious injury by at least a tenth;
- Mental illness: to reduce the death rate from suicide and undetermined injury by at least a fifth.

The government then published an *Action Report* in 1999 with the aim to 'improve the health of the worst off in society and to narrow the health gap' whereby health and social services, were required to work together to set up health programmes and health action zones with local targets to address areas of particular local health inequalities.[67]

The *NHS Plan* followed in July 2000 and stated the government's plan to reform the NHS; to target prevalent diseases through prevention and improved management; to reduce inequalities in access to health services; and to improve child health. The NHS plan also set out national health inequalities targets to narrow the gaps in infant mortality and life expectancy. It also set out a major expansion in smoking cessation services. Local targets for reducing health inequalities were strengthened by the introduction of Public Service Agreements (PSA), in which targets were agreed between the Treasury and government departments. The PSA targets for health inequalities are shown in Figure 10 below, and include tackling smoking.

Figure 10: Public Service Agreement (PSA) targets for health inequalities

- Starting with children under one year, by 2010 to reduce by at least 10% the gap in mortality between routine and manual groups and the population as a whole;
- Starting with local authorities, by 2010 to reduce by at least 10% the gap in life expectancy between the fifth of areas with the worst health and deprivation indicators (the Spearhead Group) and the population as a whole;
- To reduce the inequalities gap between the fifth of areas with the worst health and deprivation indicators and the population as a whole by at least 40% for cardiovascular disease and by at least 6% for cancer;
- To reduce adult smoking prevalence in routine and manual groups to 26% or less by 2010.

Following on from these initiatives the Government carried out a cross cutting review on health inequalities in 2002. The review found inequalities in access to prevention, screening, diagnostic and treatment services for CHD and cancer. It recommended developing service provision, access and quality in areas and among underserved populations and improving the quality of preventive and treatment services for coronary heart disease, stroke, diabetes and cancer through National Service Frameworks. The Government published a 10-year review in 2009, 'Tackling health inequalities: 10 years on,' showing progress in reducing inequalities in health (Figure 11).

Figure 11: Improvements in health over the last 10 years

	1995-97	2005-07	Difference over 10 years
Life expectancy: males (years)			
England	74.6	77.7	+3.1
Spearhead areas*	72.7	75.6	+2.9
Absolute gap	1.9	2.1	
Life expectancy: females (years)			
England	79.7	81.8	+2.1
Spearhead areas	78.3	80.2	+1.9
Absolute gap	1.4	1.6	
Infant mortality (per 1,000 live births)			
England	5.8	4.7	-1.1
Spearhead areas	6.6	5.4	-1.2
Absolute gap	0.8	0.7	

*The spearhead group comprises the 70 local authority areas with the worst health and deprivation indicators. This is the basis for the life expectancy targets. The routine and manual group covers groups 5-7 in the ONS NS-SEC socio-economic classification. This is the basis of the infant mortality target.

Source: based on the Department of Health (2008) Tackling Health Inequalities: 2005-07 Policy and Data Update for the 2010 National Target. Absolute gap and difference over 10 years based on rounded figures

The Marmot Review

The World Health Organization's Commission on Social Determinants of Health published a critical report in 2008, *Closing the gap in a generation*. The chair of the commission, Professor Sir Michael Marmot, was then asked by the UK government to chair an independent review of health inequalities and to come up with evidence-based strategies to reduce variation. The Review had four aims:

1. To identify, for the health inequalities challenge facing England, the evidence most relevant to underpinning future policy and action

2. To show how this evidence could be translated into practice

3. To advise on possible objectives and measures, building on the experience of the PSA target on infant mortality and life expectancy

4. To publish a report of the Review's work that will contribute to the development of a post-2010 health inequalities strategy.

The final report, *Fair Society Healthy Lives*, was published in 2010 and showed that socio-economic disparities persist.[46] For example, in England, the health expectancy (disability-free life expectancy) for people living in the poorest areas is 17 years lower than for people living in the most affluent areas. The review found (page 62), 'Risk factors for cancer and circulatory diseases, such as smoking, physical inactivity and obesity, are elevated along the social gradient. The burden of disease falls disproportionately on people living in deprived conditions, and for some health conditions falls particularly heavily on certain ethnic groups'.

Marmot stated (page 46). 'While there have been improvements in health across the social spectrum, there has been no narrowing of the gap between rich and poor despite several

attempts over the years to tackle health inequalities, and there is some evidence of the gap widening.' The report recommended the following six policy objectives:

1. Give every child the best start in life;

2. Enable all children, young people and adults to maximize their capabilities and have control over their lives;

3. Create fair employment and good work for all;

4. Ensure healthy standard of living for all;

5. Create and develop health and sustainable places and communities;

6. Strengthen the role and impact of ill-health prevention.

Within recommendation 6 (page 142) is the specific recommendation to:

'Implement evidence-based ill health preventive interventions that are effective across the social gradient by:

- Increasing and improving the scale and quality of drug treatment programmes, diverting problem drug users from the criminal justice system;
- Focusing public health interventions such as smoking cessation programmes and alcohol reduction on reducing the social gradient;
- Improving programmes to address the causes of obesity across the social gradient.'

The report emphasizes the importance of tobacco control to reducing health inequalities, particularly pricing, and (page 145) 'at local levels, greater emphasis in smoking cessation initiatives on the psychosocial reasons for smoking and prioritizing deprived and marginalised groups is required, focused particularly on routine and manual socioeconomic groups, and people with mental health problems.'

Inequalities in health between ethnic groups

As described previously, the Marmot review found (page 62) 'The burden of disease falls disproportionately on people living in deprived conditions, and for some health conditions falls particularly heavily on certain ethnic groups.' Ethnicity is a complex concept, which varies according to context and has a wide sociological literature. One definition given by Nazroo in a paper published in 1998 (page 712) is that ethnicity 'reflects self-identification with cultural traditions that both provide strength and meaning, and boundaries (perhaps fluid) between groups.[68]

The censuses in 1991 and 2001 classified ethnicity as shown in Figure 12. However, there are several concerns about the validity and reliability of ethnic group classifications when used in research. Self-selected ethnicity may not match researcher-assigned ethnicity. Limited choices such as 'White; Black; Asian' may mask within group differences and exaggerate between-group differences. Ethnicity is not recorded on death certificates, so mortality data usually uses country of birth as a proxy, which would not pick up people from minority ethnic groups who were born in the UK.

Figure 12: Census ethnic categories

1991 census ethnic categories

1. White
2. Black-Caribbean
3. Black-African
4. Black Other please describe
5. Indian
6. Pakistani
7. Bangladeshi
8. Chinese
9. Any other ethnic group please describe

The 2001 census ethnic categories

A. White

- British
- Irish
- Any other white background, please write in

B. Mixed

- White and black Caribbean
- White and black African
- White and Asian
- Any other mixed background, please write in

C. Asian or Asian British

- Indian
- Pakistani
- Bangladeshi
- Any other Asian background, please write in

D. Black or Black British

- Caribbean
- African
- Any other black background, please write in

E. Chinese and other ethnic group

- Chinese
- Any other, please write in

Source: ONS

Despite the limitations in classifying ethnicity, evidence for health inequalities across ethnic groups has been extensively demonstrated in the United States and the United Kingdom[69] For example, for cardiovascular disease, in the United Kingdom people who were born in South Asia have far higher mortality rates from ischaemic heart disease, and those born in the Caribbean have higher mortality rates from strokes and other outcomes resulting from hypertension, than those born in England.[70]

One theory, extrapolated from the Black Report, is that these variations are due to socio-economic causes rather than directly due to differences in genetics or behaviour, including differences in ability to access services.[71] However, other authors suggest health is adversely affected by the stress of racism.[72] For example, Salway et al, in a rapid response to a BMJ editorial by Hunter in 2010,[73] suggest 'Socioeconomic deprivation inter-relates closely with racialised hierarchies of exclusion and discrimination across the life-cycle. There is evidence that health outcomes of some minority ethnic groups are worse than would be expected on the basis of their socioeconomic circumstances alone, and that the direct and indirect experience of racism in everyday life is an important contributory factor.'

The Acheson report recommended addressing ethnic group inequalities in the socioeconomic determinants of health through improved data collection and monitoring of disparities and through considering the needs of ethnic minority groups when designing health services. The report specifically recommended:

- The needs of minority ethnic groups are specifically considered in the development and implementation of policies aimed at reducing socioeconomic inequalities;
- Further development of services which are sensitive to the needs of minority ethnic people and which promote greater awareness of their health risks;

- The needs of minority ethnic groups are specifically considered in needs assessment, resource allocation, health care planning and provision.

The focus on reducing inequalities due to ethnicity was strengthened by the Race Relations (Amendment) Act 2001. This Act promotes race equality by all public sector authorities and requires them to show that their policies do not discriminate against any ethnic group though equality impact assessments.

Inequalities and smoking

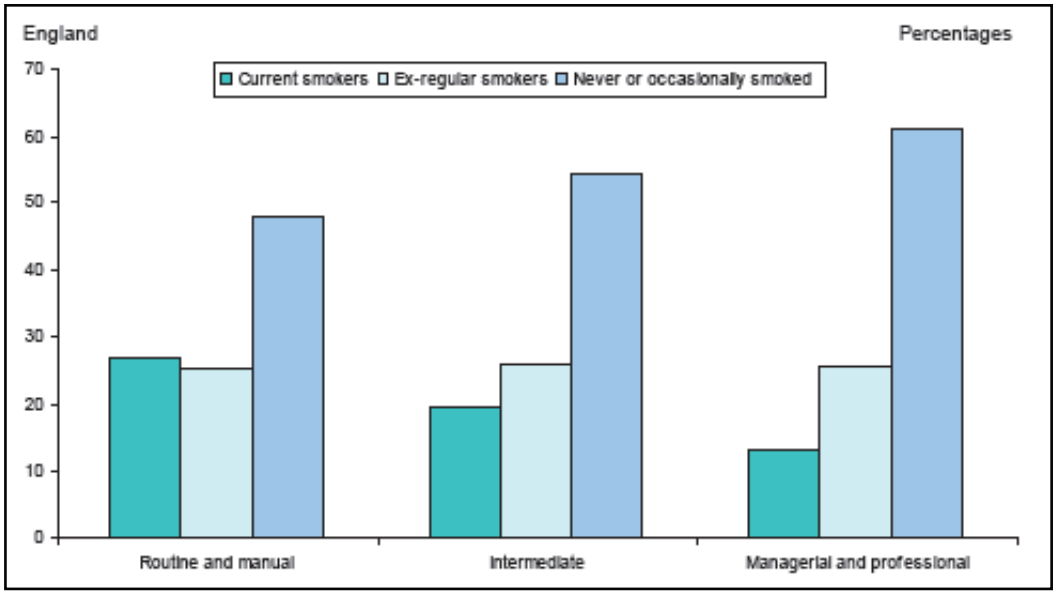
> "Smoking prevalence is strongly associated with social disadvantage and is the largest cause of social health inequalities."

Ferguson et al, 2012[74]

The Whitehall studies and others previously described have shown that smoking contributes between a third and a half of the excess risk of morbidity and mortality seen between people from the most and least deprived backgrounds. In the Whitehall II study, 32% of the age and sex-adjusted excess all-cause mortality seen between highest and lowest socio-economic groups could be explained by smoking. The hazard ratio (HR) for all-cause mortality for the lower socio-economic group compared with the higher socio-economic group was 1.60 (CI 1.06 to 2.04) before smoking was taken into account. The HR reduced to 1.36 (CI 1.06 to 1.74) after adjusting for smoking, which more prevalence in the lower socio-economic group (29.7% vs 10.1% in the higher socio-economic group).[61] In a study by Jha et al looking at mortality from lung cancer, the mortality rate among men aged 35 to 69 years in England and Wales was 43% for men from the lowest socio-economic group compared to 21% for men in the highest socio-economic group.[75]

People from low-income backgrounds are more likely to start smoking as adolescents and less likely to quit as adults,[6] and so prevalence rates are higher in more deprived groups. In 2010, 28% of adults in routine and manual households smoked compared with 13% of those in managerial and professional households (See Figure 13).[1] Children from deprived families are more likely to be exposed to second-hand smoke and women from low-income backgrounds are more likely to smoke while pregnant.[35]

Figure 13: Cigarette smoking status among adults, by socio-economic classification of household reference person, 2010

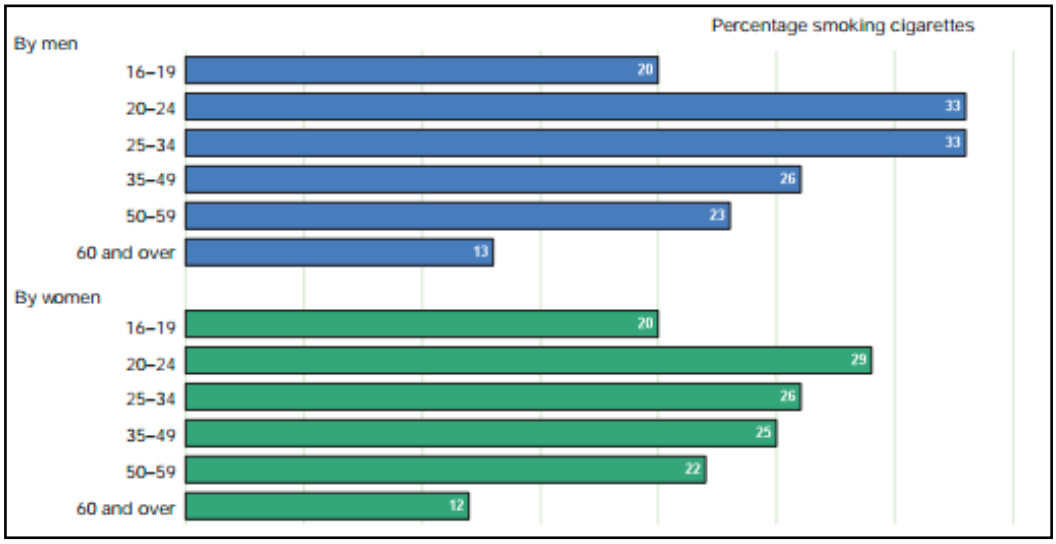


Source: General Lifestyle Survey 2010. © The Office for National Statistics, 2012,

There are also differences in smoking prevalence with respect to gender and geography, with rates varying from 27% of men in the North East of England to 20% of women in the West Midlands, the East of England, London and the South East.[76]

The main sources of data for smoking prevalence among adults in Great Britain are the General Lifestyle Survey (GLS), formerly the General Household Survey (GHS), published as reports by the Office for National Statistics (ONS). The Health Survey for England (HSE) also contains questions about smoking. The smoking statistics for England published in 2012 showed a continuing trend for higher smoking prevalence in men aged 20-34 (33%) and women aged 20-24 (29%).[1] Smoking rates then tend fall with age, as people give up smoking or die from smoking-related illnesses, and are also lower in people aged under 20, see Figure 14.

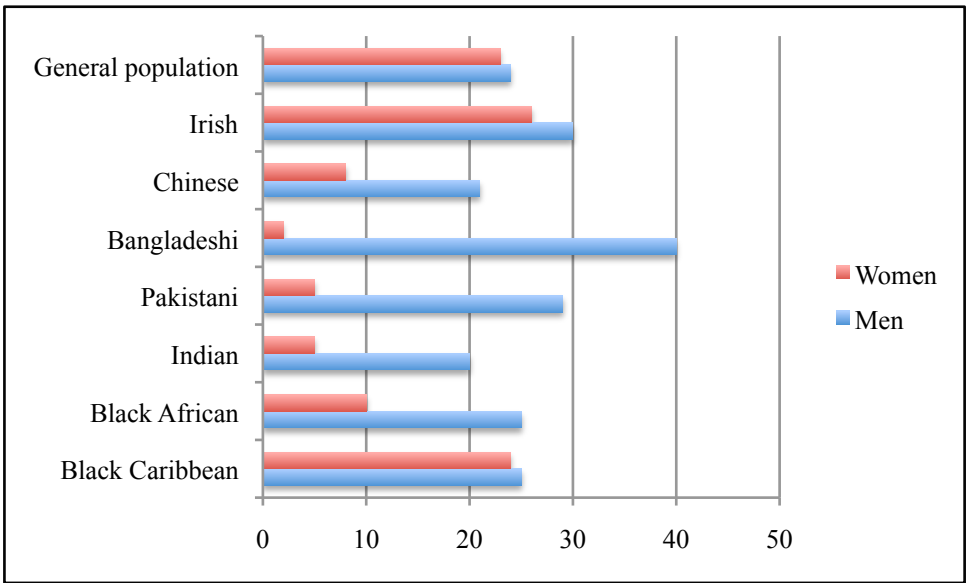
Figure 14: Adult smoking prevalence by gender and age, Great Britain, 2010



Source: General Lifestyle Survey 2010. ©The Office for National Statistics, 2012

Research examining inequalities between ethnic groups in smoking prevalence and the provision of smoking cessation interventions in the UK is sparse but studies using the Health Survey for England in 2004 and 2010[77] have shown the following differences. Both surveys showed higher smoking rates in men than women in all age groups. In the 2004 survey the highest smoking rates were in Bangladeshi, Irish and Pakistani men (Fig 15). For women, there were far lower smoking rates in women from South Asian and Chinese ethnic groups.[76]

Figure 15: Adult smoking prevalence by ethnicity and gender



Source: 'Tackling Health Inequalities: 10 Years On' using data from the Health Survey for England, 2004

In the 2004 General Household Survey which specifically looked at smoking among ethnic minorities, smoking prevalence ranged from 20% for Indian men, to 40% for Bangladeshi men, compared with a National average for men of 24%. For women, smoking prevalence ranged from 2% for Bangladeshi women to 26% for Irish women, compared with a National average at the time of 23% for women.[78] The same report showed that smoking prevalence tends to fall with age for all ethnic groups, with the highest prevalence being in those aged 16-34 years. However in Bangladeshi and Caribbean men this was not the case, and the highest prevalence was found in those aged 35-53 years.

In a more recent study by Karlsen et al using combined data from the HSE 2006-08,[77] the authors found higher age-standardised smoking rates among black Caribbean men (37%) and Bangladeshi men (36%) compared with white British men (27%). The authors also found higher smoking rates for White women and black Caribbean women (28% and 25%,

respectively) than for women from other ethnic groups. Studies from the USA have shown higher smoking prevalence among Whites and African-Americans,[79 80] and for non-White smokers to be less likely to receive smoking cessation advice.[81 82] These disparities are an important cause of health inequalities, given the higher risk of smoking-related diseases among south Asian and African-Caribbean populations,[77] and higher mortality rates in these groups particularly for circulatory disease linked to smoking. For example, a study by Wild et al using Census data from 2001 examined mortality rates by ethnicity, where ethnicity was classified by country of birth (although acknowledging this would miss people from different ethnic groups born in England and Wales), linked with mortality data from ONS.[83] The authors found standardized mortality rates for ischaemic heart disease were statistically significantly higher among man and women aged over-20 years born in Ireland, East Africa, Bangladesh, Pakistan or India compared with rates for England and Wales, with the highest rates seen in Bangladeshi men (SMR 1.75, CI 158 to 193).

Smoking rates are particularly high among people with severe mental health conditions, such as major depression, schizophrenia and bipolar disorder, and studies have shown that people with these conditions find it particularly difficult to stop smoking. For example, in a survey study of 168 patients with schizophrenia in Scotland, Kelly et al found that 58% of the 135 respondents smoked compared with 28% in the general population.[84] In a US study of 4411 respondents aged 15 to 54 years, using the National Comorbidity Survey, Lasser et al found current smoking rates for people with no mental illness, lifetime mental illness, and past-month mental illness were 22.5%, 34.8%, and 41.0%, respectively ($p<0.001$). Smokers with a history of mental illness had a self-reported quit rate of 37.1% ($p = 0.04$), and smokers with past-month mental illness had a self-reported quit rate of 30.5% ($p<0.001$) compared with smokers without mental health problems (42.5%).[85] The authors suggest that people with

such mental health conditions may be self-medicating with tobacco, but also cite evidence suggesting that smoking may cause mental health problems in susceptible people, also suggested by Kelly et al, who found that 90% of the smokers with schizophrenia in their study started smoking before diagnosis.

Key points from Chapter 1

- Smoking causes a range of serious diseases and leads to premature mortality.
- Smoking costs the UK in the region of £14bn each year.
- Smoking is the biggest cause of health inequalities.

Chapter 2: Policies to reduce smoking prevalence

Reducing the incidence of smoking-related diseases is a key international public health objective. World Health Organisation's (WHO) Framework Convention on Tobacco Control (FCTC)[86] was developed in response to what WHO calls 'the globalisation of the tobacco epidemic' and suggests tackling the problem through demand reduction strategies in addition to reducing the supply of tobacco products. The core provisions are summarised in Figure 16.

Figure 16: Core demand and supply reduction provision in the WHO FCTC

The core **demand reduction provisions** are contained in articles 6-14:

Price and tax measures to reduce the demand for tobacco, and Non-price measures to reduce the demand for tobacco, namely:

- Protection from exposure to tobacco smoke;
- Regulation of the contents of tobacco products;
- Regulation of tobacco product disclosures;
- Packaging and labeling of tobacco products;
- Education, communication, training and public awareness;
- Tobacco advertising, promotion and sponsorship; and,
- Demand reduction measures concerning tobacco dependence and cessation.

The core **supply reduction provisions** in the WHO FCTC are contained in articles 15-17:

Illicit trade in tobacco products;

Sales to and by minors;

Provision of support for economically viable alternative activities.

Article 14 recommends that countries implement 'demand reduction measures concerning tobacco dependence and cessation' alongside population level strategies such as the introduction of smoke-free workplaces, restricting advertising and raising taxation on tobacco. To ensure these measures are carried out, WHO introduced the 'MPOWER measures' to 'assist in the country-level implementation of effective interventions to reduce the demand for tobacco, contained in the WHO FCTC,' and the website provides detailed guidance about how to carry out the measures (http://www.who.int/tobacco/mpower/en/). The six components of MPOWER are:

1. **M**onitor tobacco use and prevention policies;
2. **P**rotect people from tobacco smoke;
3. **O**ffer help to quit tobacco use
4. **W**arn about the dangers of tobacco
5. **E**nforce bans on tobacco advertising, promotion and sponsorship;
6. **R**aise taxes on tobacco.

UK policy has followed these measures through regular surveys to monitor prevalence as described in Chapter 1, through its tobacco control policy, described in the next section, and through the provision of NHS stop smoking services, described below and in more detail later in this chapter.

UK tobacco control policy

Tobacco control efforts began in the UK following the first RCP report in 1962, which set out to prove 'the overwhelming case against tobacco' and recommended restrictions on tobacco advertising, smoking in public places and the sale of tobacco to children, plus increased taxation of tobacco. These recommendations were echoed in the first US Surgeon General's report 'Smoking and Health' in 1964. Cigarette advertising on television and radio was banned in the UK in 1965, and this has been followed over the decades by more comprehensive efforts by the UK government to reduce deaths from smoking and to reduce inequalities, as described in the previous chapter, resulting from higher levels of tobacco use among people from more deprived backgrounds. Current policy under the UK Coalition Government[39] targets five areas, with promotion through a marketing and education strategy:

- Stopping the promotion of tobacco;
- Making tobacco less affordable;
- Effective regulation of the sale of tobacco products (including packaging, displays and vending machines);
- Helping tobacco users to quit;
- Reducing exposure to second-hand smoke.

Stopping promotion of tobacco

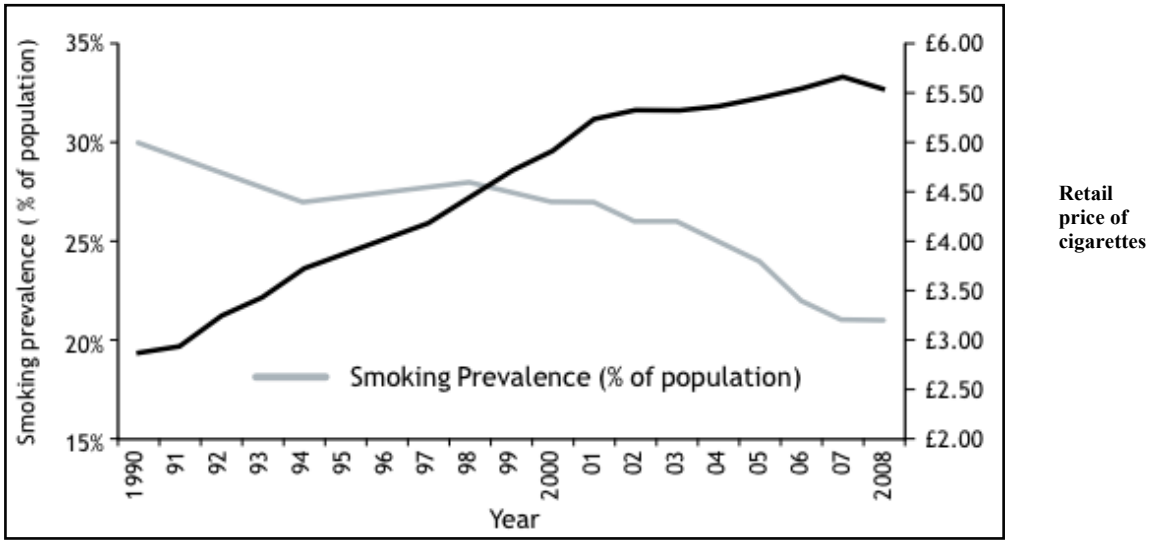
The Tobacco Advertising and Promotion Act 2002 prohibits tobacco advertising but the Tobacco Industry has strategies to circumvent this, including targeted packaging, point-of-sale displays and through the entertainment sector, including the internet. Through the Health Act 2009, displays are being removed from large shops from April 2012 and from all shops by 2015. Sale of cigarettes from vending machines was discontinued in 2011. There is currently a consultation about introducing plain packaging for cigarettes and means of

reducing promotion through films and the internet. Health warnings on cigarette packets have been in place since 1971, and from 2003 large pictorial health warnings have been compulsory.

Making tobacco less affordable

The use of tobacco is highly sensitive to price (see Figure 17, taken from the All Party Parliamentary Group on Smoking and Health's Inquiry[42] into the effectiveness and cost-effectiveness of tobacco control), so raising the price of tobacco through taxation is one way to reduce consumption. Efforts have also been made through UK Border Agency and Her Majesty's Revenue and Customs to reduce the illegal importation of tobacco products as tobacco smuggling undermines the effect of price rises. The government estimates that this action has reduced the market share of smuggled cigarettes in the UK from 20% in 2000 to around 12% in 2010.

Figure 17: Effect of increasing cost of cigarettes on smoking prevalence



Source: Source: APPG on Smoking and Health Inquiry using data from General Household Survey/General Lifestyle Survey. Cigarette prices: Tobacco Manufacturers' Association

Effective regulation of the sale of tobacco products

In 1986 the sale of any tobacco product to children under 16 years was made illegal. In 2007 the legal age for purchase was increased from 16 years to 18 years. The effect of this increase was examined by Millett et al, who analysed data from the Smoking, Drinking and Drug Use among young people in England (SDDU) survey.[50] The authors found that the age increase was associated with reduced prevalence of regular smoking among young people (adjusted OR 0.67, $p<0.001$) and that this reduction was seen in across all socio-economic groups. The government's Tobacco Plan seeks to strengthen enforcement of the age limits and also restrict the sale of niche tobacco products such as waterpipe (shisha) tobacco.

Helping smokers to quit

Action on Smoking and Health (ASH) was set up in 1971 by the Royal College of Physicians in order to educate the public about the dangers of smoking and to campaign for tobacco control policies. The Department of Health also provides information and advice through a website (http://gosmokefree.nhs.uk/) and with television advertising campaigns. In March 1984 National No Smoking Day was launched in the UK and remains an annual event. The government set up the NHS Stop Smoking Service, in 1999/2000, following recommendations of the White Paper *Smoking Kills* in 1998. This is discussed further in the section 'Individual level smoking cessation interventions', below. Smoking surveillance through surveys helps to inform policy and service delivery

Reducing exposure to second-hand smoke

In 2002 the International Agency for Research on Cancer reported that regular exposure to environmental tobacco smoke increased the risk of lung cancer by 20% to 30% and evidence suggests the risk of cardiovascular diseases increases by 25%.[87] In 2004 the WHO

Framework Convention on Tobacco Control was ratified and Ireland became the first country in the world to ban smoking in public places, public transport and workplaces, followed by Scotland and England in 2007.

Effect of tobacco control policies

As several tobacco control initiatives were introduced from 2000 onwards, the effect of individual components of tobacco control policy to the reduction in smoking prevalence in the UK after 1998 is difficult to determine. However, before-and-after studies and time-series analyses show improvements. For example, after the smoking ban in the UK evaluations showed improved health outcomes[52] including reduced hospital admissions for myocardial infarction[88] a reduction in asthma admissions[89] and a reduction in premature and low birth weight babies.[90]

Helping smokers to stop smoking

Individual level smoking cessation interventions by health care professionals are highly effective and, if delivered equitably, have the potential to reduce health inequalities resulting from tobacco use.[91-93] In order to improve smoking cessation rates, effective pharmacological treatments are usually required, as well as advice or behavioural support.[36]

Smoking cessation services in the UK

NHS stop smoking services

NHS stop smoking services were set up in England in 1999 following the publication of the tobacco white paper *Smoking Kills*.[94] Treatment was based on the 'Maudsley model'[95] with evidence-based guidelines first published in the journal Tobacco Control[96] [97] and

incorporating pharmacological treatments for tobacco addiction and health belief models about smoking cessation. The evidence base for smoking prevention and cessation treatment has been extensively reviewed by the Cochrane Tobacco Addiction Group (http://tobacco.cochrane.org/our-reviews) and summarised by Aveyard.[98]

About 150 clinics now exist, providing counselling and support to smokers wishing to quit, either in groups or one-to-one, together with pharmacological therapy such as Nicotine Replacement Therapy (NRT) and Bupropion (Zyban) or Varenicline (Champix) available free of charge or on prescription. There is also an NHS smoking and pregnancy helpline and midwives and GPs offer help to pregnant women to stop smoking. The advisers are nurses or pharmacists trained in smoking cessation techniques. Primary Care Trusts were required to provide regular reports of the numbers of smokers accessing service, the number setting a quit date, and the number of successful four week quitters.

Smoking cessation advice in Primary Care

Opportunistically identifying smokers in routine primary care consultations and then giving them brief advice to stop smoking results in more referrals to stop smoking services, more quit attempts,[99] and a small increase in successful quit attempts compared with receiving no help.[100] Despite these modest effects, they lead to a large public health benefit as approximately 80% of the population visit a general practice each year.[101]

Effectiveness of NHS Smoking cessation service

Even brief advice to smokers to stop smoking has been shown in a recent systematic review and meta-analysis to have some benefit in helping smokers to stop smoking[102] and this can be amplified by the addition of pharmacological treatments and behavioural support.[98] The systematic review included 13 randomised controlled trials and the meta-analysis found that, compared to no intervention, advice from a physician to quit smoking increased the

frequency of quit attempts (Relative risk, RR, 1.24, CI 1.16 to 1.33). Adding in behavioural support or medication increased this further (RR 2.17, CI 1.52 to 3.11 with behavioural support; RR 1.68, CI: 1.48 to 1.89 with medication). Compared with advice only, adding in other support resulted in more quit attempts (RR 1.69, CI 1.24 to 2.31 with behavioural support; 1.39, CI 1.25 to 1.54 with medication). However, the evidence for these interventions leading to increased quit rates was inconclusive.

A Cochrane systematic review published in 2012 and looking at the effect of both counselling and pharmacotherapy identified 41 relevant randomised or quasi-randomised controlled trials. One trial used a particularly intensive treatment regimen so was not included in the meta-analysis due to heterogeneity of effect size. The pooled estimates from the remaining 40 studies (15,021 participants) found good evidence for a benefit from pharmacotherapy and behavioural therapy for smoking cessation compared to usual care, brief advice, or less intensive support. (RR 1.82, CI 1.66 to 2.00). There was more of an effect when patients were recruited from healthcare settings than in community-based trials (RR 2.06, CI 1.81 to 2.43 compared with RR 1.51, CI 1.33 to 1.76).[103]

Another Cochrane systematic review of behavioural therapies to help smoking cessation in pregnant women identified 76 randomised controlled trials (20,000 patients) and showed a significant reduction in rates of smoking compared to information or 'usual care' (risk ratio 0.94, CI 0.93 to 0.96).[65] However, the evidence for pharmacotherapy (NRT) in pregnancy is less compelling. A Cochrane systematic review of randomised controlled trials of NRT in pregnancy identified only six relevant randomised controlled trials (1745 patients) and found no statistically significant difference between NRT and placebo (risk ratio 1.33, CI 0.93 to 1.91) and there were also no differences in rates of stillbirth, miscarriage, premature birth or

low birth weight.[24] A recent randomised controlled trial of NRT in pregnancy by Coleman et al recruited 1050 women and found a validated quit rate at delivery of 9.4% in the NRT group compared to 7.6% in the placebo group (OR 1.26; 95% CI, 0.82 to 1.96).[104]

Early evaluations of NHS stop smoking services found around 15% of people accessing the service and successfully quitting were still not smoking at 52 weeks[105] and there was a modest reduction in health inequalities.[6] The service has been evaluated more recently. For example, Brose et al,[106] used data from 24 stop smoking services (127,000 consecutive attendances) to determine at the effectiveness of different interventions after adjusting for client characteristics. The authors found that smokers who attended specialist stop smoking clinics, had group treatment and who received Varenicline, or NRT plus Varenicline, were more likely to quit (assessed at four weeks after a designated quit date) than those receiving treatment in primary care, one-to-one and receiving just NRT. Four week quit rates are typically higher than 52 week quit rates due to high rates of relapse. For example, in one study by Bauld et al[107] comparing group treatment to pharmacy 1:1 treatment, four week quit rates (validated by carbon monoxide readings of patients' breath) were 22.5% but by 52 weeks this had fallen to 6.3% for smokers receiving group treatment and 3.6% for those receiving 1:1 treatment, but both treatments were considered highly cost-effective in the accompanying cost-benefit analysis. This study had a very low 52 week quit rate compared to other studies but was conducted in a deprived area of Glasgow where the environmental cues may be more difficult to overcome. A recent systematic review of 20 studies by Bauld et al published in 2010 and looking at the effectiveness of NHS stop smoking services confirmed earlier studies' findings with average 52 week quit rates of 15%.[108]

Research suggests the NHS stop smoking services have been successful in reaching disadvantaged people and so could reduce the inequalities caused by smoking.[105 107 109] For

instance, Bauld et al, in a national study examining smokers in receipt of NHS stop smoking services, published in 2007, found a modest contribution to reducing smoking prevalence in the most deprived areas. They found that although short-term cessation rates were lower in disadvantaged areas than in other areas (52.6% vs 57.9%, $p<0.001$), the proportion of smokers being treated was higher (16.7% compared with 13.4%, $p<0.001$).[6]

Despite evidence of effectiveness of smoking cessation advice, it tends to be under-provided in primary care,[110 111] even though patients think it is appropriate for GPs to give smoking cessation advice.[112] To maximise the effectiveness of smoking cessation advice in primary care guidelines have been published[36] and research has focused on examining the barriers to providing such advice.[113 114] In a systematic review of studies examining GPs' attitudes and beliefs about providing smoking cessation advice, which identified 19 studies, eight themes were identified.[114] The systematic review found that GPs believe that smoking cessation advice is time-consuming within the timeframe of a routine appointment (weighted proportion: 42%), ineffective (38%), that they lacked confidence in their skills to provide effective advice (22%), 18% thought such discussions were unpleasant and 16% lacked confidence in their knowledge. A few thought that it intruded on patients' privacy (5%), was not their duty (5%) or that it was not appropriate. In a postal survey of 468 Leicestershire GPs published in 1996, Coleman et al found that 97% of GPs felt that smoking cessation advice was more effective when linked to the presenting complaint but they were also concerned about damaging the doctor-patient relationship.[113] Although not specifically stated, lack of time equates to lack of finance, as with more resources, additional staff can be employed for smoking cessation work. A survey study of general practitioners by Bass in British Columbia in 1996 found that lack of financial reimbursement was a barrier to providing smoking cessation advice.[115]

To address GPs' concerns about lack of training, researchers have looked at the effect of specifically training health professionals in primary care to delivery smoking cessation interventions. A Cochrane systematic review by Carson et al published in 2012 identified 17 randomised controlled trials in which the intervention was training of health care professionals in smoking cessation work.[116] The authors found that training health professionals results in them being more likely to give advice, including: asking patients to set a quit date, making follow-up appointments, providing counselling, providing self-help material (difference between training and no-training groups clinically and statistically significant for all interventions). However, there was no difference in the chance of prescribing NRT between trained and not-trained groups. Meta-analysis of eight studies that reported continuous abstinence from smoking showed that training was effective compared with no training (OR 1.60, 95% CI 1.26 to 2.03, p = 0.03). The authors concluded (page 20), 'Overall, a moderately large amount of methodologically rigorous evidence has been presented to support the effectiveness of training health professionals in smoking cessation.'

The Quality and Outcomes Framework provides financial incentives for smoking indicators and so goes some way to addressing GPs' concerns about lack of financial incentives for this work. I will discuss this in more detail in Chapter 3.

Key points from Chapter 2

- Tobacco control measures have been successful in reducing smoking rates in the UK but reductions may now be plateauing.
- Effective and cost-effective treatments are available through NHS stop smoking services and in primary care. However, they tend to be underprovided in primary care.

- Research into the reasons for this under provision has identified several possible reasons including practitioners' concern about effectiveness and whether they are skilled in providing advice, but also time constraints and lack of financial incentives.
- Financial incentives may therefore be one means of encouraging smoking cessation work in primary care.

Chapter 3: Improving the quality and delivery of smoking cessation interventions in health care settings

Defining and measuring quality in healthcare

Defining quality

Healthcare quality has for many years defied a consensus definition due to the different perspectives of clinicians, managers and patients, and whether applied to individual patients or populations. Definitions include 'generic' and 'disaggregated' versions. Examples of generic versions include that of the Institute of Medicine in 1990, described in a paper by Campbell et al published in 1982, citing Lohr, which defined healthcare quality as (page 1614) 'the degree to which health services for individuals and populations increase the likelihood of desired health outcomes, and are consistent with current professional knowledge.'[117]

Disaggregated definitions are summarised by Campbell et al in their paper published in 1982[118] They list the different components of healthcare individual authors regard as important and relate quality to the achievement of standards for these different components. For instance, Donabedian, cited by Blumenthal et al (page 892), defined high quality care as 'that kind of care which is expected to maximise an inclusive measure of patient welfare, after one has taken account of the balance of expected gains and losses that attend the process of care in all its parts.'[119] The items included in models by Donabedian and other authors are compared in Figure 18.

Campbell and colleagues have therefore stated (page 1862) that 'there is no universally accepted definition of care, quality or quality of care' and that patient access is key to quality.[120] The authors contribute their own definition as 'quality of care for individual patients is defined by their ability to access effective care with the aim of maximising health benefit in relation to need.' Blumenthal suggests taking a pragmatic approach, quoting Donabedian's advice (page 892) that 'several formulations are both possible and legitimate, depending on where we are located in the system of care and on what the nature and extent of our responsibilities are.'[118]

Figure 18: Comparison of dimensions of quality of healthcare included in different models

Donabedian	**HSRG**	**Maxwell**	**O'Leary & O'Leary**
1990	**1992**	**1992**	**1992**
-	Accessibility	Accessibility	Accessibility
-	Patient-centeredness	-	Patient perspectives
Effectiveness	Effectiveness	Effectiveness	Effectiveness
Efficiency	Efficiency	Efficiency	Efficiency
-	Continuity/ Co-ordination	-	Continuity
Efficacy	-	-	Efficacy
Acceptability	-	Acceptability	-
Equity	-	Equity	-
Legitimacy	-	-	-
-	Comprehensiveness	-	-
-	-	Relevance	-

Source: Adapted from Campbell et al[118] HSRG = Health Services Research Group

Evaluating quality

Quality of care can be evaluated by quantifying and measuring items relating to structure, process, or outcome, as devised by Donabedian.[121] Structure relates to the numbers of staff, equipment, beds and services provided at hospitals or in the community. Process data are what Brook and Appel describe in their 1973 paper (page 1323) as 'what physicians do to patients.'[122] These are components of management the patient receives such as blood tests ordered, or having blood pressure measured. Outcome data they describe (page 1323) as 'what happened to the patient.'[122] They measure the patient's subsequent health status and include mortality, myocardial infarction or stroke, or an improvement in quality of life or symptoms. Intermediate outcome measures are frequently applied to capture short-term improvements in quality, such as cholesterol control, or four-week smoking quit rates.

For structure or process outcomes to be useful for evaluation they must predict outcome in some credible and validated way. So it must be shown that, for instance, measuring the blood pressure of hypertensive patients regularly and having blood pressure reduced to recommended levels leads to a reduced chance of myocardial infarction, stroke or death.[123]

Disadvantages of the use of process data include the following. The measures may not be sufficiently good at predicting outcomes; there may be associations of good care with poor outcomes, e.g. sicker patients, who may go on to die despite treatment, often have received all the required process measures; they need constant updating in the light of new evidence.[124]

On the other hand, critics of outcome measures believe they are not as useful as they should be given that they can be influenced by factors other than medical care.[125] Even with shorter-term outcomes such as recovery from surgery, patients receiving the same treatment can have

different outcomes, with variation in patient-level characteristics having greater influence on the outcome. In practice, adjusting for case-mix (such as co morbidity or age) allows both process and outcome measures to contribute to quality evaluation.

Brook et al[121] in their 1996 paper suggest five methods of using process and/or outcome measures to evaluate quality. The first three are 'implicit' whereby there are no previously agreed standards of good quality and the patient's episode of care is reviewed in order to answer three questions (page 966): 'was the process of care adequate (first method)? Could better care have improved the outcome (second method)? Considering both the process and outcome of care, was the overall quality of care acceptable (third method)'?

The fourth and fifth methods are 'explicit'. In the first, the assessment of quality is made by determining the proportion of patients who received components of (usually) evidence-based management. For example, national QOF rewards quality on the basis of the proportion of patients with diabetes registered at a general practice for whom a range of indicators have been met, such as having a record of retinal screening in the last 15 months.[126] In the second method, actual outcomes for a population are compared to those predicted by a validated statistical model using pre-set criteria for high, average or poor quality care.

Explicit methods are stricter than implicit methods and outcome measures. Brook et al used the five methods to evaluate the care of 296 patients with urinary-tract infection, hypertension or ulcerated gastric or duodenal ulcers.[122] Evaluating outcomes using explicit criteria the authors found that only two percent of patients received adequate care, but when they used implicit outcome methods 63% of patients received adequate care. The authors also suggest that process measures may be better than outcome measures in evaluating healthcare quality, because they allow timely routine monitoring, and patients often get better even

when care is sub-optimal. For instance, they suggest (page 967) that 'it is therefore not surprising that when physicians are asked to describe what they mean by quality of care, they define it in terms of process rather than outcome (i.e., they would find it unacceptable if patients who were ideal candidates for thrombolytic therapy but did not receive it were considered to have received good care because they were lucky enough to live)'.

Setting standards

The process of setting guidelines, standards, criteria or indicators to assess quality requires a strong evidence base or well-established consensus. Definitions for these terms are given in Figure 19. Guidelines have been shown to change practitioner behaviour and to improve patient outcomes.[125]

Indicators can be identified from process measures recommended in guidelines, and used to develop criteria and standards to reflect intended quality of care. Data to evaluate whether standards have been reached, or guidelines followed, is available from a number of sources, each having advantages and disadvantages, as summarised in Figure 20.

Figure 19: Definitions of guidelines, standards, criteria and indicators

A **guideline** (clinical practice guideline) is a 'systematically developed statement to assist decisions for practitioner and patient about appropriate healthcare for specific clinical circumstance'. *Institute of Medicine*

An **indicator** is a 'measureable element of practice performance for which there is evidence or consensus that it can be used to assess the quality, and hence change in the quality, of care provided'. *Lawrence and Olesen*

A **criterion** (review criterion) is a 'systematically developed statement that can be used to assess the appropriateness of specific healthcare decisions, services' *Institute of Medicine*

or a 'discrete, definable and measureable phenomenon, relevant to the definition of quality, and so clearly defined that we can say whether it is present or not'. *Donabedian*

A **standard** is 'the level of compliance with a criterion'. *Black*

or 'the percentage of events that comply with a criterion'. *Baker and Fraser*

Source: Lawrence and Olesen (page 105), 1997[125]

Figure 20: Advantages and disadvantages of types of data for measuring quality of care

Types of data	Advantage	Disadvantage
Secondary data (administrative)	Easily available inexpensive	Lacks specificity and detail
Medical record data	Available Richer in detail than administrative data If standardised in an electronic medical record, reduces data collection burden	Expensive to obtain May have insufficient detail
Prospectively collected clinical data	Most specific Can define exactly what data are required Quality control of data collection	Not readily available Expensive to obtain unless already incorporated into EMR
Survey data	Can collect what is important to patients Collects data not otherwise available	Not readily available Expensive to collect Valid instrument required Recall bias

Source: Rubin et al (page 494), 2001[127]

Quality improvement initiatives in the UK

In addition to an explicit aim to reduce health inequalities, the previous Labour Government also intended to improve the quality of care provided by the NHS.[128] This aspect of health policy was developed in response to rising healthcare costs, increasing public expectation and the evidence for variation in health outcomes between different socio-economic groups and geographical areas previously discussed. Importantly there was growing evidence that the UK was lagging behind other European countries in health outcomes such as survival rates from cancers.[48] In addition, highly publicised healthcare failures, such as poor outcomes from paediatric heart surgery at the Bristol Royal Infirmary, prompted the government to introduce quality standards and to make hospitals and doctors accountable for quality assurance. This

led to the introduction of regular appraisal for clinicians, the National Performance Framework for the NHS, and clinical governance for NHS organisations.

The government introduced National Performance Framework for the NHS in 2009. This brought in a series of indicators across the domains of Finance, Operational Standards and Targets, Quality and Safety and User Experience in order to identify 'unsustainable' NHS organisations.[129]

Clinical governance was introduced by the government in 1997 along with a huge increase in funding for the NHS (£1.5bn in the first year) to counter years of underinvestment, and substantial reorganisation of the NHS with the introduction of Hospital Trusts and Primary Care Trusts.[130] Clinical governance is defined by the Department of Health as 'a framework through which NHS organisations are accountable for continually improving the quality of their services, safeguarding high standards by creating an environment in which excellence in clinical care will flourish,' cited by Campbell et al in their paper published in 2001.[131] This includes leadership, staff training, learning from patient safety incidents, and regular clinical audit. The government also introduced a body to monitor the performance of healthcare organisations, the Commission for Health Improvement, subsequently named the Healthcare Commission, a role now undertaken by the Care Quality Commission.

Other quality improvement initiatives brought in by the then Labour government included the introduction of guidelines called National Service Frameworks (NSFs) which set national minimum standards for the management of chronic diseases (e.g. for coronary heart disease and for diabetes). The government also established the National Institute for Clinical Excellence (subsequently the National Institute for Health and Clinical Excellence, NICE), to evaluate and publish guidance on clinical treatments. Such guidelines are devised from

evidence-based measures intended to prevent further disease and maintain or improve a patient's health status once they have been diagnosed with a chronic disease (secondary prevention).

The Labour government also brought in the Quality and Outcomes Framework (QOF)[126] as part of a reform of the GP contract in 2004. This financially rewards general practices for meeting evidence-based targets for clinical care, mainly chronic disease management. QOF is further described below.

Changes in the quality of care resulting from these initiatives have been extensively examined, usually using process measures for the reasons described in the previous section. These are relatively easily-extractable items which are routinely recorded on electronic medical records,[132] such as whether blood pressure has been measured and what the result was of that measurement. Generally these studies have shown improvements following the introduction of quality improvement initiatives.[133] However, a systematic review of studies of the quality of care provided in primary care in the UK, Australia and New Zealand found that practices still fell short of providing all the standards set by national guidelines. For example, 11 studies examining hypertension management found that the proportion of hypertensive patients who were prescribed hypertension medication ranged from 51% to 64% when the standard was 100%.[54]

The Conservative-Liberal Democrat Coalition government, which came into power in 2010, introduced its Health and Social Care Bill in 2011 which detailed radical plans to reorganise the NHS, abolishing Primary Care Trusts and setting up clinical commissioning groups, overseen by a new authority called NHS England, and setting up Public Health England to oversee public health provision across England. The reforms had the stated aim of decentralising control of the NHS, increasing clinical autonomy and patient input to services, and encouraging competition between providers, in order to improve value for money and quality of care.[134] Critics have expressed concern about the cost and scope of this reorganization and have concerns that quality will in fact fall in the short term.[135]

The Coalition government has also introduced the NHS constitution,[136] which states a commitment to quality (page 3), 'The NHS aspires to the highest standards of excellence and professionalism – in the provision of high-quality care that is safe, effective and focused on patient experience; in the planning and delivery of the clinical and other services it provides; in the people it employs and the education, training and development they receive; in the leadership and management of its organisations; and through its commitment to innovation and to the promotion and conduct of research to improve the current and future health and care of the population'.

Quality improvement initiatives for smoking cessation interventions in the UK

National Service Frameworks (NSFs) and clinical guidelines for chronic disease management recommend that smokers should be advised to stop smoking in order to reduce the risk of further cardiovascular events or exacerbations of respiratory conditions (secondary prevention). Lifestyle advice such as smoking cessation is also important for primary prevention (to avoid disease in healthy people). The NHS Futures Forum has recommended that 'every contact counts' in the NHS (page 10),[137] whereby healthcare professionals take the opportunity to discuss weight loss, exercise, health eating and alcohol intake, as well as providing smoking cessation advice as appropriate, when they see patients for other routine appointments. The current government is consulting on how this might be taken up by the NHS.

Overview of financial incentives

There is increasing international interest in financial incentives, also known as 'pay-for-performance' or P4P schemes. Financial incentives are interventions to support quality improvement in which a proportion of the remuneration of providers is related to the achievement of quality indicators.[138] These schemes aim to reward performance in reaching evidence-based targets, with the intention of improving healthcare quality and reducing inequalities.

Definitions of incentives and financial incentives are shown in Figure 21. Incentives work on a person's motivation to act in a particular way. Motivation may be internal, such as wishing to do a good job for personal satisfaction or to help others, or external, such as for payment or other reward.

Figure 21: Definitions of incentives

An incentive is any factor (financial or non-financial) that provides motivation for a particular course of action, or counts as a reason for preferring one choice over all alternatives.

A financial incentive is defined as an external source or motivation, and exists when an individual can expect a monetary transfer which is made conditional on acting in a particular way.

Source: Flodgren et al, 2011 (page 3)[139]

Financial incentives may target patients or healthcare providers. There is evidence that providing incentives directly to patients may help them change health behaviours[140] including smoking.[141] The use of payments to patients is controversial, particularly for the treatment of drug misuse. Financial incentives aimed towards healthcare organisations or individual practitioners, with an emphasis on primary care, are the subjects of this thesis.

A variety of pay-for-performance schemes for primary care practitioners have been developed to strengthen or transform the capacity to provide a foundation for high-quality, efficient care. The United Kingdom and the United States have the most established schemes,[142-145] but other countries are initiating them, such as Australia,[146] Canada,[147] Germany,[148] the Netherlands,[149] and New Zealand.[150] Most countries have mixed payment systems. The main components of financial incentives are described in Figure 22.

Figure 22: Types of financial incentives

1. Salary or sessional payment (payment for working for a specified time period);
2. Fee-for-service (payment for each service, episode or visit);
3. Capitation (payment for providing care for a patient or for a special population);
4. Target payments and bonuses (payment for providing a pre-specified level or change in a specific behaviour or quality of care).

Source: Flodgren et al, 2011 (page 3)[139]

Pay-for-performance has been recommended by influential health organisations such as WHO, to encourage purchasers of healthcare services to move from passive purchasing of health care services to more strategic, outcome-focused purchasing. The IOM also recommended using financial incentives to encourage evidence-based practice as a means to improve quality in their report *Crossing the Quality Chasm*.

All payment systems have good and bad points. Robinson recommends 'blended systems' and condemns sole use of the first three incentives described above, stating (page 149) 'Fee for service rewards the provision of inappropriate services, the fraudulent up coding of visits and procedures, and the churning of 'ping-pong' referrals among specialists. Capitation rewards the denial of appropriate services, the dumping of the chronically ill, and a narrow scope of practice that refers out every time-consuming patient. Salary undermines productivity, condones on-the-job leisure, and fosters a bureaucratic mentality in which every procedure is someone else's problem.'[151] Roland counters (page 1), 'All payment systems can

have perverse consequences - we rely on the professionalism of doctors to minimise these adverse effects. All incentives must therefore be as closely aligned to professional values as possible.'[152]

Financial incentive schemes can also have unintended adverse consequences on practitioner behaviour, such as taking away doctors' internal motivation, also known as 'crowding out' whereby external drivers such as financial incentives impair self-determination and damage self-esteem if doctors believe their professionalism is not valued and their work is subject to bureaucratic regulatory activity.[153]

Financial incentives may also encourage more obviously detrimental practitioner behaviours, as described by McDonald and Roland.[154] Such actions includes adverse patient selection or exclusion ('cherry-picking'), whereby practitioners choose to register and treat patients without complex problems or de-list patients who do not comply with medical treatment, which may lead to widening of inequalities for some groups. Financial incentives may also result in practitioners neglecting types of care for which quality is not measured. They may also interfere with the doctor-patient relationship as the patient's agenda is supplanted by the need to meet incentivised targets or the practitioner's attention is displaced from the patient to the computer screen.

Reviewers of the UK's pay-for-performance scheme, the Quality and Outcomes Framework (QOF, described below), such as Dixon et al (page 1) suggest they entrench 'a medicalised and mechanistic approach to managing chronic disease that does not support holistic care or promote self-care and self-management.' [155] There is also evidence that performance may revert to previous levels after incentives have been removed.[156]

Pay for performance programmes in the US and UK

United States

The United States has over 100 private and federal Medicare reward and incentive programmes.[157] Pay-for-performance programmes differ between public and privately funded healthcare schemes, between health plans within either sector, and even from state to state. Such differences include the level of incentives offered, the performance outcomes measured, and whether thresholds are reached in order to trigger reward, or whether payment follows improvement from baseline. In some programmes primary care organisations are incentivised and in others secondary care organisations or individual healthcare practitioners receive incentive payments.

UK (Quality and Outcomes Framework)

In the UK capitation, salary and fee for service payments are the main methods of payment used in primary care.[158] However, in 2004 a major pay-for-performance scheme, the Quality and Outcome Framework (QOF), was introduced to provide up to 25% of general practice income. Its goal was to incentivise general practitioners to achieve evidence-based quality targets, mainly for chronic disease management, supported by investment in improved information technology and prompts on patients' electronic medical records (EMRs).[132] QOF has been described by authors such as Gillam and Roland as (page 461) 'arguably the most comprehensive national primary care pay-for-performance (P4P) scheme in the world.'[142 159]

Participation in QOF is voluntary but almost all general practices have signed up to it. When QOF was first introduced the scheme was funded by an £1.8 billion investment. Payments now account for around one-third of average practice earnings and expenditure associated with QOF is over £1 billion a year in England (around 15% of the primary medical care budget).[160]

QOF has been refined over the intervening years as the Department of Health's initial expectations of GPs' achievements were vastly exceeded, resulting in unexpected large performance payments.[161] In 2005/06, the average QOF points achieved by practices in England were 1010.5 (96.2% of the total 1050 points available per practice at the time). In the clinical domains achievement was even higher with the average practice attaining 97.1% of the maximum 550 points available.[162]

New indicators and more demanding thresholds for existing indicators have been added since 2004, although the General Practitioners' Committee has resisted ambitious changes proposed for 2013/14. Other indicators have been phased out if high levels were consistently achieved. In 2009 the National Institute for Health and Clinical Excellence (NICE) was given responsibility for developing QOF indicators, particularly primary prevention and public health targets. Changes to QOF are negotiated between NHS Employers (mandated by the Department of Health) and the General Practitioners Committee (GPC), part of the British Medical Association (BMA).

QOF is now on its fifth revision. There are currently 148 performance indicators, which are measures of achievement against which practices are awarded points, within four domains, as shown in Figure 23.[126]

Figure 23: Domains and indicators of the Quality and Outcomes Framework

Domain	Indicator
Clinical	Secondary prevention of coronary heart disease Cardiovascular disease: primary prevention Heart failure Stroke and transient ischemic attack Hypertension Diabetes mellitus Chronic obstructive pulmonary disease Epilepsy Hypothyroidism Cancer Palliative care Mental health Asthma Dementia Depression Chronic kidney disease Atrial fibrillation Obesity Learning disabilities Smoking Peripheral arterial disease Osteoporosis: secondary prevention of fragility fractures
Organizational	Records and information Information for patients Education and training Practice management Medicines management Quality and productivity
Patient Experience	Length of consultations
Additional Services	Cervical screening Child health surveillance Maternity services Contraception

Source: http://www.qof.ic.nhs.uk/

QOF's indicators broadly align to Donabedian's framework for assessing quality:

- Structure (e.g. keeping disease registers);
- Process (e.g. recording risk factors, delivering evidence-based tests or treatments);
- Outcomes (e.g. achieving targets for treatment outcomes, such as control of blood pressure).[162]

The points for each indicator are weighted according to practice factors, prevalence and workload through the 'Carr-Hill allocation formula'. There are currently a maximum of 1,000 QOF points available, worth £130 each in 2012/13, and payments depend on practices reaching the targets for each indicator i.e. the proportion of patients for whom practices have achieved the set thresholds.

Achievement of QOF indicators is assessed through the presence of relevant Read Codes and associated dates on the patient's EMR. Achievement is assessed annually via the QOF Management and Analysis System (QMAS), software specifically developed for QOF,[163] which also allows estimations of national disease prevalence. There are random checks by Primary Care Trusts and national comparisons of practices with similar patient populations for quality assurance. The development of the QOF business rules for extracting the data and determining achievement of indicators has been the responsibility of the NHS Information Centre for Health and Social Care (NHS IC) since 2010. QOF business rules also allow 'exception reporting' which was introduced to avoid penalizing practices where it was impossible or inappropriate to pursue the indicator, for example when patients do not attend or refuse treatment, or are on maximum treatment, or for whom the proposed treatment is contra-indicated.

QOF rewards absolute achievement, which means practices are rewarded for reaching pre-set thresholds, rather than relative achievement, or improvements in performance from baseline, because the second method is administratively burdensome. So practices that start from a low baseline achievement may improve more than those who started from a higher level of achievement and yet not be rewarded for their effort. For example, for asthma, one of the indicators is 'the percentage of patients with asthma between the ages of 14 and 19 years in whom there is a record of smoking status in the previous 15 months.' There are 6 points

available, paid in stages depending on achievement from a minimum of 45% of eligible patients to a maximum of 80%. If a practice had recorded the smoking status of only 6% of their patients at baseline then managed 50%, improving by 46%, then it would get fewer points than a practice that improved from 70% to 80%.

However, QOF still encourages improvement from whatever baseline each practice starts by setting a minimum and maximum threshold for which payment is released[162] and, for some indicators where the target is difficult to attain, by setting two targets. For example, for patients with diabetes general practices are rewarded for the percentage of patients with diabetes who have a high degree of blood pressure control (last blood pressure is 140/80 mmHg or less, 10 points, payment stages 40% to 65%) but for practices who do not achieve the higher level, there are points for the percentage with a lower degree of control (150/90 mmHg or lower) are awarded up to eight points, with payment in stages of 45% to 71%.

Impact of financial incentives on quality of healthcare

Current evidence on the effectiveness of financial incentives on healthcare quality has been described by Glasziou et al (page 1) as 'modest and inconsistent,'[156] with little attention to possible unintended consequences, despite many reviews of the literature on financial incentives. Van Herck et al, in their systematic review of P4P schemes in 2010, noted that 16 literature reviews had been conducted on the subject prior to their own study being published.[138] The authors identified 128 studies with a mixture of study designs including randomised controlled trials, before-and-after studies and interrupted time series analyses. The studies were published between 1990 and 2009, and 79 had not been included in earlier reviews. Sixty-three studies were from the USA, 57 from the UK, two from Australia, two from Germany, two from Spain, one from Argentina and one from Italy. There were 111

studies evaluating P4P in primary care settings and 30 in hospital settings, and 13 covered both settings. The studies looked at the effects of P4P on preventive services, acute care and chronic care.

In general Van Herck et al found there was about 5% improvement due to pay-for-performance, but with much variation, depending on the measure and program. The pay for performance schemes frequently failed to affect results in acute care. In chronic care, diabetes and asthma had the highest rates of quality improvement following the introduction of P4P. The authors found conflicting results for preventive care and little or negative effects on non-incentivised quality measures.[138]

A 2011 Cochrane meta-review of four systematic reviews of financial incentives in healthcare by Flodgren et al found none had examined the effect on patient outcomes.[139] The authors found that financial incentives had mixed effects on consultation or visit rates (three studies showed improvements in 10 of 17 outcomes) and improved process measures of care (19 studies, showing improvements for 41 of 57 outcomes). They also showed reduced prescribing costs (10 studies, with 28 of 34 outcomes showing improvements). However, they did not improve compliance with guidelines (five studies identified for this outcome, in which only five of 17 outcomes showed improvements).

Another 2011 Cochrane review, by Scott et al, found seven eligible studies in primary care, randomised controlled trials, controlled before-and-after studies or time series analyses. The outcomes examined ranged from prevention (mammography, cervical screening, Chlamydia screening, smoking cessation) to chronic disease management (diabetes and asthma care). The authors found that financial incentives were effective in six of the seven studies but not for all outcomes, and all studies had methodological weaknesses. This review excluded all

QOF studies because they were observational studies, necessitated by QOF being introduced nationally. The authors concluded (page 13) that there was 'insufficient evidence to support or not support the use of financial incentives to improve the quality of primary health care. Implementation should proceed with caution and incentive schemes should be more carefully designed before implementation.'[164]

Other reviews have examined financial incentives for preventive care. Hillman et al (1989) looked at their effect in improving physician delivery of breast, cervical and colorectal cancer screening, and found there were no statistically significant differences in cancer screening rates between the two groups (an intervention group, which got feedback plus bonuses, and a control group). The authors concluded that the small incentive size, lack of physician awareness of the incentive program and the type and length of the intervention might explain the ineffectiveness of explicit financial incentives to improve physician delivery of preventive service.

Kouides et al[165] examined the effect of performance-based incentives on the influenza immunizations rate in primary care practices participating in the 1990 Medicare Influenza Vaccination demonstration Project. Practices were randomly assigned to an intervention group (a financial bonus per shot if the practice attained a certain immunization rate) and a control group. Their findings suggest that assignment to the intervention group resulted in a 7% increase in the immunization rate among older persons. The authors concluded that small explicit financial incentives improve immunization rates.

A Cochrane review in 2009[166] by Giuffrida et al examined the effects on professional practice and health outcomes of target payments in primary care and included the study by Kouides et al together with an interrupted time series analysis by Ritchie et al, which also looked at the

effect of payments on immunization rates. [167] The review found that although both studies showed positive effects (increased rates), the improvements were not significant, probably due to insufficient power. The authors concluded there was insufficient evidence to show that such payments improved quality of care.[166]

Impact of QOF on quality of care and inequalities

Evidence as to whether the QOF is influencing improvements in clinical care is equivocal. For instance, in 2007 Campbell et al published a longitudinal analysis of primary care data from the records of patients with diabetes, asthma and coronary heart disease (CHD) from a random selection of 60 general practices from six geographical regions of England. The authors computed an overall quality improvement score for each condition using data from 1998, 2003 and 2005 and compared the outcomes with those predicted on the basis of the trend seen prior to the introduction of QOF (resulting from other quality improvement measures as previously discussed). Across the study period there were large improvements in the scores for all three conditions but compared with the predicted improvements these were only statistically significant for diabetes and asthma but not for CHD. For example, for diabetes the mean score increased from 61.6% in 1998 to 81.4% in 2005, compared with a predicted score of 73.2%, mean difference between transformed observed score and predicted score was 0.68 (CI 0.27 to 1.1, p=0.002). The authors also showed that improvements were only seen in incentivised conditions and not for unincentivised conditions.[168]

In a follow up study published in 2009 Campbell et al conducted an interrupted time series analysis with data from the electronic medical records of patients with diabetes, asthma and CHD from 42 practices. Comparing data extracted pre-QOF (1998 and 2003) and post-QOF

(2005 and 2007) the authors found that improvements stabilized and did not increase substantially after the first two years of QOF.[169]

Higher QOF scores appear to be associated with modest reductions in hospital admissions for some conditions. For example, linking primary care data with hospital admissions in a large cross-sectionals study with 1.8 million patients with diabetes registered at 8441 general practices across England, Bottle et al found a 10-fold variation in admission rates for diabetes and showed that higher QOF scores were significantly but weakly associated with lower hospital admission rates for patients aged over-60.[170]

Some authors have raised concerns about gaming with QOF, for example through exception reporting, as previously described. Fleetcroft et al, looking at QOF data from 8407 English general practices in the National Primary Care Database and exception reporting data from the Information Centre in 2005/06, found exception reporting accounted for around 48% of the gap between the percentage of maximum incentive gained and the percentage of patients receiving indicated care at the practice level.[171] However, Doran et al found a median of only 5.3% of patients had been exception reporting when examining 2005/06 QMAS data from 8105 general practices in England, and concluded (page 274), 'rates of exception reporting have generally been low, with little evidence of widespread gaming.'[172]

There is now a large body of research examining the effects of QOF on different quality-of-care measures within different disease areas. In order to summarise the literature on the impact of QOF, Gillam et al published a systematic review in 2012.[173] Studies were included with a range of designs, including before-and-after and interrupted time series observational analyses and qualitative studies, methodologies regarded as appropriate for researching complex interventions. The review identified 94 studies for inclusion, and found results on effectiveness and equity or inequalities, with similar results to those described above, and

also identified studies that looked at effects on patient experience and healthcare professionals' experiences of the QOF and impact on team working. There were no studies examining the impact on patient safety.

For effectiveness, Gillam et al identified 47 studies. The authors suggest that QOF has helped consolidate evidence-based practice by increasing the use of computers (with decision support software and prompts, patient reminders and recalls). It has improved recording, led to increased recording of processes of care and improved intermediate outcomes, particularly for diabetes. However, improvements peaked after the first year after the introduction of QOF, then reached a plateau or have merely followed the pre-existing trends in improvement thereafter. There was no effect on unincentivised conditions in the first few years, but after that achievement was well below that predicted by trend (for example, Doran et al, 2011[174]).

For efficiency and costs Gillam et al found limited evidence from five studies that QOF led to reduced admissions and hence costs for some conditions. For example, patients with epilepsy had fewer epilepsy related emergency conditions following the introduction of QOF.

For equity or inequalities the authors identified 25 studies, but point out that QOF was not designed to reduce inequalities resulting from socio-economic disadvantage. The systematic review showed that inequalities in process of care measures for some conditions appear to have narrowed. For example, Doran et al found that median overall achievement for practices from most and least deprived quintiles narrowed from 4% to 0.8% between 2004 and 2007.[175] However, disparities between men and women for management of cardiovascular diseases and diabetes persisted or increased. Ashworth and colleagues, in a retrospective longitudinal survey of primary care data from 8515 general practices from 2005 and 2007, found evidence for both improvements in outcomes and a narrowing of inequalities related to deprivation.[176] For example, achievement of target blood pressure levels in 2005 for practices from the least

deprived areas ranged from 71.0% (95% CI 70.4% to 71.6%) for diabetes to 85.1% (CI 84.7% to 85.6%) for coronary heart disease, whereas practices in the most deprived achieved 68.9% (CI 68.4% to 69.5%) and 81.8 % (CI 81.3% to 82.3%) respectively. Post-QOF, achievement for the least deprived practices had risen to 78.6% (CI 78.1% to 79.1%) and 89.4% (CI 89.1% to 89.7%) respectively. Target achievement in the most deprived practices rose similarly, to 79.2% (CI 78.8% to 79.6%) and 88.4% (CI 88.2% to 88.7%) respectively. Ashworth et al concluded (page 7), 'Improvements in achievement have been accompanied by the near disappearance of the achievement gap between least and most deprived areas.' For variation between different ethnic groups, Millett et al found larger improvements in blood pressure control for Black patients with diabetes than White patients such that differences in 2003 were attenuated by 2005.[177]

Gillam e al's findings on inequalities echo those of Alshamsan et al in their earlier systematic review of pay-for-performance schemes in healthcare,[178] which identified 22 studies, of which 20 were evaluations of QOF. The authors found weak evidence that financial incentives reduced inequalities in the management of patients with chronic diseases from different socio-economic groups but that inequalities associated with age, gender and ethnicity persisted after the use of these incentives.

For patient experience, Gillam et al identified seven studies, which found no significant changes in patient ratings of overall satisfaction, nursing care, communication or co-ordination of care. There were modest improvements in access to urgent appointments for patients with chronic diseases (but not for other patients) but continuity of care worsened.

For team working and professionalism, the authors identified six studies that suggested that QOF had positive effects on practice organisation and enhanced roles for nurses in managing chronic diseases. In qualitative studies healthcare professionals expressed concern that 'box-

ticking' due to QOF distracted them from patient-led consultations and also impacted on non-incentivised quality improvement and practice development. They also expressed regret over declining continuity of care.

QOF and smoking cessation

The Quality and Outcomes Framework initially rewarded smoking cessation activities in primary care mainly as a part of secondary prevention management of particular long-term conditions (coronary heart disease, stroke or transient ischaemic attack (TIA), diabetes mellitus, chronic obstructive pulmonary disease (COPD), asthma and hypertension). For these patients QOF rewarded general practices for recording smoking status within the last 15 months (unless, as is the case with the current version of QOF, the patient has never smoked, in which case their status only needs to be recorded once, or if they have three consecutive ex-smoker codes, in which case their status does not need to be ascertained again) and providing stop smoking advice to smokers within the last 15 months.

There was initially little focus in QOF on smoking cessation for patients without smoking-related conditions (primary prevention). In the 2004 version of QOF the requirement for patients with relevant co-morbidities (coronary heart disease, diabetes mellitus, chronic obstructive pulmonary disease (COPD), transient ischaemic attack (TIA) or stroke, asthma, hypertension), smoking status had to be recorded within the previous 15 months (except for never-smokers, for whom their status only needed to be recorded once) and smoking cessation advice offered to smokers in this group within the previous 15 months. However, for patients without smoking-related co-morbidity the requirement was that the smoking status of patients aged 15 to 75 years should be recorded for at least 75% of patients but there was no requirement for repeated recording for this group or for offering advice.

Targets for smoking indicators were revised in 2006, 2008 and 2011. In 2006, for the first time, regular recording of smoking status for patients without smoking-related diseases was required every 27 months rather than 'ever' to meet the target. In 2008, chronic kidney disease (CKD) and mental illness (schizophrenia, bipolar affective disorder and other psychoses) were added to the smoking-related diseases for which recording of smoking status and cessation advice every 15 months was required to meet the target. In 2011 peripheral arterial disease was added to the smoking-related conditions for which smoking indicators apply and the total number of points for the smoking indicators for these patients reduced from 60 to 50. Points for advising smokers over the age of 15 without smoking-related conditions were also added in 2011, plus points for lifestyle advice for cardiovascular primary prevention. So the points available for primary prevention have increased, although QOF still focuses more on secondary prevention than primary prevention, with 61 points available for smoking indicators associated with smoking-related conditions and 24 points available for those without smoking-related conditions. The current smoking indicators are shown in Figure 24. Overall, it is estimated that smoking related work contributes 8% to the total remuneration to general practices from QOF.[179]

The Department of Health has announced plans to introduce a public health domain in next year's QOF, which will be the responsibility of the incoming Public Health England. Fifteen percent of existing QOF points will be ring-fenced for indicators that prevent disease and tackle health inequalities. No new indicators have so far been proposed and the public health domain will contain the current QOF indicators on primary prevention of cardiovascular disease, blood pressure, obesity and smoking, indicators for cervical screening, child health surveillance, maternity services, and contraception.

Figure 24: QOF smoking indicators 2012/13

Indicator	Points	Payment stages
SMOKING 5. The percentage of patients with any or any combination of the following conditions: CHD, PAD, stroke or TIA, hypertension, diabetes, COPD, CKD, asthma, schizophrenia, bipolar affective disorder or other psychoses whose notes record smoking status in the preceding 15 months	25	50-90%
SMOKING 6. The percentage of patients with any or any combination of the following conditions: CHD, PAD, stroke or TIA, hypertension, diabetes, COPD, CKD, asthma, schizophrenia, bipolar affective disorder or other psychoses who smoke whose notes contain a record of an offer of support and treatment within the preceding 15 months	25	50-90%
SMOKING 7. The percentage of patients aged 15 years and over whose notes record smoking status in the preceding 27 months	11	50-90%
SMOKING 8. The percentage of patients aged 15 years and over who are recorded as current smokers who have a record of an offer of support and treatment within the preceding 27 months	12	40-90%
Cardiovascular disease Primary Prevention 2. The percentage of patients diagnosed with hypertension (diagnosed after 1 April 2009) who are given lifestyle advice in the preceding 15 months for: increasing physical activity, smoking cessation, safe alcohol consumption and healthy diet	5	40-75%
ASTHMA 10. The percentage of patients with asthma between the ages of 14 and 19 years in whom there is a record of smoking status in the preceding 15 months	6	45-80%
Information 5. The practice supports smokers in stopping smoking by a strategy which includes providing literature and offering appropriate therapy	2	Yes/No

Impact of QOF on smoking

Studies investigating the effect of QOF on smoking recording and advice using UK primary care data up to 2005/06 showed large increases in the recording of smoking status and cessation advice to smokers following the introduction of QOF, with far higher rates of recording in patients with smoking-related conditions incentivised by QOF.[160 180] For example, the study by Millett et al[180] examined changes in the recording of smoking status and advice to smokers in 4284 patients with diabetes using primary care data from 32 general practices in Wandsworth, London, between 2003 and 2005. The authors found that significantly more patients had their smoking status ever recorded in 2005 compared with 2003 (90% in 2003 and 98.8% in 2005, $p<0.001$) and there was also a large increase in the proportion of smokers receiving stop smoking advice (from 48.0% in 2003 to 83.5% in 2005, $p<0.001$). The prevalence of smoking among diabetic patients also reduced across the study period, from 20.0% in 2003 to 16.2% in 2005 ($p<0.001$). The study also looked at variation in smoking outcomes between patients from different demographic groups and found that the improvement in recording of smoking status was greatest for women and for non-white ethnic groups (except Bangladeshi). There were no significant differences with age, gender, ethnicity or deprivation in the chance of receiving smoking advice before or after the introduction of QOF. There were differences in smoking prevalence with higher rates seen in men, younger patients and white British patients. Reductions in smoking prevalence seen after the introduction of QOF were lower among women than men (AOR 0.71, CI 0.53 to 0.95) and lower in black African and Bangladeshi patients than in white British patients (AOR 0.33, CI 0.17 to 0.67; AOR 0.12, CI 0.02 to 0.72, respectively).

A study by McGovern and colleagues in 2008, examining the impact of QOF on smoking indicators for patients with coronary heart disease in Scotland using data from 310 general practices, found statistically significant increases in the recording of smoking status from

69.5% in 2004 to 95.7% in 2005, and for advice given from 81.0% to 96.2%. They also found variation in the chance of recording smoking status and advice between men and women and between different age groups, and patients from deprived areas were less likely than those in affluent areas to have their smoking status recorded (Pre-QOF AOR 1.04, CI 0.86 to 1.26; Post-QOF AOR 0.78, CI 0.62 to 0.99).

Recent studies have looked at whether improvements in the recording of smoking status and advice to smokers were sustained and what happened with the changes in the smoking targets for patients without smoking-related conditions. The first, by Simpson et al,[181] looked at UK primary care data from 2001 to 2007 using the QRESEARCH database, containing anonymised data from 525 UK general practices and regarded as representative of UK primary care patients. They looked at data from around 2.7 million patients aged over 15 years in a cross-sectional before-and-after study and found that the proportion of patients with their smoking status recorded increased from 46.6% in 2001/02 to 79.5% in 2006/07. There was also a large increase in the proportion of smokers given stop smoking advice (from 43.6% to 84.0%), or who were referred to stop-smoking services (from 1.0% to 6.6%). They also observed a reduction in smoking prevalence across the study period, from 28.4% to 22.4%.

The authors also looked for evidence of variation in care between different demographic groups and found some significant differences. For instance, in 2001/02 women and people from more deprived areas were more likely to have smoking status recorded compared with men and people from more affluent areas ($p<0.001$). In 2006/07 the difference with gender persisted but there was no longer a difference with deprivation. Also, by 2006/07 older patients were more likely to have had smoking status recorded compared with younger

patients. Men, younger patients and those from more deprived areas were more likely to be smokers, and this was still the case in 2006/07. For smoking advice, older people, men and people from more deprived areas were more likely to have received stop smoking advice in 2001/02. By 2006/07 more women than men were given such advice, there were similar rates of advice for people from different socio-economic backgrounds, but the age differences persisted. The authors did not look at differences with ethnicity.

In another study, Taggar et al[179] looked at the response to the QOF smoking indicators using The Health Improvement Network (THIN) primary care data for each year from 2000 to 2008 in a serial cross-sectional study. The THIN database contains over 6 million patient records from 446 practices throughout the UK, and has been validated as broadly representative of the UK primary care population. The authors found rapid large increases in recording smoking status and advice to smokers following QOF's introduction in 2004 with a subsequent leveling off of achievement after 2005. The proportion of all patients for whom practices met the targets rose from around 5% of all patients having status recorded within 27 months and 18% of smokers having advice within 15 months in 2000, to 58% and 45% respectively in 2005, then 64.5% and 50.5% in 2008. They also found greater improvements for patients with the smoking-related conditions for which greater incentives were available, that for those without those conditions. For example, patients with COPD were 3.37 times more likely to have their smoking status recorded in 2004 compared to patients without smoking-related conditions (OR 3.37, CI 3.11 to 3.65, $p<0.001$), rising to 15.38 times more likely in 2008 (OR 15.38, CI 13.70 to 17.27, $p<0.001$).

Although studies from QOF have shown improvements in the recording of smoking status and recording of advice being given to smokers, there has not been any synthesis of the

published evidence on effectiveness of financial incentives for smoking cessation activities in healthcare. My systematic review will address this deficit. There has also been little published on the effects of financial incentives such as QOF on primary prevention or on inequalities relating to smoking, which my work will also address.

Key Points from Chapter 3

1. The use of financial incentives in health care, such as the Quality and Outcomes Framework in the UK, is increasing internationally;
2. Such schemes have been introduced to accelerate quality improvements in healthcare;
3. Financial incentive schemes may produce unintended consequences, including widening inequalities in access to and outcomes from smoking cessation activities provided by healthcare organisations.

Chapter 4: Aims, objectives and overall methodology

Justification for this research

As discussed in the previous three chapters, smoking is an important public health problem, the leading cause of morbidity and premature mortality.[2] It is the main cause of health inequalities[6] and costs the UK around £14 billion pounds annually.[42] Population-wide tobacco control measures may be the most cost-effective ways to reduce smoking prevalence, but there is still a need for effective smoking cessation advice and treatments to help smokers to quit.[182 183]

Primary care provides a good opportunity to reach smokers as around 80% of patients visit their general practice annually.[101] However, smoking cessation activities tend to be under-provided in primary care.[111]

Financial incentives, including the UK's Quality and Outcomes Framework, have been shown to improve healthcare quality, assessed mainly through process outcomes. They may therefore improve the identification of smokers in primary care and so enable advice to be given to smokers.

However, the evidence for the effects of financial incentives on smoking cessation activities in healthcare is mixed, and there has been no synthesis of the literature. In addition, there are few studies examining the effects of financial incentives on smoking cessation activities in patients without existing smoking-related conditions (primary prevention), and the evidence for their effects on inequalities in the provision and outcomes of such advice is also sparse.

Hypothesis

The null hypothesis for this research is that financial incentives do not affect healthcare providers' behaviour in the provision of smoking cessation activities in primary care and therefore also do not affect smoking prevalence in people with or without long-term conditions, regardless of demographic group. The alternative hypothesis is that financial incentives do affect these prevention activities in primary care and may therefore influence inequalities in healthcare provision and outcomes.

Main research question

What are the effects of financial incentives on smoking cessation activities undertaken in healthcare, and do they affect inequalities in the provision of smoking cessation activities in primary care?

Aims

I plan to examine the effect of financial incentives for the provision of smoking cessation activities to people without smoking-related diseases (primary prevention) as well as for secondary prevention in people with smoking-related long-term conditions by undertaking a systematic review of the literature as well as statistical analyses of general practice datasets. I also aim to look at smoking outcomes with respect to inequalities in provision for people from different disease groups (primary and secondary prevention), and from different demographic groups based on age, gender, ethnicity and socio-economic status.

Objectives

- To undertake a systematic review of the effects of financial incentives for smoking cessation activities by healthcare providers.
- To examine the effects of a financial incentive scheme (QOF) on smoking cessation activities (the proportion of patients whose smoking status is recorded and who then

receive smoking cessation advice, or referral to other smoking cessation services) provided to patients with and without smoking-related long-term conditions in general practices, and the effect on smoking prevalence in these patients, using data from general practices in Wandsworth, London, UK.

- To examine the effects of a local financial incentive scheme (QOF+) on smoking cessation activities and smoking prevalence for adult patients without smoking-related long-term conditions using data from general practices in Hammersmith & Fulham, London, UK.
- To examine the effects of a local financial incentive scheme (QOF+) on smoking cessation activities and smoking prevalence for pregnant women using data from general practices in Hammersmith & Fulham, London, UK.
- To examine the effects of QOF and QOF+ on inequalities in the provision of smoking cessation activities to different groups (defined by age, gender, ethnicity and socio-economic status and, for QOF data, by disease group).

Methodology

1. Systematic review of the effectiveness of financial incentives to health care professionals for smoking cessation activities using Medline, Embase, PsychInfo, Cochrane, and Web of Science databases, the methodology and findings of which are discussed in Chapter 5.
2. Cross-sectional study of the effect of QOF on ethnic disparities in the ascertainment of smoking status, smoking prevalence, and smoking cessation advice to smokers with and without long-term conditions (cardiovascular disease; chronic obstructive pulmonary disease or asthma; depression; and none of these conditions) using anonymised data from general practices in Wandsworth, London, UK. The methodology and findings of this study are discussed in Chapter 6.

3. Before-and-after study of smoking outcomes for patients without smoking-related long-term conditions using anonymised QOF+ data from Hammersmith & Fulham, London, UK (2008 to 2011). The methodology and findings of this study are discussed in Chapter 7.
4. Before-and-after study of smoking outcomes for pregnant women using anonymised QOF+ data from Hammersmith & Fulham, London, UK (2008 to 2011). The methodology and findings of this study are discussed in Chapter 8.

Ethics approval

For Wandsworth study

Wandsworth Local Research Ethics Committee granted ethics approval for the use of general practice data to examine the effects of QOF on a number of health outcomes including smoking in the population.

For Hammersmith & Fulham QOF+ study

I submitted an application to the South East Research Ethics Committee (SE REC) to set up a General Practice Research Database using QOF+ data from general practices in Hammersmith & Fulham PCT using the on-line application system (IRAS). The application was approved in August 2010.

The subsequent application to the SE REC to use data from the database for evaluations of QOF+ with respect to smoking cessation activities and other prevention work received an unfavourable decision from the committee. I re-wrote the proposal and the ethics application following feedback from the committee and these received a favourable decision from the London Queen Square Research Ethics Committee meeting on 16 June 2011.

Chapter 5: Systematic review of the effectiveness of financial incentives to health care professionals for smoking cessation activities

Background

Individual-level smoking cessation interventions by healthcare professionals are effective and can reduce health inequalities related to tobacco use.[92 102] However, smoking cessation interventions tend to be underprovided in healthcare.[184] Healthcare practitioners have negative attitudes towards discussing smoking cessation with their patients, doubt their personal effectiveness in providing cessation advice, worry about compromising their relationship with the patient, and lack time in the average consultation,[114] although practitioners consider disease prevention activities to be important and worth spending time on during the consultation.[185]

Pay-for-performance schemes are becoming more mainstream in healthcare, particularly in the USA[186 187] and the UK.[142 188] They aim to improve the quality of healthcare by financially rewarding practitioners for achieving performance targets. Financial incentives may encourage more systematic use of smoking cessation interventions and have been incorporated into many quality improvement programmes. For example, the Quality and Outcomes Framework (QOF), introduced in the UK in 2004, rewards smoking cessation activities, although mainly for secondary prevention of long term conditions such as coronary heart disease, diabetes and chronic obstructive pulmonary disease.[180] I carried out a systematic review to examine the evidence for the effectiveness of providing financial incentives to healthcare professionals for smoking cessation.

I wrote up the review as first author. Co-authors commented on the first draft and it was published in a peer-reviewed journal and it was published in a peer-reviewed journal (*Tobacco Control*) in 2011 (See Appendix C).

Methods

Search strategy for identification and selection of studies

I identified studies by searching the electronic databases MEDLINE, EMBASE, PsychINFO, the Cochrane database of systematic reviews, and ISI Web of Science and included papers in languages other than English in the search. The titles and abstracts of those studies identified by the initial searches were scanned and, for those that appeared relevant, the full paper was obtained and reviewed. Further papers were identified by looking at the citations and reference lists of review papers and papers identified in the initial search.

For MEDLINE I searched from 1947 to 1 May 2011 using Medical Subject Heading (MeSH) terms: (Motivation/ or Reimbursement, Incentive/ or financial incentive.mp or Reimbursement Mechanisms/ or payment.mp or "Salaries and Fringe Benefits"/ or pay.mp) and (general practice.mp or Family Practice/ or Primary Health Care/) and (Disease Management/ or Chronic Disease/ or "Quality of Health Care"/ or chronic disease management.mp or Diabetes Mellitus/ or Cardiovascular Diseases/ or Bronchitis/ or Pulmonary Disease, Chronic Obstructive/ or Respiratory Tract Diseases/ or Lung Diseases/ or respiratory disease.mp or Asthma / or Lung Diseases, Obstructive/ or Primary Prevention/ or Secondary Prevention/ or "Tobacco Use Disorder"/ or Smoking/ or Smoking Cessation/).

For EMBASE I searched from 1947 to 1 May 2011 using the following terms: (motivation/ or Incentives/ or policy/ or incentive*.mp or finance*.mp or fee/ or payment.mp or pay*.mp or "salary and fringe benefit"/ or P4P.mp) and (health care quality/ or chronic disease/ or

long term condition.mp or diabetes mellitus/ or copd.mp or chronic obstructive lung disease/ or cardiovascular disease/ or asthma/ or coronary heart disease.mp or ischemic heart disease/ or smoking/ or smoking cessation program/ or cigarette smoking/ or smoking.mp or smoking cessation/ or tobacco dependence/ or health education/ or secondary prevention/ or prevention/ or primary prevention/) and (primary care.mp or primary medical care/ or family practice.mp or general practice/ or gp.mp).

For PsychINFO I searched from 1967 to 1 May 2011 using the following terms: (exp Incentives/ or exp Monetary Incentives/ or pay.mp or exp Salaries/ or exp Employee Motivation/ or exp Motivation/ or exp Extrinsic Motivation/) and (exp Primary Health Care/ or exp General Practitioners/ or general practice.mp) and (exp Chronic Illness/ or long term condition.mp or exp Diabetes/ or exp Diabetes Mellitus/ or copd.mp or exp Chronic Obstructive Pulmonary Disease/ exp Cardiovascular Disorders/ or ischemic heart disease.mp or coronary heart disease.mp or exp Heart Disorders) and (exp Smoking Cessation/ or smoking.mp or exp Tobacco Smoking/).

For ISI Web of Science I searched using keywords: (financial incentive and smoking); (payment and smoking). For the Cochrane Collaboration, I searched all titles of reviews and protocols produced by the Tobacco Addiction group and the Effective Practice and Organisation of Care (EPOC) group in the Cochrane database of systematic reviews (CDSR) for relevant studies. I searched the Cochrane Database of Abstracts and Reviews of Effectiveness (DARE) using keywords (smoking, payment and financial incentive). I searched the Cochrane Central Register of Controlled Trials (CENTRAL) using key words (financial incentive, payment, and smoking).

Inclusion criteria for studies to review

1. Types of studies: randomised controlled trials, controlled trials, and observational studies with before-and-after, longitudinal or time series analysis designs, and reporting quantitative results.
2. Participants: participants aged 15 and over, with and without chronic disease, registered with any healthcare provider.
3. Types of financial incentives: studies that examined the effects of financial incentives (pay-for-performance) for individual and groups of healthcare providers to provide smoking cessation advice, referral and/or prescription of medication to help with smoking cessation.

Exclusion criteria

1. Studies examining the effects of financial or other rewards to patients, patient competitions, or provision of reduced cost or free medication to help with smoking cessation (unless this was associated with a provider financial incentive).
2. Studies reporting results as a composite quality score including other measures of chronic disease management if it was not possible to isolate impacts on smoking-related activities.

Assessment of methodological quality and data extraction

I and another researcher scored each paper for methodological quality using the Downs and Black guidelines for assessing the quality of both randomised and non-randomised studies of healthcare interventions,[189] the scoring system for which is given in Downs and Black paper reproduced in Appendix A. The scores were collapsed to give four categories: 1 (poor), 2 (acceptable), 3 (good), 4 (excellent), using a similar method as that employed by Petersen et al in their 2006 systematic review of financial incentives for quality of healthcare.[190] Any differences of opinion were resolved by discussion with my supervisor.

I then extracted the numerical results from the identified papers for the results section of the review. These included summary measures (odds ratios, rate ratios, mean differences in observed versus predicted scores and differences in proportions) for changes in outcomes such as the recording of smoking status, advice given, referrals to smoking cessation services and prescriptions given to aid smoking cessation, as well as changes in smoking rates. I used the data reported to estimate the effect size (odds ratio, OR) for each outcome for each study if this was not reported. I did not calculate a summary measure of effect for the studies by meta-analysis as they used different settings, population groups and outcome measures and I did not consider them to be combinable.

Results

Search results

The flow chart of the search strategy for included studies is given in Figure 25. Most of the papers initially identified by the search could be excluded after scanning the abstracts, as they were descriptive articles, editorials, commentaries or reviews.

Excluded papers and reasons for exclusion

Two sets of papers were duplicates, reporting results from the same datasets. The first set were papers by Twardella and Brenner, published in 2007[191], and Salize et al, published in 2009.[192] The paper by Salize et al included cost effectiveness analysis so I included this one. The other set were two papers by Coleman et al, published in 2007[160] with a follow up study in 2010.[193] I excluded the later paper as this reported results only in the form of graphs, and it was not possible to extract numerator and denominator data in order to calculate effect size (odds ratio) for outcomes.

Included studies

The final set of studies consisted of 11 observational studies examining the effect of QOF in the UK, in which reaching pre-set targets is rewarded (Table 1a); and eight studies looking at specific financial incentives for smoking cessation on individual physicians or groups of physicians in which reimbursement depended on performance (Table 1b).

Figure 25: Flow diagram of study selection for inclusion in a systematic review of financial incentives for smoking cessation activities in healthcare

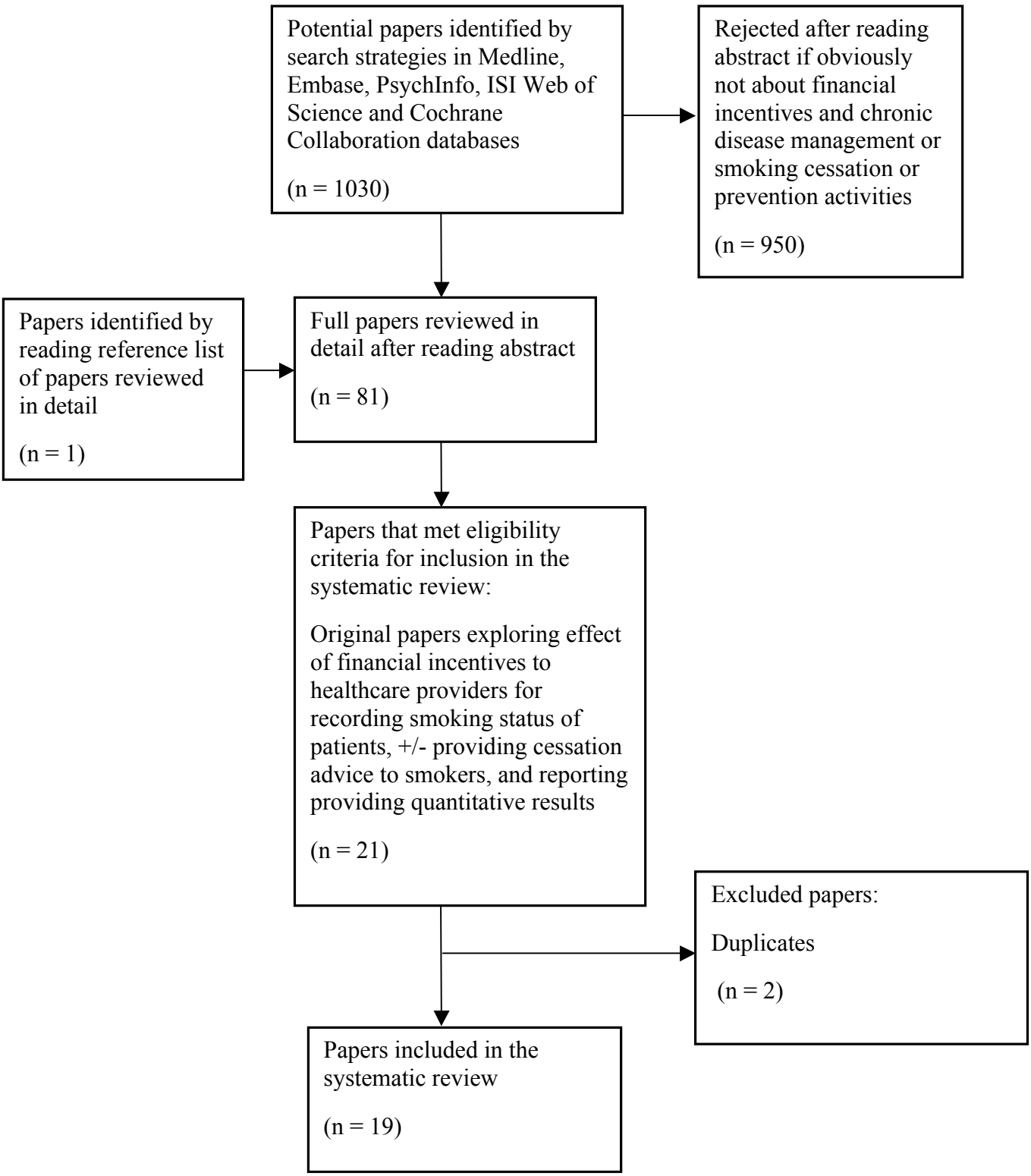


Table 1a: Studies evaluating the effectiveness of the Quality and Outcomes Framework in the UK on smoking-cessation activities

Author Year Country	Design	Incentive	Setting	Population	Outcome measure reported	Results	Quality score
Smoking status as main outcome							
Millett et al, 2008[194] UK	Comparison of two cross-sectional surveys using electronic patient records	Introduction of QOF in 2004, with financial incentives for quality of care for people with chronic diseases, including smoking cessation activity For details of smoking indicators in QOF see Chapter 3	32 general practices in south London, UK	2,891 patients with coronary heart disease (CHD) registered with participating practices in 2003 and 3,101 in 2005	Proportion of patients with CHD whose smoking status was recorded in the 2003 and 2005 study periods	Recorded smoking status increased between 2003 and 2005 in the three ethnic groups studied: from 70.6% to 89.8% (OR 3.6, CI 2.5-5.4) in White patients; from 76.6% to 92.0% (AOR 3.5, CI 2.2-5.7) in Black patients; and from 70.1% to 92.4% (AOR 5.3, CI 3.0-9.5) in Asian patients Combining these results gives overall improvement in recording smoking status from 72.4% in 2003 to 91.4% in 2005 (OR 3.12, CI 2.80 to 3.48)	3
Sutton et al, 2010[195] UK	Cross-sectional historic before-and after study of recording of risk factors, for which practices were either incentivised or	QOF	315 general practices contributing data to the Scottish Programme for Improving Clinical	391326 patients aged > 45 in one of the following disease categories: COPD (1.7%), CHD (9.0%), diabetes (6.6%), hypertension (15.6%), stroke (2.7%),	Proportion of patients with smoking status recorded annually between 2000/1 and 2005/6	The overall effect of all incentivised factors was substantially larger on the targeted patient groups (+19.9%) than on unincentivised (+5.3%) For the recording of smoking status, we were unable to calculate an OR for improvement for all patients as the results were only given for CHD as an illustration. For CHD the proportion of patients with recorded smoking	2

	not, including smoking data, for chronic disease. Analysis used dynamic probit models		Effectiveness in Primary Care	untargeted or no disease (64.4%)		status increased over the study period from around 12% in 2000/1 to 60% immediately pre-QOF and to 80% in 2005/6. The improvement from 2003/4 to 2005/6 was 20% (OR 2.67, CI 2.58 to 2.76)	
Smoking status and smoking cessation advice as outcomes							
Campbell et al, 2007[168] UK	Cohort study	QOF	Random sample of 42 nationally representative general practices in England	Patients with CHD, asthma and Type 2 diabetes registered at participating general practices	Smoking status recorded during the previous 5 years Smoking advice to smokers recorded during the previous 5 years	The authors reported mean difference in observed and predicted quality scores at practice level in 1998 and 2003 (pre-QOF) and 2005. For CHD recorded smoking status increased by 0.87 (CI 0.47-1.27, p<0.001); for asthma recorded smoking status increased by 0.59 (CI 0.16-1.01, p=0.008); for type 2 diabetes recorded smoking status increased by 0.58 (CI 0.13 to 1.03, p=0.01). Smoking advice increased at all three time points for all conditions but the authors did not report differences in observed vs predicted scores for this Combining results for all three chronic diseases the proportion of patients having smoking status recorded increased from 86.5% to 97.6% between 2003 and 2005 (unadjusted OR 9.82, CI 7.30 to 13.22). For smoking	2

						advice the proportion increased from 80.6% to 97.0% between 2003 and 2005 (unadjusted OR 7.87, CI 5.68 to 10.90)	
Campbell et al, 2009[169] UK	Follow up study to earlier study using additional data from 2007 and using an interrupted time-series analysis	QOF	As above	Same patient population as for earlier study	Smoking status recorded during the previous 5 years Smoking advice to smokers recorded during the previous 5 years	Mean difference in observed versus predicted scores for recording smoking status and advice given to smokers at practice level in 1998 and 2003 (pre-QOF) and 2005 improved for patients with CHD, asthma and diabetes (described above, with OR) The mean score for recording smoking status for CHD, asthma and diabetes improved slightly more between 2005 and 2007, from 97.6% to 99.2%, and the proportion receiving smoking cessation advice also slightly improved, from 97% to 98.2%	2
McGovern et al, 2008[196] UK	Serial cross-sectional study with multivariate analyses to assess variation with respect to gender, age,	QOF	310 general practices in Scotland	Patients with a computer record of coronary heart disease registered at participating practices	Proportion of patients with a recording of smoking status Proportion of smokers recorded as receiving smoking cessation advice	The proportion of eligible patients with smoking status recorded increased from 69.5% to 95.7% between 2004 and 2005, OR 22.86 (CI 21.70 to 24.0, $p<0.05$), and the proportion of smokers given advice increased from 81.0% to 96.2%, OR 5.94 (CI 5.53 to 6.38, $p<0.05$). The multivariate analysis identified that pre-QOF older patients were the only group less likely to be asked about smoking or given advice if smokers (OR 0.54, CI	3

	deprivation					0.48 to 0.60 for over-75s compared with younger patients for being asked (OR 0.56, CI 0.48 to 0.66 for being offered advice). Post-QOF there was no difference with age in being asked about smoking, and those from more affluent areas were somewhat less likely to be asked about smoking (OR 0.78, CI 0.62 to 0.99 compared with least deprived); female smokers were more likely to be offered advice compared with males (OR 1.19, CI 1.05 to 1.34); but smokers over-75 were less likely to be offered advice compared with younger smokers (0.44, CI 0.36 to 0.53).	
Simpson et al, 2006[197] UK	Serial cross-sectional study with multivariate analyses	QOF	310 general practices in Scotland	Patients with a computer record of transient ischaemic attack or stroke registered at participating practices	Proportion of patients with a recording of smoking status Proportion of smokers recorded as receiving smoking cessation advice	The proportion of eligible patients with smoking status recorded increased from 41.1% to 90.6% between 2004 and 2005and the proportion of smokers given advice increased from 79.0% to 95.9% The OR of smoking status being recorded in 2005 compared with 2004 was 13.73 (CI 13.09 to 14.39) and for smokers receiving smoking cessation advice was 6.21 (CI 5.54 to 6.97)	3
Tahrani et al, 2007[198]	Observational retrospective before-and-after	QOF	66 general practices in	15,628 patients on the diabetes register of participating general	Proportions of patients with smoking status recorded across the	Recorded smoking status increased over the study period, from 44% in 2004 to 96% in 2005 and stabilised at 95% in 2006 ($p<0.001$). Smoking cessation advice	3

UK	study		Shropshire, UK	practices in April 2004, 16,121 in March 2005 and 16,867 in March 2006	study period Proportion having received smoking cessation advice across the study period	increased over the study period from 83.8% in 2004 (my estimate from October 2004 data in paper as April 2004 data not reported) to 95% in 2005 and 96% in 2006 (p<01.01) OR for recording smoking status in 2006 compared with 2004 was 24.19 (CI 22.42 to 26.11) and for smokers receiving smoking cessation advice was 4.64 (CI 4.25 to 5.06)	
Smoking status, smoking cessation advice, and providing prescription as outcomes							
Coleman et al, 2007[160] UK	Historic trend analysis for effect on smoking cessation activities of QOF in UK using data from The Health Improvement Network (THIN) database for	QOF	UK primary care	Registered patients aged 15-75: data available on THIN for 776,302 patients in 1990, rising to 1,569,177 in 2000 and 1,607,782 in 2004	Smoking status recorded Smokers given advice to stop smoking Prescriptions to help stop smoking	Comparing data from 2000 and 2004, there was an increase in recording of smoking status from 14% to 39% (OR 3.93, CI 3.91 to 3.95) and in brief advice to smokers from 7% to 37% (OR 7.80, CI 7.70 to 7.90) The absolute increase in annual recording of smoking status and advice was more marked in the chronic diseases groups from around 10% in 2000 to over 80% in 2004 for patients with COPD, ischaemic heart disease or diabetes, 75% for those with TIA/stroke; 66% for those with hypertension; 57% for those with asthma NRT/Bupropion prescriptions increased from around	3

	each year between 1990 and 2005					1% of smokers in 2000 to around 6% of smokers in 2004 (OR 6.32, CI 5.85 to 6.83). Nicotine addiction treatments were prescribed more often for patients with COPD than for those with other conditions	
Smoking status and smoking prevalence as outcomes							
Cupples et al, 2008[199] UK	Cross-sectional study to compare baseline cardiovascular risk management between different healthcare systems	QOF	16 randomly selected general practices in Northern Ireland (P4P) and 32 in the Republic of Ireland (no P4P). Data were collected between October 2004 and January 2006	903 patients with CHD registered at the general practices, mean age 67.5 years, 69.9% male	Recorded smoking status during previous year Smoking status ever recorded Recorded smokers Self-reported smokers	Fewer RoI than NI patients had their smoking status recorded over the previous year (22% vs 84%, OR 21.11, CI 14.68 to 30.36, p<0.001). Recorded smoking prevalence was lower in NI than RoI but the difference was not statistically significant (13.4% vs 16.9%, OR 0.76, CI 0.50 to 1.15, p=0.19). Self-reported smokers prevalence conversely was higher in NI than RoI, but the difference again was not statistically significant (16.9% vs 13.8%, OR 1.27, CI 1.27 to 1.86, p=0.22)	3
Smoking status, smoking cessation advice or referral, and smoking prevalence as outcomes							

Millett et al, 2007[180] UK	Population based longitudinal study using electronic patient records	QOF	32 general practices in Wandsworth, London, UK	4,284 patients (≥18 years) with diabetes registered at participating general practices in 2003 and 2005	Of patients with diabetes: Proportion with smoking status recorded in the 15 months before the 2003 and 2005 study periods Proportion who smoked who were given smoking cessation advice Prevalence of smoking	Significantly more patients had their smoking status recorded within 15 months in 2005 than in 2003 (86.7% vs 67.6%, OR 5.62, CI 5.08 to 6.21, p<0.001). The prevalence of smoking declined (from 20.0% to 16.2% , OR 0.77, CI 0.69 to 0.86, p<0.001). The proportion of patients with documented smoking cessation advice also increased significantly (from 48.0% to 83.5%, OR 5.46, CI 4.30 to 6.95, p<0.001).	2
Simpson et al, 2010[181] UK	Cross-sectional study with historic before-and-after analysis	QOF	525 general practices contributing to QRESEACH database (anonymised aggregated data from about	All patients aged >15 years registered at the general practices contributing to the database	Numbers with smoking status recorded in 2001/2 (pre-QOF) and 2006/7 Proportions of smokers given smoking cessation advice in the two study	The proportion of people with smoking status recorded increased by 32.9% (from 46.6% in2001/2 to 79.5% in 2006/7, OR 4.45, CI 4.43 to 4.46) There was a large increase in provision of smoking cessation advice (43.6% in 2001/2, 84% in 2006/7, OR 6.75, CI 6.66 to 6.85) The proportion of patients referred to stop smoking	2

			2,710,000 patients)		periods Proportions of smokers referred to a stop smoking service in the previous 12 months in the two study periods Smoking prevalence	clinics increased (from 0.95% to 6.56%, OR 7.32, CI 6.92 to 7.73) The proportion of people recorded as being a smoker reduced from 28.4% in 2001/2 to 22.4% in 2006/7 (OR 0.73, CI 0.72 to 0.73)	

UK = United Kingdom; QOF = Quality and Outcomes Framework; NI = Northern Ireland; RoI = Republic of Ireland; P4P = pay for performance; GP = general practitioner; CHD = coronary heart disease; TIA = transient ischaemic attack; CI = 95% confidence interval; RR = relative risk; OR = odds ratio; AOR = adjusted odds ratio

Table 1b Specific financial incentives for performance in smoking cessation activities

Author Year Country	Design	Incentive	Setting	Population	Outcome measure reported	Results	Quality score
Providing smoking cessation advice, medication or referral as outcomes							
An et al, 2008[200] USA	RCT	US$5000 for 50 faxed referrals of smokers by physicians to a stop smoking telephone advice service (also providing NRT for free or with insurance copayment) plus US$25 for each referral after the initial 50 and feedback on referral numbers Incentives were paid into clinics' general operating fund, not to individual physicians, administrators or other staff	24 clinics with incentive vs 25 clinics with usual care in Minnesota, USA. 32 of the 49 clinics used an electronic medical record system (EMR)	Smokers ≥18 years old who visited the clinics and were intending to quit	Number of referrals to the tobacco quitline Percentage of clinic smokers taking up smoking cessation services	Numbers of referrals: 11.4% of smokers (CI 8% to 14.9%; total referrals 1483) for clinics with financial incentive vs 4.2% (CI 1.5% to 6.9%; total referrals 441 for usual care clinics), p=0.001. OR 2.93 (CI 2.63 to 3.27) for referral with financial incentive compared to control There was no association between clinic specialty (family practice; internal medicine; obstetrics-gynaecology; multispecialty), number of physicians at the clinic, or the use of EMRs and the proportions of smokers referred to the quitline. Overall percentage of clinic smokers who then enrolled in the quitline smoking cessation service was higher in incentivised clinics (3.0%, CI 2.2% to 3.8%) compared with controls (1.3%, CI 0.4% to 2.1%), p=0.005 Costs for referral/enrolment were higher for the intervention clinics (US$65/US$232) than for the	3

						control clinics (US$20/US$72) but resulted in 1042 additional referrals and 289 additional enrolments. Marginal cost for the incentivisation was US$83 per additional referral and US$300 per additional enrolment	
Chang et al 2010[201] Taiwan	Before-and-after analysis of data from the Taiwan Adult Tobacco Survey 2004-2007	Increase of reimbursements for physicians in all medical specialties to provide smoking cessation services. From January 2005 participating physicians received 350 New Taiwan Dollars (NT$, equivalent to US$11) for providing brief cessation counselling during each routine outpatient visits vs $NT 250 (US$8) in 2004. Also, increased medication subsidy for eligible patients (aged ≥18 years and smoking ≥10 cigarettes a day) of up to NT$400 (US$13), up from NT$250 (US$8) in 2005.	General population in Taiwan	Adults aged ≥18 selected and phoned via random digit sampling: 16,788 (2004); 16,749 (2005); 16,922 (2006); 16,588 (2007) Of these 5,358; 4,846; 5,220; and 4,866 respectively were ever-smokers and 3,290; 3,131; 3,072; and 2,953 were current smokers	Numbers of ever smokers and current smokers receiving smoking cessation advice from health professionals Prevalence of smoking in 2004, 2005, 2006 and 2007	After adjusting for other variables, the increased funding in 2005 was associated with an increase in the prevalence of receiving smoking cessation advice during the previous year from 21.1% in 2004 to 26.8% in 2005 (adjusted OR 1.26, CI 1.11 to 1.42 compared with 2004) and 28.2% in 2006 (adjusted OR 1.39, CI 1.25 to 1.56 compared with 2004). The rate reduced slightly to 27.6% in 2007 when funding reduced to 2005 level (adjusted OR 1.37, CI 1.22 to 1.53) compared with 2004) The multivariate analysis results suggested that increasing financing for smoking cessation services in 2005; being male; older; smoking daily; previously having attempted to stop smoking; having a self-assessment of poor health; and being aware of the benefits of smoking cessation services were significantly positively associated with receiving quit advice	2

		In 2006 funding fell to the 2005 level but with low income patients receiving higher subsidies (US$16 per week)				The prevalence of smoking in each of the years surveyed was 23.9%, 22.2%, 21.4% and 21.1% respectively. The prevalence of ex-smokers for each of the years was 6.4%, 5.7%, 7.4% and 7.4% respectively	
Coleman et al, 2001[202] UK	Before-and-after-after study	Pilot health promotion payment aimed at increasing GP stop smoking advice to smokers. All members of participating primary care teams received training in helping patients stop smoking. The numbers of patients who quit were recorded for a control period of nine months, followed by nine months with a financial incentive. Individual general practitioners could claim £15 (approximately US$24) for each patient who stopped smoking (the authors estimated each GP could	31 GPs working at 13 general practices in Leicester, UK	Patients registered at participating general practices: 1,878 patients participated in the control period and 1,647 participated in the intervention period	Proportion of patients who had stopped smoking during the previous year who recalled receiving stop smoking advice from their GP before and after the intervention	21% of smokers recalled receiving antismoking advice after the intervention period compared with 19% in the control period (OR 1.17, CI 0.85 to 1.62). The difference was not significant and neither was the difference in proportions who had tried to stop smoking during the previous year (44% after the intervention period compared with 39.6% in the control period) However, a greater proportion of patients said they wanted to stop smoking (60.5% vs 52.2%) and intended to try to stop smoking in the next month (27.8% vs 18.8%)	2

		claim between £285 and £1125 a year). Patients attending a random selection of general practices in both time periods completed questionnaires to determine proportion of smokers who had been given smoking cessation advice					
McMenamin et al, 2003[203] USA	Cross-sectional survey of physician organisations. Multivariate analysis of survey data	Organisations receive or do not receive financial incentives from HMOs to support smoking cessation interventions. Figures for financial incentives received were not given in the paper	1,104 physician organisations in US with ≥20 physicians	Representatives (president; chief executive officer; or medical director) of the physician organisations	Numbers of HMOs providing smoking cessation advice and other interventions such as self help materials and NRT	5% of organisations polled received direct financial incentives from HMOs to provide smoking cessation interventions and 40% received additional income from health plans for scoring well on quality measures including smoking cessation activities Adjusted OR for supporting smoking cessation interventions for those organisations with financial incentives: Offering health promotion programme, OR 3.63 (CI 1.70 to 7.76, p<0.001); providing NRT starter kit OR 2.75 (CI 1.33 to 5.65, p=0.006); providing written materials on (a) pharmacotherapy OR 2.13 (CI 1.04 to 4.33, p=0.034), (b) counselling OR 3.11 (CI 1.50 to	3

						6.44, p=0.002), (c) self-help OR 2.33 (CI 0.93 to 5.84)	
Stevens et al, 2005[204] USA	Cross-sectional study with three components: HMO policy survey; patient survey; survey of primary care physicians	Financial incentives provided in some HMOs for physicians to provide smoking cessation services (5As: Ask, Advise, Assess, Assist and Arrange) vs no incentive. All provided coverage for smoking cessation medications and counselling. Figures for financial incentives received were not given in the paper	11 non-profit HMOs, 9 affiliated with Cancer Research Network in USA	Random selection of 64,764 patients in the 9 CRN HMOs who had a primary care consultation in the previous 12 months. Patients completed mail or telephone survey	For patients who were self-reported smokers: Proportion who reported being asked about tobacco use at their last clinic visit; were given advice to quit; were asked about readiness to quit; received assistance in quitting; were scheduled for follow up visits to help in quitting	Five HMOs had policies for tobacco control and smoking cessation activities. A greater proportion of patients at HMOs with incentives reported receiving smoking cessation advice (74% vs 67%, OR 1.40, CI 1.23 to 1.60); assessment of readiness to quit (60% vs 52%, OR 1.23, CI 1.23 to 1.57); received smoking cessation materials (28% vs 22%, OR 1.38, CI 1.20 to 1.59) or received counselling by a physician (34% vs 29%, OR 1.26, CI 1.11 to 1.44). For all comparisons p<0.01 using chi-squared tests	3
Quit rates as outcome							
Salize et al 2009[192] Germany	Cluster-randomised smoking cessation trial. Main outcome	1.GP training and a financial incentive of (€130, approximately US$152 using exchange rate of 1€=US$1.17 in 2003) for	94 GPs working in 82 General practices in Germany: 20	577 patients aged 36 to 75 years who smoked at least 10 cigarettes a day and who visited a GP for a general health	Abstinence rates 12 months after recruitment (self-report confirmed by serum cotinine levels)	The TI intervention was not effective compared with TAU. The point prevalence of abstinence at 12 months was 3.5% vs 2.7%, OR 1.29, CI 0.25 to 6.84, p=0.75 However, the point prevalence of abstinence at 12 months with TM (12.1%) and TI/TM (14.6%) differed	3

	was cost-effectiveness but abstinence rates also compared with mixed logistic regression	each abstinent patient (TI) 2.GP training plus cost-free smoking cessation medication (TM) 3.A combination of 1 & 2 (TI/TM) 4.Treatment as usual (TAU)	practices were randomised to group 1; 21 to group 2; 21 to group 3; 20 to control group	examination (offered biannually and, free for all patients covered by compulsory health insurance)		significantly from TAU (2.7%) and for TM compared with TAU, OR 4.98, CI 1.22 to 22.16, p=0.05. For TI/TM compared with TAU, OR 6.16 (CI 1.44 to 26.37, p=0.02) TM and TI/TM were cost-effective compared with TAU but TI was not. The total intervention costs per treated patient in each of the arms were €14.16 (US$16.57) for TI, €39.10 (US$45.75) for TM and €50.04 (US$58.55) for TI/TM against €0 for TAU. This translated to an investment of €92.12 (US$107.78) per patient in the programme to gain one additional quitter with TM whereas for TI/TM €82.82 (US$96.90) would be required	
Providing smoking cessation advice and quit rates as outcomes							
Chang et al, 2008[205] Taiwan	Historic before-and-after and after cross-sectional database study of claims from physicians for providing	Increase of reimbursements for smoking cessation activities as described above for Chang et al 2010	Private and public healthcare organisations (clinics and hospitals) in Taiwan. Physicians of	Patients aged ≥18 attending clinics or hospitals for routine visits who were then offered a six-minute counselling session with a five-point agenda (5As: Ask,	Numbers of patients receiving smoking cessation services in 2004 and 2005 Quit rates in 2004 and 2005	The increased reimbursement rates and medication subsidies for smoking cessation were positively related to the number of physicians enrolling in the programme (1,841 in 2004 vs 3,466 in 2005), the number of cessation consultations per month per physician (5.1 vs 14.6) and number of cessation visits per year per patient (2.0 vs 2.5) The number of patients receiving cessation counselling	3

	smoking cessation advice. Multivariate and GEE statistical analysis Logistic regression was used to examine quit rates after conducting a six-month follow up of patients using three datasets (Patient Claims data; Patient intake survey; Patient six-month follow-up survey)		any specialty were eligible from 2005. Previously only family practitioners, psychiatrists and internal medicine physicians	Advise, Assess, Assist and Arrange) including a prescription of medication to help smoking cessation		increased from 22,167 (0.50%) in 2004 to 109,508 (2.75%) in 2005, OR 5.05 (CI 4.98 to 5.12) However, the 2005 increase in funding was not associated with an increase in quit rates (25.2% in 2004 vs 21.3% in 2005, OR 0.96, CI 0.87 to 1.06) The average cost for smoking cessation consultations and medication per quitter was more expensive with the new system (US$135 in 2004 and US$300 in 2005)	

Asking about smoking and providing smoking cessation advice or assistance and quit rates as outcomes							
Roski et al, 2003[206] USA	RCT (3 arms)	1) Financial incentives of US$5000 for clinics with up to 7 providers, US$10,000 for clinics with 8 or more providers, available for superior performance (if ≥75% of patients ≥18 years had their smoking status recorded and if ≥65% of smokers had smoking advice recorded) 2) Financial incentives plus a smoker registry and telephone support for smoking cessation for patients ready to quit within 30 days at no cost to patients. Clinics received weekly updates of numbers of referrals and could see their performance compared with	40 primary care clinics in USA: 15 clinics received financial incentives; 10 received financial incentives plus registry and telephone support; 15 were controls	Patients aged ≥18 visiting clinics completed exit surveys at baseline (May 1999) and follow up (June 2000) to determine smoking status and whether they received quit advice or assistance (advice about or prescription for smoking cessation aids) during their appointment 4,435 patients were surveyed at baseline, 4,377 at follow up. Of these, 873 smokers were surveyed at baseline and 863 at follow up	Smoking status Quit advice given to smokers 7 day sustained abstinence from smoking	There was no difference between the intervention clinics and the control clinics in identifying patients' smoking status at baseline (40.5% for control clinics, 39.9% for incentive clinics, 40.3% for registry clinics), but at follow up the proportion identified was greater in the incentives clinics compared with control clinics (54%, vs 46.7%, OR 1.34, CI 1.17 to 1.54) than for registry clinics compared with control clinics (48.4% vs 46.7%, OR 1.07, CI 0.92 to 1.25) There was no difference between the intervention clinics and the control clinics in the proportion of patients receiving advice to quit at the last visit, and at follow up the proportion was not statistically greater in the incentives clinics compared with the control clinic (55.5% vs 53%, OR 1.07, CI 0.79 to 1.44) or the registry clinics compared with the control clinics (57.3% vs 53.7%, OR 1.15, CI 0.79 to 1.65) There was no statistically significant difference in the proportion of patients from the incentives clinics receiving assistance to quit at the last visit compared with control clinics (31.4% vs 34%, OR 0.89, CI 0.65 to	3

		other clinics 3) Control (printed smoking cessation guidelines) Clinics were aware of their performance levels prior to the start of the study and were aware if they were eligible for financial incentive		In addition, in July/August 2000 a baseline mail survey of 2,729 patients with clinic visits subsequent to the interventions was carried out with follow up six months later looking at 7 day quit rates and at assistance received for stopping smoking		1.23) or of patients from the registry clinics compared with control clinics (36.7% vs 34%, OR 1.13, CI 0.77 to 1.65) There was no difference in 7 day quit rates for smokers from the incentive clinics compared with those from control clinics (22.4% vs 19.2%, OR 1.21, CI 0.98 to 1.49) or for those from the registry clinics compared with those from the control clinics (21.7% vs 19.2%, OR 1.16, CI 0.91 to 1.48) Patients accessing registry clinics accessed counselling programmes more often than patients in the incentives or control clinics ($p<0.001$) but there was no difference between any of the groups in the proportions using medication to quit smoking or other aids	

UK = United Kingdom; USA = United States of America; HMO = Health Management Organisation; GP = general practitioner; 5As = Ask, Advise, Assess, Assist and Arrange; NRT = nicotine replacement therapy; CHD = coronary heart disease; TIA = transient ischaemic attack; TI = training and incentive; TM = training and medication; TAU = treatment as usual; CI = 95% confidence interval; RR = relative risk; OR = odds ratio; GEE = generalised estimating equations

Type of incentive

Eleven papers looked at the effect of QOF in the UK on smoking cessation activities. The financial rewards are paid to general practices rather than to individual general practitioners and the amount paid depend on the number of points achieved (as described in Chapter 3). Several of the papers looked at smoking cessation in patients with particular chronic diseases such as coronary heart disease, asthma, diabetes and stroke, while others examined results for all registered patients. Also most papers used data from different regions of the UK, only two used data from general practices from all of the UK. Only two of the studies took account of secular changes in smoking prevalence resulting from new guidelines for smoking cessation interventions, recent fiscal policy or legislation such as banning smoking in public places. They did this either by comparing actual outcomes against those predicted by modeling,[168] or by using interrupted time series analysis.[169]

The other group of studies I identified examined the effect of fee for service or bonuses on targeted smoking cessation activities in the UK, Germany, Taiwan and the US. They included two randomised controlled trials,[192 200] one cluster randomised trial,[206] two serial cross-sectional studies comparing health maintenance organisations (HMOs) with and without financial incentives for smoking cessation work,[203 204] and three before-and-after designs.[201 202 205] However, the designs of the before-and-after studies did not take account of secular changes in smoking prevalence.

Individual practitioners or organisation receiving incentives

Four studies examined the effect of financial incentives on individual doctors.[192 200 201 205] In one of the studies it was unclear whether the incentive payment was to individual doctors or to groups of doctors.[204] The remainder looked at the effects on providing incentives to groups of healthcare professionals working in clinics or general practices.

Amount of incentive provided

Incentives included large bonuses such as that provided in An et al's study[200] whereby US$5000 was given to participating clinics for achieving 50 referrals to a stop smoking telephone advice line, then US$25 per patient after the first 50. In the study by Roski et al[206] the incentive was US$5000 to US$10,000 if ≥75% of patients at participating clinics had their smoking status recorded and if ≥65% had been given smoking cessation advice. In the studies by Chang et al[201 205] the bonus was paid per smoker advised and was of the order of US$24. In two of the papers the payment was paid per smoker who stopped smoking, varying from US$24[202] to US$152.[192] For the cross-sectional studies of HMO funding[203 204] the amount of the incentive was not reported and had not been collected (correspondence with the authors).

Outcome measures

Most of the studies examined process measures such as the recording of smoking status, smoking cessation advice and/or referral to stop smoking services. For these measures most of the studies showed statistically significant increases in the proportion of subjects receiving the outcome measures of interest after financial incentives were introduced compared to the prior period. Three studies examined the impact of financial incentives on quit rates. For all outcomes there was too great a degree of statistical heterogeneity for the studies to be

combinable for a meta-analysis even when sub-analysis was undertaken by QOF and non-QOF studies (I_2 >90%, p<0.001 using RevMan[207] software).

- **Smoking status**

For the QOF studies the absolute improvements in recording smoking status ranged from 19%[194] (72.4% in 2003, 91.4% in 2005, OR 3.12, 95% CI 2.80 to 3.48), to 52%[198] (44% in 2004 to 96% in 2005, OR 24.19, CI 22.42 to 26.11), summarised in Table 2a. The improvement in the RCT by Roski et al[206] was 7.3% (54% for incentives clinics, 46.7% for control clinics, OR 1.34, CI 1.17 to 1.54) and 1.7% for incentive plus registry clinics (48.4% for incentive plus registry clinics, OR 1.07, CI 0.92 to 1.25).

Table 2a: Summary measure of recording smoking status (odds ratio, OR) following introduction of a financial incentive in order of effect size

Author and year	Type of study, effect size for financial incentive on recording of smoking status
Cupples et al, 2008[199]	QOF study. No statistically significant difference between area with incentive and area without: OR 0.76 (CI 0.50 to 1.15)
Roski et al, 2003[206]	RCT of incentives clinics compared with control clinics: OR 1.34 (CI 1.17 to 1.54)
Sutton et al, 2010[195]	QOF study. 2005/6 compared with 2003/4: OR 2.67 (CI 2.58 to 2.76)
Millett et al, 2008[194]	QOF study. 2005 compared with 2003: OR 3.12 (CI 2.80 to 3.48)
Coleman et al, 2007[160]	QOF study. 2004 compared with 2000: OR 3.93 (CI 3.91 to 3.95)
Simpson et al, 2010[181]	QOF study. 2006/7 compared with 2001/2: OR 4.45 (CI 4.43 to 4.46)
Millett et al, 2007[180]	QOF study. 2005 compared with 2003: OR 5.62 (CI 5.08 to 6.21)
Campbell et al, 2007[168]	QOF study. 2005 compared with 2003: OR 9.82 (CI 7.30 to 13.22)
Simpson et al, 2006[197]	QOF study. 2005 compared with 2004 was 13.73 (CI 13.09 to 14.39)
McGovern et al, 2008[196]	QOF study, 2005 compared with 2004: OR 22.86 (CI 21.70 to 24.0)
Tahrani et al, 2007[198]	QOF study. 2006 compared with 2004: OR 24.19 (CI 22.42 to 26.11)

OR = odds ratio

- **Smoking advice or referral**

For QOF studies, recorded smoking advice increased by between 12.2% (from 83.8% in 2004 to 96% in 2006, OR 4.64, CI 5.23 to 5.34)[198] to 16.4% (80.6% in 2003, 97.0% in 2005, OR 7.87, CI 5.68 to 10.90).[168] The findings on smoking advice from other studies were less consistent (see Table 2b). Roski et al[206] and Coleman et al[202] found no difference between control and financial intervention groups. Otherwise the improvement ranged from an increase of 2.25% in Chang et al's patient database study (0.50% in 2004, 2.75% in 2005, OR 5.05, CI 4.98 to 5.12)[201] to 5.7% in the study by Chang et al using the Taiwan Tobacco survey (21.1% in 2004, 26.8% in 2005, adjusted OR 1.26, CI 1.11 to 1.42).[205]

Table 2b: Summary measure for receiving smoking cessation advice (odds ratio, OR) following introduction of a financial incentive in order of effect size

Author and year	Type of study, effect size for financial incentive on recording of smoking status
Roski et al, 2003[206]	RCT. There was no statistically significant difference between the intervention clinics and the control clinics in the proportion of patients receiving advice to quit: OR 1.07 (CI 0.79 to 1.44)
Coleman et al, 2001[202]	Before-and-after-after study. Non-significant increase in proportion of smokers recalling receiving antismoking advice in the intervention period compared with the control period: OR 1.17 (CI 0.85 to 1.62)
Chang et al 2010[201]	Before-and-after study. Increased funding in 2005 was associated with an increase in the prevalence of receiving smoking cessation advice compared with 2004: OR 1.26 (CI 1.11 to 1.42) compared with 2004
An et al, 2008[200]	RCT. Increased numbers of referrals from clinics with financial incentives compared with those without: OR 2.93 (CI 2.63 to 3.27)
McMenamin et al, 2003[203]	Cross-sectional survey of Outcomes for organisations with financial incentives compared with those without. Offering smoking cessation counseling: OR 3.11 (CI 1.50 to 6.44)
Tahrani et al, 2007[198]	QOF study. 2006 compared with 2004: OR 4.64 (CI 4.25 to 5.06)
Chang et al, 2008[205]	Before-and-after study. Patients receiving cessation counselling increased in 2005 compared with 2004: OR 5.05 (CI 4.98 to 5.12)
Millett et al, 2007[180]	QOF study. 2005 compared with 2003: OR 5.46 (CI 4.30 to 6.95)
McGovern et al, 2008[196]	QOF study, 2005 compared with 2004: OR 5.94 (CI 5.53 to 6.38)
Millett et al, 2007[180]	QOF study. 2005 compared with 2003: OR 5.48 (CI 4.86 to 6.17).
Simpson et al, 2006[197]	QOF study. 2005 compared with 2004: OR 6.21 (CI 5.54 to 6.97)
Simpson et al, 2010[181]	QOF study. 2006/7 compared with 2001/2: OR 6.75 (CI 6.66 to 6.85); Increase in proportion of patients referred to stop smoking clinics: OR 7.32 (CI 6.92 to 7.73)
Coleman et al, 2007[160]	QOF study. 2004 compared with 2004: OR 7.80 (CI 7.70 to 7.90)
Campbell et al, 2007[168]	QOF study. 2005 compared with 2003: OR 7.87 (CI 5.68 to 10.90)

OR = odds ratio

- **Prescriptions for nicotine replacement therapy (NRT)/Bupropion**

Two studies found financial incentives were associated with an increase in the proportion of smokers receiving prescriptions. For Coleman et al[202] comparing pre/post-QOF, the OR was 6.32, (CI 5.85 to 6.83). For McMenamin et al[203] comparing HMOs with financial incentives to those without, the OR was 2.75 (CI 1.33 to 5.65).

- **Quit rates and changes in smoking prevalence**

Few studies examined quit rates and changes in smoking prevalence. A summary of the findings is shown in Table 2c, below.

Table 2c: Summary measure for reduction in prevalence or quit rates (odds ratio, OR) following introduction of a financial incentive in order of effect size

Author and year	Type of study, effect size for financial incentive on recording of smoking status
Chang et al, 2008[205]	Before-and-after study. 2005 compared with 2004: OR 0.96, CI 0.87 to 1.06)
Roski et al, 2003[206]	RCT. There was no difference in 7 day quit rates for smokers from the incentive clinics compared with those from control clinics: OR 1.21 (CI 0.98 to 1.49)
Simpson et al, 2010	QOF study. 2006/7 compared with 2001/2: OR 0.73 (CI 0.72 to 0.73)
Millett et al, 2007	QOF study. 2005 compared with 2003: OR 0.77 (CI 0.69 to 0.86)

OR = odds ratio

Three non-QOF studies examined quit rates and longer-term abstinence but produced mixed findings. Chang et al[205] found no improvement in quit rates over the previous 6 months when funding for smoking cessation activities in Taiwan increased between 2004 in 2005 (25.2% in 2004 vs 21.3% in 2005, OR 0.96, CI 0.87 to 1.06). Roski et al[206] found no difference in 7-day quit rates in their RCT (22.4% vs 19.2%, OR 1.21, CI 0.98 to 1.49 for incentive clinics compared with control clinics; 21.7% vs 19.2%, OR 1.16, CI 0.91 to 1.48 for registry clinics compared with control clinics). Salize et al[192] also found no difference in effect in their

cluster RCT, for the financial incentive group (TI) compared with the usual care group (TAU). However, they did find an improved quit rate in the group with GP training plus patient reimbursed medications (TM) of 12.1% compared with 2.7% for TAU, OR 4.98 (CI 1.22 to 22.16) and also in the group with GP training, patient reimbursement plus GP incentives (TI/TM), of 14.6%, OR 6.16 (CI 1.44 to 26.37), the large confidence intervals reflecting the relatively small sample size of the study. However, the TI/TM group did not significantly outperform the TM group, suggesting that the cost-free medication may have accounted for the effect observed.

Three QOF studies looked at smoking prevalence. They were not able to examine quit rates as such as these are not specifically recorded on GP electronic medical records. Cupples et al[199] found no difference between recorded smoking prevalence between patients with coronary heart disease (CHD) in the Republic of Ireland where there was no financial incentive scheme compared with Northern Ireland (QOF). Millett et al[180] found a reduction in smoking prevalence in patients with diabetes following the introduction of QOF (from 20.0% to 16.2%, OR 0.73, CI 0.69 to 0.86). Simpson et al[181] found a reduction in smoking prevalence in UK from 28.4% in 2001/2 to 22.4% in 2006/7, OR 0.73 (CI 0.72 to 0.73). However, it was not clear whether this reduction was due to smokers quitting through GP management or whether it can be explained by secular trends in the UK. Chang et al [201] also noted a reduction in smoking prevalence between 2004 and 2007 (23.9%, 22.2%, 21.4% and 21.1% for each year respectively) and an increase in the proportion of ex-smokers in Taiwan (6.4%, 5.7%, 7.4% and 7.4% respectively) associated with the increase in funding for smoking cessation activities, but the authors acknowledge they could not distinguish whether this was due to the funding change or more widespread information about smoking through media campaigns and hospital-based smoker identification programmes.

- **Inequalities**

Only three of the studies examined the effect on inequalities in the ascertainment of smoking status and provision of smoking cessation to smokers. Millett et al looked at differences with ethnicity in the likelihood of patients with CHD being asked about smoking pre/post-QOF and found a greater improvement among Asian patients compared with white British patients.[177] In another study examining the effect of QOF on smoking outcomes among patients with diabetes, Millet et al found variations in outcomes post-QOF with respect to gender, age and ethnicity.[180] Improvements in the recording of smoking status greater for women compared to men (AOR 2.01, CI 1.59 to 2.54) and for ethnic groups (except Bangladeshi) compared with white British patients after adjusting for age, sex, ethnic background, deprivation status and practice-level clustering. They also found that reduction in smoking rates post-QOF was lower among women (AOR 0.71, CI 0.53 to 0.95) although fewer women were smokers (11.5% of women smoked compared with 20.6% of men) and rates differed with age (from 10.6% for patients over-75 years to 25.1% for those aged 18-44) and by ethnicity (rates ranged from 4.9% for black African patients to 24.9% for white Irish) but there was no significant difference in the smoking rates between most and least deprived groups.

McGovern et al in their QOF study of patients with CHD found that older patients were less likely to be asked about smoking pre-QOF but after the introduction of QOF this difference was no longer seen, and people from more deprived areas appeared to have benefitted more with those from more affluent areas being less likely to have been asked about smoking (OR 0.78, CI 0.62 to 0.99 compared with least deprived). They also found that female smokers were more likely to be offered advice compared with males (OR 1.19, CI 1.05 to 1.34).

However, smokers over the age of 75 were less likely to be offered advice compared with younger smokers (0.44, CI 0.36 to 0.53).

Methodological Quality

Using the Downs and Black checklist, modified to give four categories, none of the studies were graded 1 (poor) so all were included in the review. Seven of the studies were graded 2 (acceptable), of which five were QOF studies and two were non-QOF studies. Twelve studies were graded 3 (good), of which six were QOF studies and six were non-QOF studies. However, no study achieved 4 (excellent). This was because the QOF studies, cross-sectional and before-and-after studies scored poorly for lack of randomisation and blinding (unavoidable given the study designs) and the randomised controlled trials fell down on not considering possible adverse events (all studies), having short follow up times poorly described randomization or blinding or both (Roski et al,[206] Coleman et al, 2001[202]) or a lack of power calculation (An et al,[200] Salize et al[192]).

Discussion

Principal findings

I identified 19 studies examining the effects of financial incentives for healthcare providers on smoking cessation activities and outcomes. The studies scored in the mid range for quality with a validated scoring guideline, so there were no methodologically poor studies, but equally there were no excellent studies. I had expected the randomised controlled trials to score higher than observational studies but this was not the case. This may be because the observational studies examined system-wide financial incentive schemes and so scored highly for having very representative samples and large sample sizes.

Most studies examined process measures (such as recording of smoking status, recording that smoking cessation advice had been given or that patients were referred to smoking cessation services). For these process measures, almost all studies showed improvements following the introduction of financial incentives. In the study by Coleman et al[202] where the proportion of patients who recalled receiving smoking cessation advice did not increase following the financial incentive, the authors considered that the effect of the financial incentive may have been diluted by giving smoking cessation training to practice staff before the beginning of the control period. For the study by Roski et al,[206] the authors suggested that management directives (to improve productivity and reduce costs) may have impacted negatively on practitioner behaviour and hence patients' smoking outcomes.

The two studies examining the effect of financial incentives on rates of prescribing nicotine replacement therapy (NRT) or Bupropion found an increase in prescribing rates.[202 203] However, Coleman et al[202] found that the increase in the proportion of smokers receiving prescriptions (from 1% in 2000 to 6% in 2004) was far less than the increase in the proportion of smokers given advice (from 7% to 37%). The authors suggest that this might be because prescribing was not incentivised. Another explanation might be that patients were not ready to stop at the time, but later may have attended community stop smoking clinics where these medications are available, or decided to buy NRT at a pharmacy.

Studies that examined quit rates had mixed results. Those examining system-level incentive schemes found a reduction in smoking prevalence, but limitations in study design meant it was not possible to determine the mechanism for this. Reductions may reflect increases in the number of never-smokers, or increases in the number of ex-smokers, which were not

examined. Smokers may have quit through doctor management or merely through being asked about smoking, or due to the influence of secular changes in smoking behaviour such as the ban on smoking in public places, or a combination of all three.

QOF papers were not able to look at quitting smoking as an outcome as this is not recorded consistently by GPs, possibly because currently practices are not incentivised to do so. In any case smoking cessation recorded in general practice is from self-report rather than confirmed by carbon monoxide testing in exhaled breath or by the presence of nicotine metabolites in urine (cotinine). Another factor is that a large proportion of smoking cessation activity takes place outside primary care, in community pharmacies and stop-smoking clinics, and information about individual quitters is often not provided to GPs.

The results from Salize et al's cluster RCT[192] suggested that financial incentives might influence quitting behaviour if combined with no cost NRT and/or Bupropion prescriptions and GP training, but a similar level of impact was seen with just the free medication group. This result is pertinent to the USA and the UK where assistance with the cost of prescriptions to treat smoking is available. In the USA, the Affordable Care Act[208] has mandated Medicaid coverage of such medications for pregnant women since October 2010. Coverage for all Medicaid beneficiaries will be increased by January 2014, and tobacco-dependence drugs will no longer be excluded from benefits covered. In the UK, smokers can access nicotine replacement treatment (e.g. Bupropion or Varenicline) usually without charge from UK National Health Service smoking cessation services, or for the price of a prescription (currently £7.65) from their GP practice, or without cost if the patient is exempt from paying prescription charges.

The few studies examining the effect of QOF on inequalities in smoking cessation activities in primary care found mixed results. Women were more likely to be asked about smoking compared with men and more likely to receive advice, but were less likely to smoke. Patients over the age of 75 years were less likely to be asked about smoking and, if smokers, to be offered advice compared with younger smokers. Patients from ethnic minority groups and from more deprived areas benefitted more from the improvement in smoking outcomes associated with QOF compared with white British patients. There were also greater reductions in smoking prevalence post-QOF in patients from ethnic minorities and for women but no significant difference in the changes in smoking rates between most and least deprived groups.

Strengths and weaknesses of the review

I employed a comprehensive search strategy to identify relevant papers and included those with observational designs as well as randomised controlled trials, as is appropriate for examining complex interventions such as smoking cessation.[138] This meant that a larger number of papers were included in the review compared to previous systematic reviews. Petersen et al,[190] looking at the effects of pay for performance schemes on improving healthcare quality, identified nine studies that looked at prevention activities, of which two were for smoking cessation. This review was conducted in 2005 before pay-for-performance schemes became more popular, which might explain the small number of relevant studies. In a recent systematic review of strategies to increase the delivery of smoking cessation activities in primary care settings, Papadakis et al[209] identified only three papers examining the effect of financial incentives. The authors excluded trials that were not indexed within Medline as randomised controlled trials, controlled clinical trials, or evaluation studies, whereas I did not limit my search strategy in this way. Observational studies are inherently

less robust methodologically compared with cohort or randomised controlled trials and I acknowledge this. However, as interventions for smoking cessation are necessarily complex, I felt it was important to include these studies to attempt a comprehensive view of the literature currently available.

Most studies focused on process measures (recording smoking status and advice given or referral made) rather than quit rates as outcomes. Improvements may therefore reflect improved recording rather than increased delivery of smoking cessation interventions. Of the non-QOF studies, follow-up times for quit rates were reasonable at between 6 and 12 months, with the exception of the seven day quit rates reported by Roski et al.[206] As previously mentioned most of the observational studies I identified did not take account of secular changes in smoking during the intervention period.

Of the 19 included studies, 11 examined the impact of the UK's QOF. Their findings may not be generalisable to other countries as the size of the incentive is large, supported by prompts from the electronic medical records (EMRs),[132 210] and is backed up with access to a comprehensive NHS smoking cessation service. The non-QOF studies identified in my review examined financial incentives that were mainly aimed at doctors. Therefore, the generalisability of most of these studies to clinicians other than doctors may be limited. However, those examining QOF would include work performed by practice nurses.

The financial incentives examined differed in amount and in this review I was not able to identify an optimal amount. If health practitioners were offered very large amounts for each smoker who stopped then the intervention would likely be successful but would not be financially practical. In addition, the results from Salize et al[192] suggest that subsidised

smoking cessation medication may have more of an effect that a financial incentive. This was the only study that also examined the cost effectiveness of financial incentives and found that GP training and remuneration per abstinent patient was not effective compared to usual treatment. However, GP training plus cost-free smoking cessation medication and a combination of GP training, free medication and remuneration were both more cost effective interventions compared with usual treatment.

These findings fit with those from other systematic reviews[211-213] that have found multi-component interventions more effective than single-component interventions in helping primary care doctors to deliver prevention services, including smoking cessation.[214] Therefore, financial incentives may have more impact when combined with other interventions, such as clinician education and subsidised smoking cessation prescriptions.

Financial incentive schemes can have unintended outcomes as described in Chapter 3, such as gaming,[215] adverse patient selection,[216] poor performance for unrewarded activities[217] and taking away doctors' internal motivation.[218] The studies identified in this review did not examine these. Also, unless quit rates are also rewarded, such schemes may not encourage practitioners to be effective in providing smoking cessation advice. Recording that smoking cessation advice has been given is no indication of the quality of advice given, and having someone stop smoking is obviously more valuable than simply recording smoking status.

Conclusions

Financial incentives can be effective in improving the recording of smoking status, recording of smoking cessation advice and referral to smoking cessation services. We know that doctor advice to smokers is effective in reducing smoking rates[102] so any intervention which increases such advice is important. However, few studies evaluated the impact of financial incentives on quit rates or inequalities and for these there were mixed results. Overall, these results are encouraging but the area does require more comparative studies. As several areas of the UK are currently developing local versions of the QOF[219] in which prevention activities such as smoking cessation are more strongly incentivised, this gives a further opportunity to examine the effectiveness of financial incentives for smoking cessation work in primary care, in particular the effects on healthcare inequalities.

Chapter 6: Effect of financial incentives on ethnic disparities in smoking cessation interventions for patients from different disease groups in primary care: cross-sectional study using data from Wandsworth, London, UK

As stated in Chapter 4, the null hypothesis for this research is that financial incentives do not the provision of smoking cessation activities in primary care, or smoking prevalence, in people with or without long-term conditions, regardless of demographic group. The alternative hypothesis is that financial incentives do affect these activities and may therefore influence inequalities in smoking cessation provision and outcomes.

Main research question

What are the effects of financial incentives on smoking cessation activities undertaken in healthcare, and do they affect inequalities in the provision of smoking cessation activities in primary care?

Objectives

- To examine the effects of a financial incentive scheme (QOF) on smoking cessation activities (the proportion of patients whose smoking status is recorded and who then receive smoking cessation advice, or referral to other smoking cessation services) provided to patients with and without smoking-related long-term conditions in general practices, and the effect on smoking prevalence in these patients, using data from general practices in Wandsworth, London, UK
- To examine the effects of QOF on inequalities in the provision of smoking cessation activities to different groups (defined by age, gender, ethnicity and socio-economic status and, for disease group).

Background

As previously noted, smoking cessation interventions by healthcare professionals are effective and can reduce health inequalities related to tobacco use.[92 102] However, smoking cessation interventions tend to be underprovided in healthcare.[184] Practitioners consider disease prevention activities to be important[185] but among several reasons healthcare practitioners give for their reluctance to give smoking cessation advice during routine appointments is a concern about lack of time. This may be due to insufficient financial reward for taking on this work.[114]

Pay-for-performance schemes are becoming more widespread in healthcare, particularly in the USA[186 187] and the UK.[142 188] They aim to improve the quality of healthcare by financially rewarding practitioners for achieving performance targets and have been incorporated into many quality improvement programmes. Some financial incentive schemes such as the UK's Quality and Outcomes Framework (QOF) reward smoking cessation work mainly for secondary prevention for smoking-related chronic diseases.

Findings from my systematic review suggested that such schemes may improve recording of smoking status, advice and referral, but there has been little research in the UK into their impact on disparities in the delivery of smoking cessation interventions or tobacco use. I carried out a cross-sectional study using data from Wandsworth, London to examine this question.

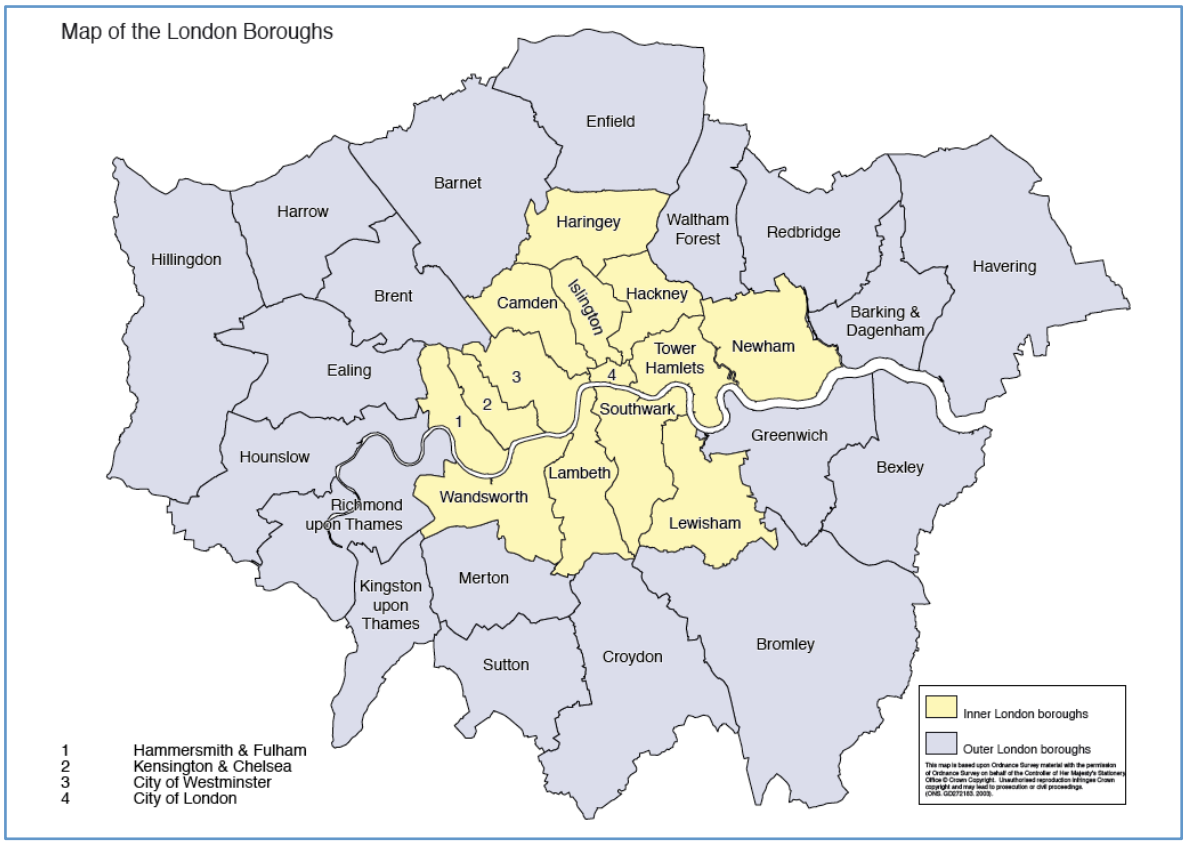
I wrote up this study as first author. Co-authors commented on the first draft and it was published in a peer-reviewed journal (*Journal of Public Health*) in 2012 (See Appendix C).

Methods

Setting and patients

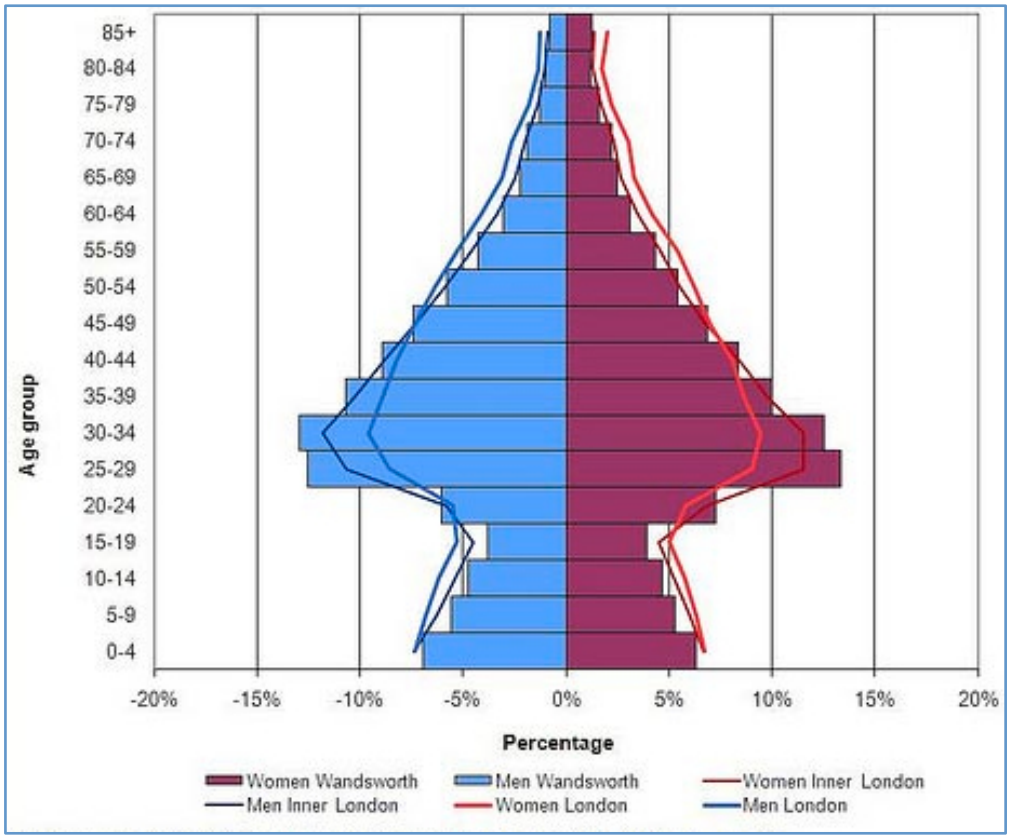
The London Borough of Wandsworth, situated in South West London, is the largest inner London borough with a population of approximately 290,000 (See Figure 26). The population is younger than average for London as a whole, as shown in Figure 27, and is ethnically diverse, with around 22% of the population from Black and Minority Ethnic groups (Greater London Authority 2008 Ethnic Group population predictions), compared with around 11% for the UK as a whole.[220]

Figure 26: Map of Greater London



Source: www.ons.gov.uk © Crown copyright

Figure 27: Population pyramid for Wandsworth

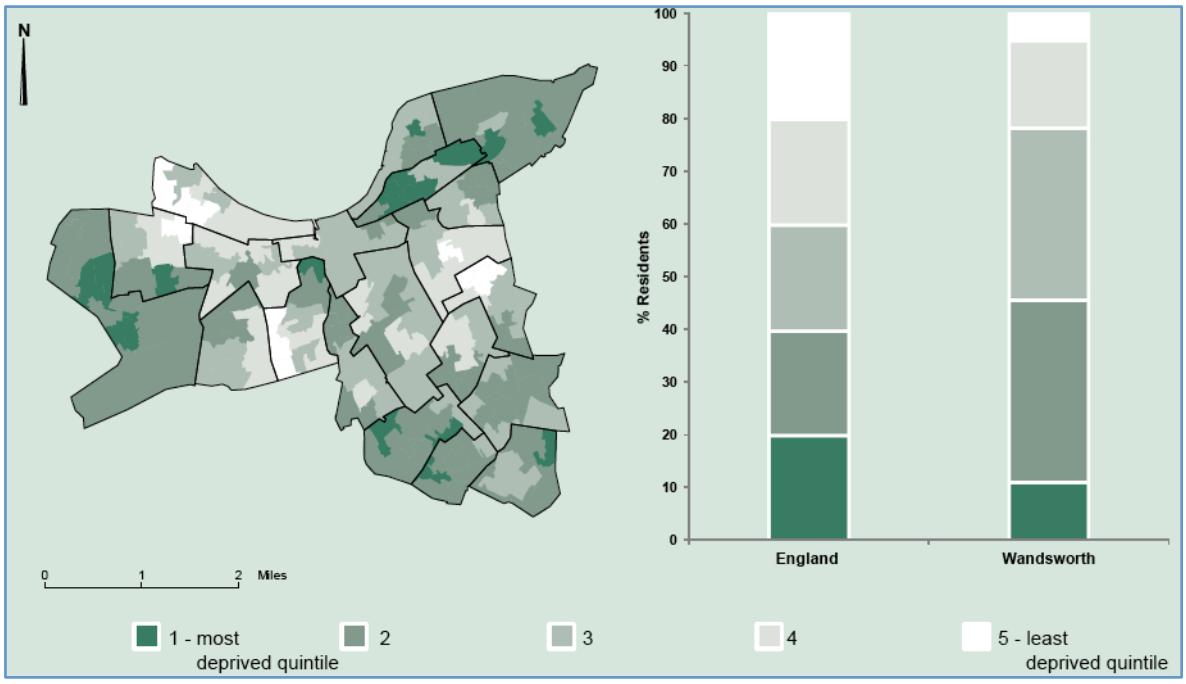


Source: © Greater London Authority 2008

Deprivation

Wandsworth has pockets of extreme deprivation, but overall is rated as less deprived than England as a whole, with around 11% of people in this area living in the 20% most deprived areas in England, compared with an average for England of 20%. The map in Figure 28 shows the range of deprivation levels in Wandsworth based on national IMD quintiles.[221]

Figure 28: Deprivation in Wandsworth compared with England 2010

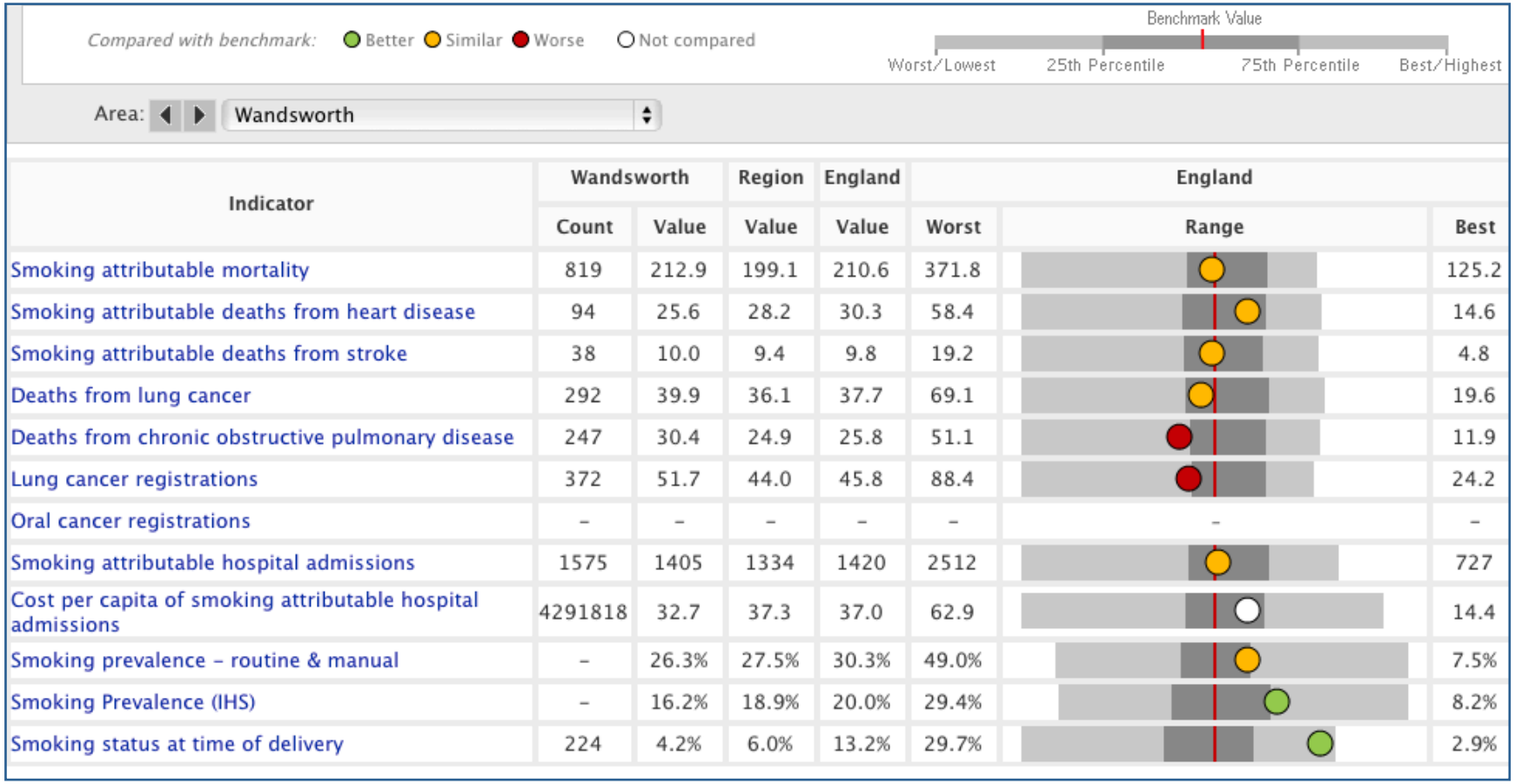


Source: APHO and Department of Health. © Crown Copyright 2012 www.healthprofiles.info

Smoking cessation services in Wandsworth

Smoking levels in Wandsworth have fallen over the last few years from around 24.2% of adults in 2007 (APHO estimate, modeled from Health Survey for England data), the year of this study, lower than the England average of 26.0% for the same year. By 2011, using data from the Integrated Household Survey the London Health Observatory estimated that 16.2% of adults (and 4.2% of pregnant women) in Wandsworth smoked compared with 18.9% of adults (and 13.2% of pregnant women) in England as a whole.[222] Smoking attributable mortality and hospital admissions in Wandsworth are similar to the average for England (Figure 29), although mortality rates from COPD and registrations for lung cancer are higher.

Figure 29: Smoking profile for Wandsworth*



Indicator	Wandsworth		Region	England	England		
	Count	Value	Value	Value	Worst	Range	Best
Smoking attributable mortality	819	212.9	199.1	210.6	371.8		125.2
Smoking attributable deaths from heart disease	94	25.6	28.2	30.3	58.4		14.6
Smoking attributable deaths from stroke	38	10.0	9.4	9.8	19.2		4.8
Deaths from lung cancer	292	39.9	36.1	37.7	69.1		19.6
Deaths from chronic obstructive pulmonary disease	247	30.4	24.9	25.8	51.1		11.9
Lung cancer registrations	372	51.7	44.0	45.8	88.4		24.2
Oral cancer registrations	-	-	-	-	-	-	-
Smoking attributable hospital admissions	1575	1405	1334	1420	2512		727
Cost per capita of smoking attributable hospital admissions	4291818	32.7	37.3	37.0	62.9		14.4
Smoking prevalence - routine & manual	-	26.3%	27.5%	30.3%	49.0%		7.5%
Smoking Prevalence (IHS)	-	16.2%	18.9%	20.0%	29.4%		8.2%
Smoking status at time of delivery	224	4.2%	6.0%	13.2%	29.7%		2.9%

Source: ©London Health Observatory 2012 http://www.tobaccoprofiles.info/[222]

*Directly standardised rates per 100,000

NHS stop smoking services available in Wandsworth (in addition to advice and prescribed medication provided by general practices) include one-to-one support with over 160 advisors throughout the borough, based at six drop-in community clinics and at around 55 pharmacies, and a freephone number for advice. Smokers can access planned programmes of up to 12 free weekly sessions of behavioural support and discounted NRT products, with other tobacco-dependence medication such as Bupropion available on prescription from GPs. (http://www.smokefreewandsworth.nhs.uk/default.asp).

Study design

I conducted a cross-sectional study using an anonymised extract of data from 29 of the 34 general practices in Wandsworth containing the medical records of all adult patients (aged 16 years and over) registered on 31 December 2007. I excluded those patients who registered in the last three months of 2007, as suggested in QOF business rules, or who were registered at a practice for less than three months in total, as practices might not have had the opportunity to ascertain smoking status for newly registered patients or to provide appropriate advice to those who were smokers. All general practices in Wandsworth were using electronic medical records at the time of this study, reflecting the high use of electronic medical records in UK primary care.[132] Missing data for the study variables were minimal. One person had indeterminate gender, 24 people were missing a gender and 136 people were missing an age, so these subjects were dropped from the study. There were no data available on exception reporting in the dataset.

I divided the patients into four disease categories depending on the presence of relevant Read diagnosis codes[223] dated prior to or during the study year:

- Cardiovascular disease, or having a long-term condition predisposing to cardiovascular disease (coronary heart disease, hypertension, heart failure, atrial fibrillation, stroke, transient ischaemic attack, diabetes, chronic renal failure)
- Respiratory disease (asthma, chronic obstructive pulmonary disease)
- Depression
- None (having none of the above specified conditions).

I chose the first two disease groups because smoking cessation activity for these conditions received greater remuneration in 2007 than for others (see Chapter 3). The depression group was chosen due to the known association between depression and smoking[224] and as this group of patients would most likely require frequent contacts with primary care, giving extended opportunities for smoking cessation advice. To avoid double counting between disease groups, I categorised patients according to the following hierarchy; (1) cardiovascular disease (2) respiratory disease excluding those with cardiovascular disease (3) depression excluding those with cardiovascular or respiratory disease (4) none – those patients not included in 1, 2 or 3.

Study variables

Binary variables for patients in each of the different disease categories were used to generate the following outcome measures:

1. The proportion of patients with their smoking status ascertained in 2007
2. The proportion of all patients coded as current smokers in 2007
3. The proportion of smokers who were offered cessation advice or referral to smoking cessation services in 2007

I used the business rules for QOF to determine whether smoking status was ascertained in 2007. Patients with a smoker code, ex-smokers with fewer than three consecutive ex-smoker codes, and never-smokers under the age of 25 need to be asked their smoking status every 15 months if they have a smoking-related long-term condition (cardiovascular disease or respiratory disease as defined above) and every 27 months if they have any other or no long-term conditions. The business rules therefore allow practice staff to permanently code (as having been asked their smoking status) all ex-smokers with three consecutive non-smoker codes and all never-smokers over 25 years.

Ethnicity was derived from the 2001 Census Ethnic Categories. I collapsed these to give nine categories including 'not-stated'. I included patients whose ethnicity was missing in the 'not stated' group because missing ethnicity is considered data missing not at random (MNAR) and other methods of dealing with these data such as imputation are inappropriate for anonymised data[225 226] Excluding these patients from the analysis may have introduced bias. Age was recorded as a continuous variable. Patients were assigned a deprivation score based on individual general practice post-code using the Index of Multiple Deprivation, IMD,[227], a validated proxy measure.[52]

Statistical analysis

I analysed the data with STATA version 11. Data analysis was conducted separately for men and women due to the known differences in smoking prevalence by gender within ethnic minority groups in the UK.[228] I computed percentages of patients with smoking status ascertained, whether they were current smokers and whether smokers had been offered cessation advice, giving results for these outcomes by ethnic group within each disease category.

I then undertook individual bivariate analyses for these outcomes by age, ethnicity, IMD, and practice size variables, and also tested for interactions between gender and disease, and disease and ethnicity. All results were statistically significant so I included all as predictor variables in the multiple logistic regression model, adjusting for practice clustering (to account for the fact that patients may be more similar to each other, for example, patients from some ethnic groups may be more likely to be registered in certain practices than others).

Results

In 2007, 172,787 adult patients were registered at participating general practices in Wandsworth. There were 21,826 patients with cardiovascular disease (10,517 men and 11,309 women); 12,798 with respiratory disease (6,129 men and 6,669 women); 12,312 with depression (4,420 men and 7,892 women); and 125,749 in the group with none of the diseases of interest (66,297 men and 59,452 women). Ethnicity coding was present in 92% patients with CVD, 82% with respiratory conditions, 80% with depression and 30% in the group without these chronic diseases. The numbers of patients in the different disease groups subdivided by ethnic group and gender are given in Table 3.

The proportion of patients in the different disease groups, subdivided by ethnicity and gender, whose smoking status was ascertained, who were smokers, and who received smoking cessation advice are given in Tables 4-6. Key results from the multiple logistic regression analyses of smoking outcomes by disease group are reported below, stratified by gender, and adjusted for age, deprivation, practice size, and for clustering at the general practice level.

Table 3: Descriptive statistics for disease groups in Wandsworth by ethnicity and gender in 2007

	CVD		Respiratory		Depression		None[1]		Total by ethnic group		
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	All
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N	N	N
White British	4622 (43.95)	4668 (41.28)	2818 (45.98)	3324 (49.84)	2019 (44.65)	3706 (46.96)	18988 (28.64)	20648 (34.73)	28447 (32.56)	32346 (37.91)	60793 (35.18)
White Other	1124 (10.69)	1189 (10.51)	645 (10.52)	894 (13.41)	483 (10.68)	1094 (13.86)	9260 (13.97)	12679 (21.33)	11512 (13.16)	15856 (18.58)	27368 (15.84)
Black African	858 (8.16)	966 (8.54)	216 (3.52)	223 (3.34)	144 (3.18)	307 (3.89)	3728 (5.62)	3635 (6.11)	4946 (5.65)	5131 (6.01)	10077 (5.83)
Black Caribbean	953 (9.06)	1485 (13.13)	281 (4.59)	419 (6.28)	281 (6.21)	424 (5.37)	2102 (3.17)	2155 (3.62)	3617 (4.14)	4483 (5.25)	8100 (4.69)
Indian	633 (6.02)	629 (5.56)	151 (2.46)	138 (2.07)	44 (0.97)	107 (1.36)	1814 (2.74)	1628 (2.74)	2642 (3.02)	2502 (2.93)	5144 (2.98)
Pakistani	466 (4.43)	345 (3.05)	125 (2.04)	115 (1.72)	83 (1.84)	114 (1.44)	1982 (2.99)	1205 (2.03)	2656 (3.04)	1779 (2.09)	4435 (2.57)
Bangladeshi	80 (0.76)	59 (0.52)	23 (0.38)	21 (0.31)	9 (0.20)	27 (0.34)	242 (0.37)	192 (0.32)	354 (0.40)	299 (0.35)	653 (0.38)
Chinese	61 (0.58)	61 (0.54)	31 (0.51)	52 (0.78)	10 (0.22)	30 (0.38)	396 (0.60)	501 (0.84)	498 (0.57)	644 (0.75)	1142 (0.66)
Mixed Ethnicity	806 (7.66)	921 (23.22)	1423 (23.22)	927 (13.90)	1091 (24.13)	1421 (18.01)	23341 (35.21)	12174 (20.48)	26661 (30.48)	15443 (17.10)	42104 (24.37)
Ethnicity not stated	914 (8.69)	986 (8.72)	416 (6.79)	556 (8.34)	358 (7.92)	662 (8.39)	4444 (6.70)	4635 (7.80)	6132 (7.01)	6839 (8.02)	12971 (7.50)
Total by disease group	**10517 (100)**	**11309 (100)**	**6129 (100)**	**6669 (100)**	**4522 (100)**	**7892 (100)**	**66297 (100)**	**59452 (100)**	**87465 (100)**	**85322 (100)**	**172787 (100)**

1 = Not diagnosed with CVD, respiratory disease or depression; N = number of patients, % = the proportion of patients, with CVD, respiratory disease, depression or other conditions for each ethnic group by gender

Table 4: Proportion of patients in Wandsworth with smoking status ascertained in 2007, by disease group, ethnicity and gender

	CVD		Respiratory disease		Depression		None[1]	
	Men	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**
	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)
White British	85.74 1	88.45 1	67.16 1	78.91 1	49.75 1	63.25 1	52.37 1	67.61 1
White Other	86.45 1.07 (0.91 to 1.28)	88.09 0.98 (0.78 to 1.25)	70.37 1.17 (0.86 to 1.57)	75.22 0.84 (0.66 to 1.06)	46.34 0.91 (0.62 to 1.32)	65.52 1.12 (0.88 to 1.43)	49.64 1.01 (0.86 to 1.18)	61.62** 0.82 (0.73 to 0.92)
Black African	92.10** 2.31 (1.48 to 3.61)	98.16** 8.57 (5.62 to 13.05)	70.30 1.26 (0.78 to 2.02)	79.17 1.04 (0.66 to 1.65)	62.26** 1.92 (1.23 to 3.00)	77.69** 2.09 (1.27 to 3.45)	59.37** 1.38 (1.13 to 1.68)	73.21** 1.32 (1.06 to 1.65)
Black Caribbean	88.79 1.27 (0.96 to 1.68)	94.63** 2.48 (1.55 to 3.96)	53.50** 0.59 (0.44 to 0.79)	73.36* 0.75 (0.57 to 0.99)	39.13 0.69 (0.43 to 1.10)	67.82 1.22 (0.92 to 1.63)	44.14** 0.69 (0.54 to 0.88)	66.74 0.92 (0.79 to 1.06)
Indian	94.08** 2.93 (1.53 to 5.60)	99.03** 15.98 (5.49 to 46.51)	64.00 0.74 (0.44 to 1.25)	92.41** 2.72 (1.36 to 5.46)	58.82 1.44 (0.57 to 3.64)	80.00** 2.35 (1.35 to 4.11)	55.18 1.09 (0.79 to 1.49)	78.59** 1.72 (1.30 to 2.28)
Pakistani	93.66 ** 2.84 (1.93 to 4.16)	97.50** 9.14 (2.52 to 33.14)	69.09 1.08 (0.57 to 2.05)	91.80 2.78 (0.98 to 7.86)	73.53* 2.77 (1.27 to 6.02)	77.08* 2.06 (1.10 to 3.89)	51.84 1.08 (0.75 to 1.57)	73.42 1.39 (0.95 to 2.02)
Bangladeshi	93.94* 2.87 (1.06 to 7.82)	97.30 6.57 (0.83 to 54.67)	90.91 5.68 (0.90 to 35.90)	100‡	33.33 0.73 (0.06 to 8.53)	80.00 2.43 (0.94 to 6.31)	50.70 1.02 (0.63 to 1.65)	69.23 1.09 (0.55 to 2.15)
Chinese	97.22 5.47 (0.72 to 41.61)	97.4 5.82 (0.79 to 42.71)	62.50 0.71 (0.25 to 2.03)	69.23 0.69 (0.33 to 1.44)	100†	84.62 3.28 (0.47 to 22.80)	56.20 1.29 (0.90 to 1.84)	75.42 1.48 (0.95 to 2.31)
Mixed Ethnicity	89.07* 1.52 (1.06 to 2.17)	94.85** 2.79 (1.56 to 5.00)	61.03 0.84 (0.45 to 0.92)	73.50 0.74 (0.54 to 1.01)	52.03 1.12 (0.82 to 1.53)	64.29 1.06 (0.75 to 1.51)	52.05 1.04 (0.80 to 1.34)	68.67 1.07 (0.89 to 1.28)
Ethnicity not stated	75.78** 0.57 (0.43 to 0.75)	85.20 0.79 (0.49 to 1.28)	56.83* 0.64 (0.45 to 0.92)	72.76 0.71 (0.48 to 1.06)	42.38 0.72 (0.43 to 1.18)	57.11 0.77 (0.58 to 1.03)	49.00 0.81 (0.50 to 1.32)	61.52** 0.72 (0.59 to 0.87)
All	**87.46**	**91.38**	**64.87**	**77.53**	**49.12**	**64.29**	**51.35**	**66.27**

1 = Not diagnosed with CVD, respiratory disease or depression; AOR = adjusted odds ratio with white British as reference group (adjusted for age, deprivation, practice size, and for clustering at the general practice level); CI = 95% confidence intervals; Significance in logistic regression analysis: *= $p<0.05$; ** = $p\leq0.01$;‡ = not included in the analysis due to small numbers

Table 5: Wandsworth smoking prevalence in 2007, by disease group, ethnicity and gender[a]

	CVD		Respiratory disease		Depression		None[1]	
	Men	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**
	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)
White British	28.29 1	23.07 1	30.44 1	26.62 1	48.13 1	40.30 1	30.70 1	21.08 1
White Other	23.58** 0.75 (0.63 to 0.90)	18.40** 0.73 (0.59 to 0.89)	28.11 0.91 (0.70 to 1.18)	20.13** 0.67 (0.51 to 0.87)	49.03 1.04 (0.75 to 1.45)	31.57** 0.67 (0.55 to 0.82)	33.58 1.03 (0.94 to 1.13)	23.37 1.02 (0.89 to 1.16)
Black African	11.43** 0.28 (0.19 to 0.41)	2.44** 0.06 (0.03 to 0.10)	17.98** 0.49 (0.31 to 0.78)	10.57** 0.31 (0.18 to 0.51)	41.30 0.72 (0.44 to 1.20)	22.55** 0.40 (0.23 to 0.69)	20.27** 0.51 (0.38 to 0.67)	6.42** 0.21 (0.15 to 0.29)
Black Caribbean	25.69 0.90 (0.73 to 1.10)	12.03** 0.38 (0.31 to 0.48)	37.14 1.31 (0.95 to 1.82)	25.20 0.85 (0.63 to 1.16)	61.97* 1.69 (1.12 to 2.54)	35.94 0.78 (0.51 to 1.18)	48.09** 1.50 (1.29 to 1.74)	26.43 0.89 (0.78 to 1.02)
Indian	17.05** 0.54 (0.39 to 0.75)	1.51** 0.05 (0.02 to 0.12)	18.33 0.54 (0.26 to 1.13)	10.39** 0.38 (0.19 to 0.74)	42.86 0.86 (0.35 to 2.11)	13.16** 0.23 (0.10 to 0.52)	25.05** 0.64 (0.52 to 0.78)	6.21** 0.21 (0.15 to 0.30)
Pakistani	14.16** 0.38 (0.28 to 0.53)	0.92** 0.03 (0.01 to 0.11)	27.12 0.88 (0.47 to 1.66)	4.76** 0.14 (0.05 to 0.40)	47.06 0.98 (0.49 to 1.97)	3.03** 0.05 (0.01 to 0.36)	33.27 0.91 (0.78 to 1.07)	4.80** 0.15 (0.10 to 0.23)
Bangladeshi	13.64** 0.36 (0.21 to 0.63)	7.89** 0.21 (0.07 to 0.64)	25.00 0.73 (0.16 to 3.39)	0.00†	50.00 1.18 (0.21 to 6.63)	8.33 0.13 (0.02 to 1.01)	36.00 0.86 (0.62 to 1.19)	4.92** 0.19 (0.08 to 0.44)
Chinese	18.18 0.60 (0.27 to 1.34)	5.41** 0.15 (0.04 to 0.52)	9.09 0.23 (0.02 to 2.17)	11.54 0.35 (0.11 to 1.10)	0.00†	45.45 1.11 (0.13 to 2.85)	20.18** 0.54 (0.37 to 0.77)	9.90** 0.33 (0.23 to 0.49)
Mixed Ethnicity	23.95** 0.74 (0.60 to 0.90)	10.58** 0.32 (0.24 to 0.43)	27.78 0.87 (0.61 to 1.23)	22.6 0.78 (0.58 to 1.07)	51.24 1.06 (0.72 to 1.55)	42.20 1.06 (0.83 to 1.35)	36.80 1.10 (0.97 to 1.24)	21.04* 0.84 (0.72 to 0.98)
Ethnicity not stated	30.70 1.05 (0.80 to 1.38)	21.48 (0.79 (0.55 to 1.13)	32.24 1.07 (0.80 to 1.44)	22.45 1.01 (0.76 to 1.33)	54.42 1.32 (0.91 to 1.92)	45.81* 1.28 (1.02 to 1.60)	40.35 1.07 (0.76 to 1.49)	26.82 1.13 (0.93 to 1.37)
All	**24.43**	**16.20**	**29.53**	**24.01**	**49.63**	**38.25**	**33.21**	**20.98**

a = Not diagnosed with CVD, respiratory disease or depression 2 = of patients with a smoking code, the proportion recorded as smokers (for denominators see Table 1); AOR = adjusted odds ratio with white British as reference group (adjusted for age, deprivation, practice size, and for clustering at the general practice level); CI = 95% confidence intervals; Significance in logistic regression analysis: *= $p<0.05$; ** = $p\leq0.01$

Table 6: Smokers in Wandsworth offered smoking cessation advice or referral in 2007, by disease group, ethnicity and gender

	CVD		Respiratory disease		Depression		None[1]	
	Men	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**
	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)	% AOR (CI)
White British	92.37 1	94.80 1	89.00 1	89.82 1	81.45 1	80.11 1	74.26 1	76.93 1
White Other	90.26 0.79 (0.42 to 1.49)	90.48** 0.50 (0.31 to 0.81)	94.28 2.04 (0.75 to 5.50)	91.58 1.22 (0.57 to 2.65)	73.68 0.64 (0.30 to 1.36)	75.78 0.80 (0.52 to 1.23)	73.21 0.88 (0.75 to 1.02)	76.61 1.05 (0.83 to 1.33)
Black African	88.89 0.76 (0.30 to 1.90)	92.86 0.77 (0.12 to 5.00)	93.75 2.07 (0.27 to 15.69)	84.62 0.70 (0.12 to 4.22)	78.95 0.93 (0.28 to 3.15)	65.22 0.50 (0.18 to 1.40)	76.24 1.16 (0.78 to 1.73)	79.17 0.82 (0.58 to 1.16)
Black Caribbean	94.32 1.41 (0.78 to 2.56)	95.20 1.09 (0.34 to 3.54)	92.31 1.36 (0.42 to 4.45)	90.48 1.11 (0.49 to 2.55)	59.09** 0.34 (0.18 to 0.66)	78.21 0.95 (0.60 to 1.51)	71.02 1.00 (0.73 to 1.36)	75.77 1.01 (0.78 to 1.30)
Indian	90.67 0.87 (0.43 to 1.76)	100‡	100‡	75.00 0.38 (0.07 to 1.85)	83.33 1.06 (0.11 to 9.61)	80.00 1.08 (0.10 to 11.13)	81.58* 1.24 (0.84 to 1.82)	67.74 0.88 (0.45 to 1.70)
Pakistani	89.36 0.69 (0.29 to 1.63)	100‡	100†	100‡	87.50 1.65 (0.43 to 6.34)	100‡	79.77 1.15 (0.64 to 2.08)	66.67 0.83 (0.37 to 1.86)
Bangladeshi	100†	100‡	66.7 0.13 (0.01 to 1.11)	100‡	50.00 0.28 (0.01 to 5.57)	100‡	77.78 1.67 (0.94 to 2.96)	100‡
Chinese	87.50 0.45 (0.08 to 2.62)	100‡	100‡	100†	Ω†	80.00 1.19 (0.08 to 17.88)	81.82 1.52 (0.68 to 3.40)	63.16 0.77 (0.38 to 1.57)
Mixed Ethnicity	93.96 1.30 (0.59 to 2.85)	92.54 0.68 (0.35 to 1.35)	83.64 0.69 (0.34 to 1.08)	89.39 1.01 (0.44 to 2.28)	88.71 1.85 (0.69 to 5.00)	76.47 0.92 (0.56 to 1.52)	73.58 1.06 (0.88 to 1.27)	73.74 0.91 (0.75 to 1.10)
Ethnicity not stated	96.33 2.41 (0.66 to 8.84)	90.80 0.57 (0.16 to 2.07)	82.65 0.62 (0.35 to 1.08)	86.27 0.70 (0.39 to 1.27)	82.05 1.05 (0.52 to 2.21)	89.78** 2.14 (1.37 to 3.35)	68.49 0.76 (0.43 to 1.37)	76.78 1.02 (0.68 to 1.52)
All	**92.45**	**93.92**	**88.86**	**89.49**	**80.03**	**80.28**	**73.21**	**76.40**

1 = Not diagnosed with CVD, respiratory disease or depression; AOR = adjusted odds ratio with white British as reference group (adjusted for age, deprivation, practice size, and for clustering at the general practice level); CI = 95% confidence intervals; Significance in logistic regression analysis: *= $p<0.05$; ** = $p\leq0.01$; ‡ = not included in the analysis due to small numbers

i) Smoking status ascertained

Eighty nine percent of patients in the cardiovascular disease (CVD) group had their smoking status ascertained in 2007 while patients in the other three disease groups were less likely to have their smoking status ascertained compared to patients in the CVD group (72% of patients with respiratory disease, adjusted odds ratio (AOR) 0.53, 95% confidence intervals (CI) 0.42 to 0.67; 60% of patients with depression, AOR 0.25, CI 0.19 to 0.33; 60% of patients with none of these conditions, AOR 0.30, CI 0.22 to 0.41). Men were less likely to have their smoking status recorded than women across all the disease groups (62% versus 73%, AOR 0.25, CI 0.55 to 0.61).

For CVD, white British patients were less likely to be asked about smoking than patients from ethnic minority groups, with the exception of those from the white Other ethnic group, as shown in Table 4. For respiratory disease, there was less variation, but black Caribbean patients with respiratory disease were less likely to be asked about smoking than white British patients (63% versus 73%, AOR 0.68, CI 0.56 to 0.84). Only 57% of men with unstated ethnicity with respiratory disease were asked about smoking compared to 67% of white British men while Indian women were more likely to have their smoking status recorded then white British women (92% versus 79%).

For depression, 70% of black African patients and 75% of Pakistani patients were asked about smoking compared with 57% of white British patients (AOR 2.02, CI 1.41 to 2.90; AOR 2.4, CI 1.37 to 4.21, respectively). Indian women were also more likely to be asked about smoking than white British women (80% versus 63%).

For patients with none of the diseases of interest, black African patients were more likely to be asked about smoking than white British patients (66% versus 60%, AOR 1.36, CI 1.13 to 1.63) as were Indian women compared with white British women (79% versus 68%).

However, black Caribbean men were less likely to be asked than white British men (44% versus 52%) as were white Other women and women with unstated ethnicity compared with white British women (both at 62% versus 68%).

ii) Smoking prevalence

The overall smoking prevalence was 26.5% (31% for men and 22% for women). Compared to patients with CVD, patients without CVD were more likely to smoke, and this was most striking for people with depression (42% of depressed patients smoked compared with 21% of those with CVD, AOR 2.58, CI 2.26 to 2.93). Men were more likely to smoke than women in all the disease groups and across almost all ethnic groups.

Twenty eight percent of white British men with CVD were smokers and 23% of white British women (Table 3). Men and women with CVD in all ethnic groups except those with unstated ethnicity were less likely to smoke than white British patients (smoking prevalence ranged from 0.92% for Pakistani women to 26% for black Caribbean men).

For respiratory disease, 30% of white British men and 26% of white British women were smokers. There was much less variation with ethnicity than with CVD for men, with black African men being the only group less likely than white British men to smoke (18% versus 30%). Women from white Other, black African, Indian and Pakistani ethnic groups were less likely to smoke than white British females (20%, 11%, 10% and 5% respectively, compared to 27% of white British women with respiratory disease).

The prevalence of smoking in patients with depression was extremely high at 48% for white males and 40% for white females. Males in all ethnic groups had smoking rates of over 40%, but black Caribbean men were even more likely to smoke than white British males (62%

versus 48%). For women with depression, only those with unstated ethnicity had higher smoking rates than white British women (46% versus 40%).

In the group of patients with none of the conditions of interest smoking prevalence was 31% for white British men and 21% for white British women. There was considerable variation with ethnicity in this group, but black Caribbean men were more likely to smoke than white British men (48% versus 31%). Black African, Indian and Chinese patients and Pakistani men and women were less likely to smoke than white British patients whilst Bangladeshi and mixed ethnicity women were less likely to smoke than white British women in this group.

iii) Smoking cessation advice or referral

Smokers with depression or none of the conditions of interest were far less likely to receive smoking cessation advice than those in the CVD group or those with respiratory diseases (80% of patients with depression compared to 93% of patients with CVD and 89% with respiratory disease (AOR for depression compared with the CVD group was 0.34, CI 0.22 to 0.51). Only 75% of patients with none of the conditions had smoking advice (AOR 0.27, CI 0.17 to 0.40). Overall, rates of smoking cessation advice were similar for men and women.

There was very little variation with ethnicity for smoking cessation advice or referral (Table 4). The exceptions were white Other women with CVD, who were less likely to receive stop smoking advice compared with white British women (90% versus 95%). Black Caribbean men with depression were also much less likely to receive such advice compared with white British men (59% versus 81%) despite being more likely to smoke, as previously noted. However, women with depression whose ethnicity was unstated were more likely to receive advice compared to white British women (90% versus 80%), and Indian men from the group with none of the diseases were more likely to receive advice than white British men (82% versus 74%).

Key points

A large percentage of patients with CVD had their smoking status ascertained and, if smokers, received smoking cessation advice. Although patients with respiratory disease were less likely to have their smoking status ascertained than those with CVD, smokers in both these disease groups received similar levels of advice. The rates of ascertainment and advice were considerably lower among patients with depression and those without the smoking-related long-term conditions for which smoking cessation is maximally rewarded by QOF, reflecting QOF's focus on secondary prevention in the other two disease groups

Smoking prevalence overall was higher than the national average of 24% for men and 21% for women in 2007 (Health Survey for England, 2007) partly reflecting the younger population in Wandsworth but this finding raises concerns particularly for high risk groups of patients with CVD or respiratory disease. There were particularly high rates of smoking seen in patients with depression (particularly black Caribbean men, white British patients and those with unrecorded ethnicity).

There was encouragingly little variation between ethnic groups in the provision of smoking cessation advice or referral, with the notable exception of black Caribbean men with depression, who were much less likely to receive such advice than white British men.

Strengths and weaknesses of the study

My study used data from a large number of patients registered at general practices in an ethnically diverse area of South London with relatively complete ethnicity coding. My findings may be generalisable to other health systems with universal coverage that utilise financial incentives for prevention activities. All practices in the study used electronic medical records to record clinical information. While this permitted me to examine the delivery of cessation interventions in an extended number of ethnic categories using the data

collected by primary care teams, the numbers of patients were too small in a few groups to produce meaningful results.

I included patients without an ethnic group category into a group where ethnicity was 'not stated' in order to avoid bias of multiple imputation as described in the methods section. However, this group would have included people from all the other ethnic groups and may have introduced bias as well. I chose to keep the group in as I considered that people who do not have their ethnicity recorded may behave differently to those who do, regardless of ethnic group. A sensitivity analysis conducted after excluding the 'not-stated' group could also be used to address this problem.

In addition, the analysis used required multiple comparisons across 10 ethnic groups. I did not undertake the analysis using a Bonferonni adjustment for this, as other studies identified in my systematic review using similar methodology did not. Ordinarily, in tests of significance, α is set at 0.05, giving a 1 in 20 chance of a significant difference in outcomes between groups occurring by chance alone, leading to the null hypothesis being rejected inappropriately, called a Type I error. The Bonferonni approach adjusts for the increase in the chance of a Type I error caused by multiple comparisons by dividing α by the number of tests. This would mean for my study reporting only a p value below 0.005 (0.05/10). Other authors such as Perneger dispute the use of Bonferonni in epidemiological studies testing prior hypotheses, suggesting they are too conservative and they increase the risk of Type II errors, whereby the null hypothesis is rejected in error due to inadequate sample sizes.[229] As most of my results were below $p<0.001$, I feel reasonably confident that the results are sound, although perhaps the results which were significant at the 0.05 level should be interpreted more cautiously.

My studies results were based on outcomes recorded in the medical record over the past 12 months rather than in the past 15 months as suggested by QOF for smoking-related long-term conditions. This is because I had incomplete data on the date that ascertainment occurred. However, in practice most patients with chronic diseases are seen at least annually in primary care, and asking about smoking status for smokers and recent ex-smokers is built into the templates for most primary care IT systems. My findings are similar to previous research looking at the proportion of patients with smoking status ascertained every 15 months.[180]

The QOF requirement for patients without smoking-related conditions in 2007 was for recording of smoking status every 27 months and there was no incentive at the time for giving advice to smokers in this group. By comparing the proportion of patients with and without smoking-related conditions using the same time frame shows there was relatively little spill over to primary prevention of the improvements in primary care achievements of smoking indicators seen for secondary prevention.

I found that smoking prevalence overall at 26.5% similar to the national average of 26.0% in 2007 but higher than the APHO estimates for Wandsworth for this year (24.2%). This partly reflects the younger population in Wandsworth but also illustrates the limitations of APHO estimates, which use modeled data but are not age-standardised, and are inaccurate for small areas. General practice data may be more useful for estimating smoking prevalence, particularly for patients with long-term conditions, as practices are financially rewarded for providing evidence-based care and so have an incentive to accurately record smoking outcomes. A study by Szatkowsky et al in 2012 compared national smoking prevalence data (modelled using prevalence figures obtained from the General Household Survey) with THIN data and found close correspondence in prevalence rates, giving credence to the use of general practice data to monitor smoking prevalence.[230] For patients without these conditions

however, who may attend infrequently, smoking status may not be up to date.[231] In addition, smoking status recorded in general practice is self-reported and not verified by CO reading or urinary cotinine, so subject to reporting bias as some smokers may not feel comfortable discussing their smoking status with general practice staff or clinicians.

The data on recording of advice given to smokers may have been subject to recording bias in that patients with conditions not incentivised by the version of QOF in 2007 might have received smoking cessation advice from healthcare practitioners but this advice may not have been coded. I was unable to determine the quality of advice given, as these data were not available. I acknowledge, it is likely to vary considerably with some practitioners giving, just enough advice, or sign-posting to NHS stop smoking services, in order to input the required Read code for the practice to meet QOF targets. Others may advise in a well-meaning way but not using evidence-based methods and others may provide an evidence-based brief intervention, taking into account the situation of the patient at the time. Qualitative research may be useful in answering this question.

The group of patients without CVD, respiratory disease or depression would have included patients with schizophrenia or other psychoses, conditions which were due to be added to the list of smoking-related long-term conditions for which the recording of smoking status and advice were maximally rewarded by QOF after 2007. Practices may have started recording smoking outcomes for these patients during 2007 in preparation for the change, but this is unlikely to have a major bearing on my findings given the small number of patients involved.

My sample includes patients who would have been exception reported when calculating QOF payments. However, this may provide a more complete picture of the delivery of cessation interventions in primary care.[232] I was also unable to examine quit rates in this study, as these are not specifically coded in primary care.

My observational study cannot show that the high levels of cessation interventions were due to the financial incentives available through QOF. However, previous research suggests marked improvement in smoking and other outcome measures were associated with the introduction of QOF.[233] [234] Wandsworth has many NHS stop smoking services provided through clinics and pharmacies, of which as detailed in the background section. This may have made it easier for GPs to provide advice through signposting to the services. Smoke-free legislation was introduced into England from 1 July 2007, and this may have impacted on the results observed. This may also have affected ethnic groups differently,[235] for example those groups for whom drinking alcohol is prohibited would be less likely to be influenced by the smoking ban being enforced in public bars.

Chapter 7: Effect of financial incentives on ethnic disparities in smoking cessation interventions in primary care: before-and-after study using data from Hammersmith & Fulham, London

Hypothesis

As stated in Chapter 4, the null hypothesis for this research is that financial incentives do not affect the provision of smoking cessation activities in primary care and therefore also do not affect smoking prevalence, regardless of demographic group. The alternative hypothesis is that financial incentives do affect these outcomes.

Main research question

What are the effects of financial incentives on smoking cessation activities undertaken in healthcare, and do they affect inequalities in the provision of smoking cessation activities in primary care?

Aims

In this study I plan to examine the effect of financial incentives for the provision of smoking cessation activities to people without smoking-related diseases (primary prevention). I also aim to look at smoking outcomes with respect to inequalities in provision for people from different demographic groups based on age, gender, ethnicity and socio-economic status.

Objectives

To examine the effects of a local financial incentive scheme (QOF+) on smoking cessation activities, smoking prevalence, and inequalities in the provision of smoking cessation activities to different groups (defined by age, gender, ethnicity and socio-economic status) for adult patients without smoking-related long-term conditions using data from general practices in Hammersmith & Fulham, London, UK.

Background

As previously noted, pay-for-performance schemes are becoming more widespread in healthcare, particularly in the USA[186 187] and the UK.[142 188] They aim to improve the quality of healthcare by financially rewarding practitioners for achieving performance targets and have been incorporated into many quality improvement programmes. Some financial incentive schemes such as the UK's Quality and Outcomes scheme (QOF) reward smoking cessation work mainly for secondary prevention for smoking-related chronic diseases.

The Wandsworth smoking study (Chapter 6) compared achievement of indicators for patients with smoking-related diseases already incentivised by QOF against achievement for patients without this incentive. This found much lower levels of achievement associated with the unincentivised patient groups. There was also evidence of inequalities in the delivery of smoking cessation activity, particularly for Black Caribbean men with depression. For the Hammersmith & Fulham study I was interested in examining the effect of additional incentives for patients without smoking-related diseases (primary prevention).

Following up on the Wandsworth study, I was interested in examining the impact of financial incentives on primary prevention smoking activities in primary care, and on disparities smoking cessation. I carried out a before-and-after study to examine these questions using data from Hammersmith & Fulham, London, which introduced a local version of QOF, called QOF+, in which smoking prevention was incentivised for all patients, with a sub-analysis for pregnant women, reported in Chapter 8.

Methods

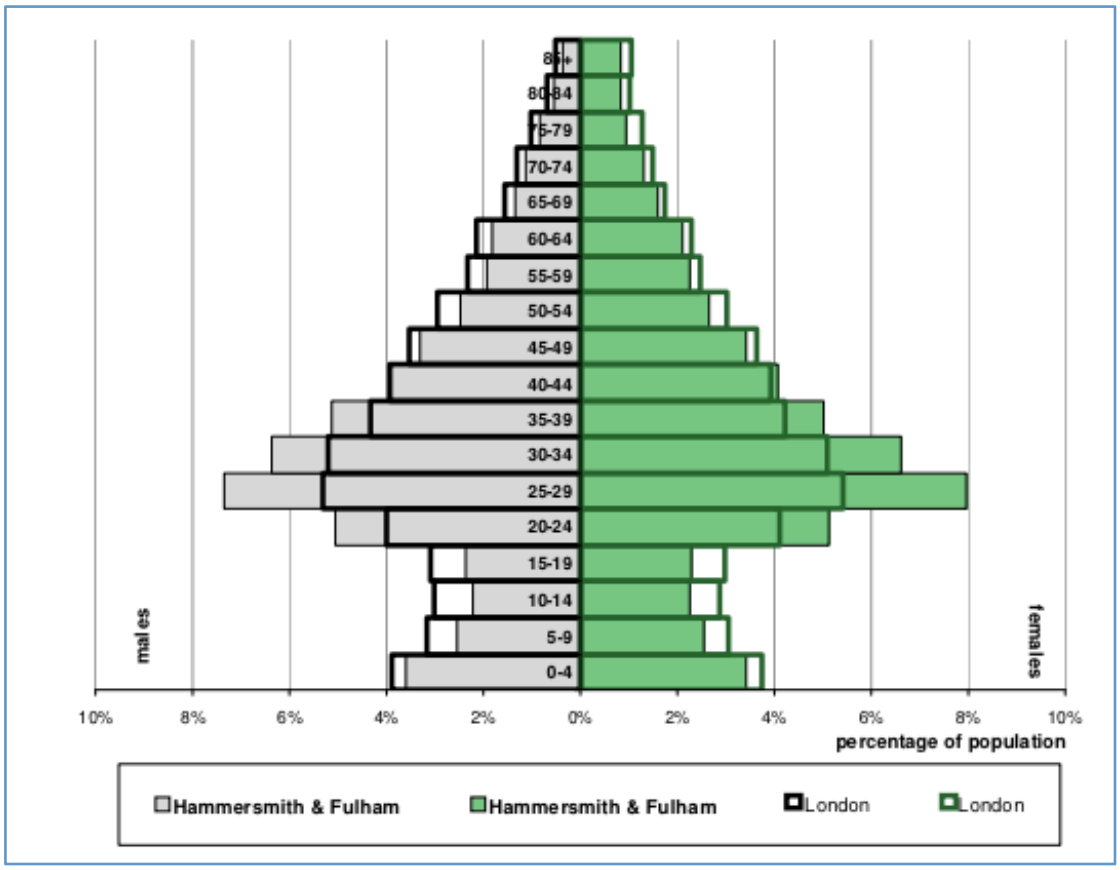
Setting and patients

The London Borough of Hammersmith & Fulham is situated in North West London and has a population of approximately 182,500 (see Figure 30, borough 1). The population is younger than average for London as a whole, as shown in Figure 31, and is ethnically diverse, with around 22% of the population from Black and Minority Ethnic groups (Greater London Authority 2008 Ethnic Group population predictions), compared with around 11% for the UK as a whole.[220]

Figure 30: Map of Greater London

Source: www.ons.gov.uk © Crown copyright

Figure 31: Population pyramid for Hammersmith & Fulham

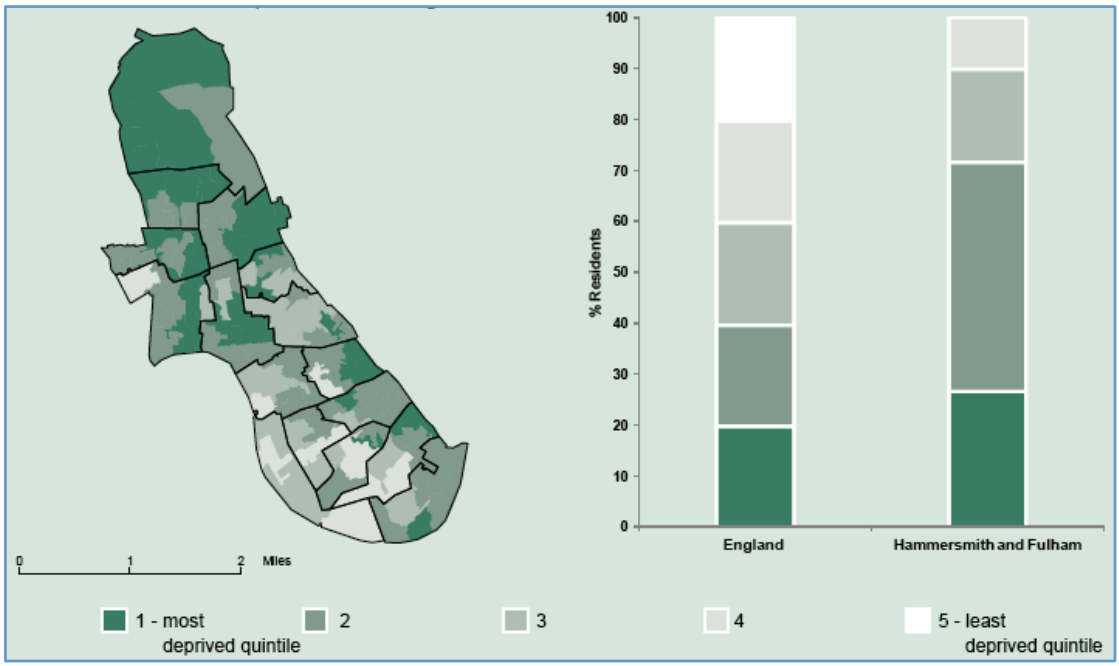


Source: © Greater London Authority 2008

Deprivation

Large parts of Hammersmith & Fulham are extremely deprived, and overall the borough is rated as more deprived than England as a whole, with around 27% of its population living in the 20% most deprived areas in England, compared with an average for England of 20%. The map in Figure 32 shows the range of deprivation levels in Hammersmith & Fulham based on national IMD quintiles.[221]

Figure 32: Deprivation in Hammersmith & Fulham compared with England 2010

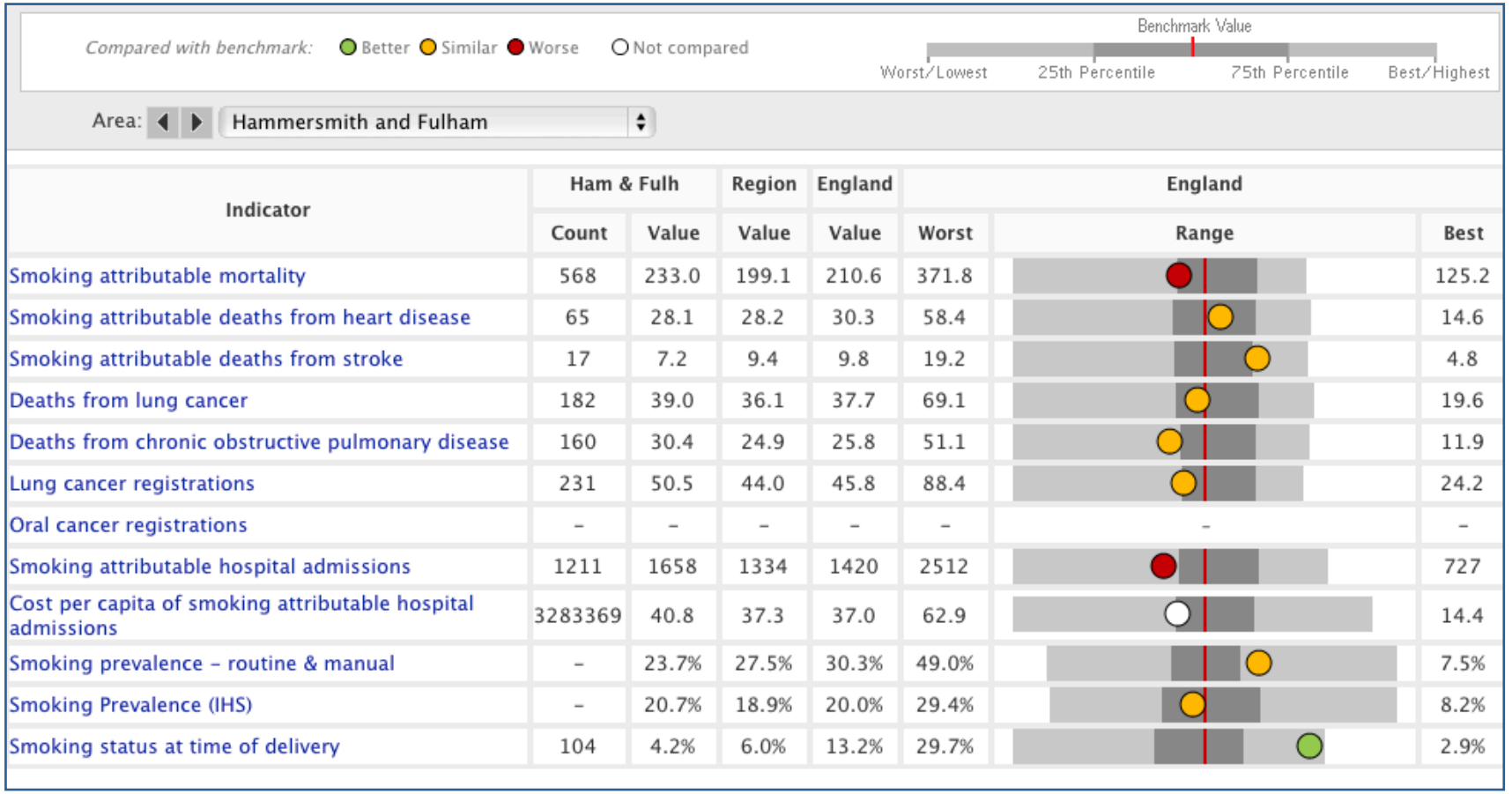


Source: APHO and Department of Health. © Crown Copyright 2012 [222]

Smoking cessation services in Hammersmith & Fulham

Smoking levels in Hammersmith & Fulham are estimated to have stayed the same over the last two years according to the London Health Observatory using data from the Integrated Household Survey. In 2008, the baseline year for this study, 24.2% of adults and 6.3% of pregnant women in the borough smoked. The rates for adult smokers were similar to that of England for adults that year (24.1%) but better than the average for women smoking while pregnant in England (14.7%). By 2011 the rate of smoking in adults had dropped to 20.7% of adults, similar to that of England (20.0%). Smoking rates also dropped in pregnant women (4.2% vs 13.2% of pregnant women in England as a whole).[221] Smoking-attributable mortality and hospital admissions are much higher than the average for England (Figure 33).

Figure 33: Smoking profile for Hammersmith & Fulham*



Indicator	Ham & Fulh		Region	England	England		
	Count	Value	Value	Value	Worst	Range	Best
Smoking attributable mortality	568	233.0	199.1	210.6	371.8		125.2
Smoking attributable deaths from heart disease	65	28.1	28.2	30.3	58.4		14.6
Smoking attributable deaths from stroke	17	7.2	9.4	9.8	19.2		4.8
Deaths from lung cancer	182	39.0	36.1	37.7	69.1		19.6
Deaths from chronic obstructive pulmonary disease	160	30.4	24.9	25.8	51.1		11.9
Lung cancer registrations	231	50.5	44.0	45.8	88.4		24.2
Oral cancer registrations	-	-	-	-	-	-	-
Smoking attributable hospital admissions	1211	1658	1334	1420	2512		727
Cost per capita of smoking attributable hospital admissions	3283369	40.8	37.3	37.0	62.9		14.4
Smoking prevalence - routine & manual	-	23.7%	27.5%	30.3%	49.0%		7.5%
Smoking Prevalence (IHS)	-	20.7%	18.9%	20.0%	29.4%		8.2%
Smoking status at time of delivery	104	4.2%	6.0%	13.2%	29.7%		2.9%

Source: ©London Health Observatory 2012 http://www.tobaccoprofiles.info/[222]

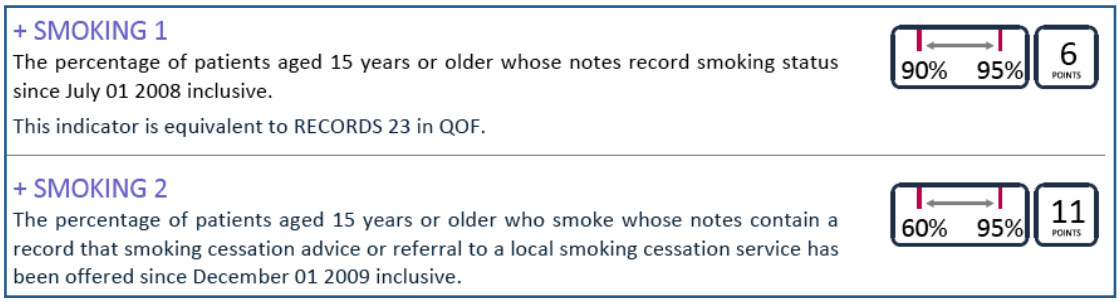
*Directly standardised rates per 100,000

NHS stop smoking services available in Hammersmith & Fulham (other than advice and prescribed medication provided by general practices) include one-to-one support with trained advisors throughout the borough, based at seven drop-in community clinics and at around 28 pharmacies, and a free phone number for advice. Smokers can access planned programmes of six free weekly sessions of behavioural support and prescriptions for NRT or tobacco-dependence medication such as Bupropion (http://www.kick-it.org.uk/).

This high rates of smoking in the Borough at the time, with associated burden of ill-health and mortality, led Hammersmith & Fulham to prioritise smoking cessation activity in primary care through a local version of the UK's financial incentive scheme (the Quality and Outcomes Framework, QOF), named QOF+.[236] The scheme was introduced on 1 July 2008 and was in place until 31 March 2011. QOF+ extended financial incentives for smoking cessation work to all patients for recording smoking status and providing smoking cessation advice or referral. It also introduced specific financial incentives for the recording of smoking status for pregnant women at the time of booking for antenatal care, and for the provision of smoking cessation advice or referral at the booking appointment for pregnant women who were smokers.

In addition to smoking cessation work it also rewarded the achievement of targets for other prevention work such as vascular risk screening for adults aged 40-74 years and alcohol screening and brief intervention. For a list of the QOF+ smoking indicators see Figure 34.

Figure 34: Smoking indicators in QOF+



Currently national QOF rewards smoking cessation mainly for smoking-related chronic diseases as previously discussed, with far fewer points available for primary prevention. QOF+ provided additional payments for the achievement of smoking indicators aimed at all adults registered at participating general practices in the borough. The indicators were for recording of smoking status and providing smoking cessation advice to smokers or referral to smoking cessation services.

Study design

I carried out a before-and-after study using anonymised data extracted from 30 general practices in Hammersmith & Fulham. All the general practices had electronic medical records (EMR).[132] The data contained the medical records of adults (aged over 16 years) registered between 1 July 2008 and 31 March 2011.

Patients included in this study were those aged 15 years or over without smoking-related chronic diseases or mental health conditions for whom smoking cessation activities are already incentivised by National QOF.

I therefore excluded patients with Read diagnosis codes[223] for CHD, stroke or TIA, hypertension, diabetes, COPD, asthma, schizophrenia, bipolar affective disorder or other psychoses dated before or during the study. Patients with peripheral vascular disease were not excluded as this group was added to the smoking indicators after the study period.

Patients with CKD (US National Kidney Foundation: Stage 3 to 5) were not specifically excluded as the majority of these patients are also on registers for hypertension, CHD or diabetes.[237] Data from two practices were excluded due to inaccurate recording of dates across all fields (dates for all registrations, deregistrations and dates of recording smoking indicators and diagnoses was missing or a default date of 1 January 1900). I excluded two patients with indeterminate gender and 1050 patients missing a date of registration.

I used a complete case cohort study design using anonymised data from patients who were registered at 28 participating practices in Hammersmith & Fulham. Patients were included in the study if they were registered at the practices throughout the 27 months prior to the introduction of QOF+ on 1 July 2008 and if they remained registered for the whole QOF+ follow up period (1 July 2008 to 31 March 2011). Although two further practices enrolled for QOF+ after 1 July 2008, their patients were not eligible for inclusion in the cohort as they were not contributing data to the pre-QOF+ period. The reason for choosing 27 months for the pre-QOF+ period was because this is the period in which smoking status should be ascertained under National QOF business rules.

I also carried out a sensitivity analysis with an open cohort design to see if there were differences in outcomes as a result of new patient checks. Patients were included in the open cohort if they were registered at participating practices on 1 July 2008 (for the baseline analysis), excluding those who registered in the three months prior to this date. I excluded these patients as practices might not have had sufficient time to ask these patients about smoking or provide brief advice (as stated in National QOF business rules) and so might have distorted the results for the pre-QOF+ period. Patients were included in the cohort for the follow up period if they were registered for at least three months during this time.

The reason for describing this as an open cohort is that the patients could enter or leave the cohort throughout the study period and contribute data as long as they were registered for at least three months. The reason for choosing three months as the minimum time a patient could be registered is that general practices do not have to include patients registered for less than three months in the denominator for smoking outcomes under National QOF business rules.

Study variables

The following binary outcome measures were extracted from the data:

- Percentage of registered patients (≥ 15 years) with smoking status recorded at baseline (within 27 months before 1 July 2008) and after the introduction of QOF+ (1 July 2008 to 31 March 2011, 33 months);
- Percentage of those patients with a smoking status recorded whose last smoking code was that of smoker before and after the introduction of QOF+;
- Percentage of smokers given smoking cessation advice before and after the introduction of QOF+.

I used the QOF business rules to examine the ascertainment of smoking status, as I did for the Wandsworth study. I identified those ex-smokers who had three consecutive ex-smoker codes, and those never-smokers under the age of 25 years who had three consecutive never-smoker codes, and coded these patients as having had their smoking status recorded. Similarly all never-smokers over the age of 25 years were recorded as having their smoking status recorded. I then determined the additional proportion of the remaining patients who had their smoking status recorded (of current smokers; ex-smokers with fewer than three ex-smoker codes; and never-smokers under the age of 25 years with fewer than three never-smoker codes).

I used the last smoking Read code recorded on the EMR of each patient to calculate the prevalence of smoking before and after the introduction of QOF+. I did not exclude patients whose smoking status was not ascertained within the study period as this might artificially reduce smoking prevalence, as smokers without smoking-related chronic diseases might not visit their GP regularly. I therefore included all patients with a smoking code ever recorded for this outcome. I used smoking advice and referral Read codes to determine the proportion of smokers offered advice or referral.

I tested for interactions between gender and smoking and as the results were statistically significant I examined outcomes separately for men and women. Predictor variables for the multiple logistic regression analysis of smoking outcomes were age, ethnicity and deprivation. Age was categorised into four groups: under-30 years, 30-49 years; 50-69 years; over-70 years. Ethnicity was derived from the 2001 Census Ethnic Categories. In order to maximize statistical power I collapsed these to give five categories: White; Black; South Asian; Mixed; Other; and a 'not-stated' category for those patients whose ethnicity was not given.

Hammersmith & Fulham Primary Care Trust staff assigned patients a deprivation score (Index of Multiple Deprivation, IMD[238]) based on their post-code before the data were anonymised and extracted to a research database held at the Department of Primary Care & Public Health, Imperial College London. London Queen Square Research Ethics Committee granted ethics approval for the use of the data for research.

Statistical analysis

I calculated the proportions of patients with the smoking outcomes at baseline and during the study period. I then examined differences in these outcomes by gender, age group, ethnic group, deprivation, and practice size.

Bivariate analyses for these outcomes by age group, ethnicity, IMD were all statistically significant (not reported) but practice size was not. I therefore included all the predictor variables except practice size in a multiple logistic regression model for each study design adjusting for practice clustering at the general practice level. I also conducted a within-group analysis, adjusted for the other main variables, to determine whether QOF+ had influenced outcomes for some groups more or less than for others. I analysed the data with STATA version 11.

Results

1. Smoking status ascertained

During the study period there were 41,239 patients eligible for inclusion in the study (18,716 men and 22,523 women). Prior to the introduction of QOF+ ethnicity data were available for 46.7% of patients, 62.3% of all patients had their smoking status ascertained (55.5% of men and 67.9% of women), and only two patients were exception reported for smoking indicators in the pre-QOF+ period.

From 1 July 2008 to 31 March 2011 (after the introduction of QOF+) ethnicity data were available for 69.6% of patients, the proportion of the total who had smoking status ascertained had increased to 75.8% (64.2% of men and 75.8% of women), a significant increase (AOR for men 1.37, CI 1.18 to 1.60, $p<0.001$; AOR for women 1.35, CI 1.17 to 1.56, $p<0.001$), and all groups benefitted from an increase. After the introduction of QOF+ 140 patients were exception reported for smoking indicators. The proportions of patients with smoking ascertained before and after the introduction of QOF+, subdivided by ethnic group and gender, are shown in Table 7.

Prior to QOF+ patients aged under-30 years were less likely to have smoking status ascertained than patients aged 30 to 49 years (47.5% vs 59.3% for men under-30 years, AOR 0.73, CI 0.57 to 0.95, p<0.001; 58.0% vs 70.4% for women under-30 years, AOR 0.52, CI 0.42 to 0.66, p<0.001). However men and women aged over-70 years were more likely to have their status recorded than those aged 30 to 49 years (73.0% vs 59.3% for men over 70 years, AOR 2.17, CI 1.71 to 2.74, p<0.001; and 78.9% vs 70.4% for women over 70 years, AOR 1.55, CI 1.26 to 1.92, p<0.001). South Asian men and men with mixed ethnicity were more likely to have smoking status recorded compared with White men (74.7% for South Asian men vs 64.6%, for White men, AOR 1.71, CI 1.27 to 2.31, p<0.001; 76.5% for men with Mixed ethnicity, AOR 1.87, CI 1.16 to 3.03, p<0.001). Women from Black, South Asian and Other ethnic groups were more likely to have their status recorded compared with White women. For example, 87.1% of South Asian women had their status recorded compared with 71.6% of White women (AOR 2.81, CI 1.75 to 4.53, p<0.001). Patients with no stated ethnicity were much less likely to be asked. There was no difference between the three deprivation categories in the chance of either men or women being asked about smoking in this cohort.

After QOF+ the youngest group of men were no longer less likely to be asked about smoking, although women under-30 years were still less likely to be asked than women aged 30 to 49 years (70.0% vs 76.2%, AOR 0.68, CI 0.58 to 0.80, p<0.001). Patients over-70 years were still more likely to be asked (75.5% vs 67.5% for men over-70 years, AOR 1.68, CI 1.29 to 2.18, p<0.001; 85.9% vs 76.2% for women over-70 years, AOR 1.79, CI 1.42 to 2.24, p<0.001).

Black men and South Asian men were more likely than White men to have their status recorded after the introduction of QOF+ (72.2% of Black men vs 69.8% of White men, AOR

1.22, CI 1.07 to 1.39, p<0.01; 81.2% of South Asian men, AOR 1.99, CI 1.42 to 2.79, p<0.001). Women from all the ethnic groups except those with ethnicity not stated were more likely to have smoking status recorded than White women. For example, 84.8% of Black women had their status recorded compared with 76.7% of White women (AOR 1.93, CI 1.65 to 2.29, p<0.001). Men and women with ethnicity not stated were still less likely to be asked than White patients. After QOF+ the middle and most deprived patients were less likely to be asked than those from more affluent areas (both genders).

Table 7: Patient characteristics associated with being asked about smoking in Hammersmith & Fulham, before and after the introduction of QOF+[1]

		Pre-QOF+				Post-QOF+			
		Men		Women		Men		Women	
		N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)
Age group	<30	4869 (47.53)	0.73* (0.57-0.95)	5532 (58.04)	0.52*** (0.42-0.66)	3913 (56.99)	0.87 (0.68-1.11)	3943 (69.95)	0.68*** (0.58-0.80)
	30 to 49[$]	8898 (59.25)	1	11547 (70.43)	1	8646 (67.49)	1	11957 (76.16)	1
	50 to 69	4386 (54.61)	1.13 (0.95-1.34)	4649 (71.46)	0.91 (0.81-1.02)	5389 (62.68)	1.23 (1.00-1.50)	5524 (77.37)	0.92 (0.82-1.03)
	70+	563 (73.00)	2.17*** (1.71-2.74)	795 (78.87)	1.55*** (1.26-1.92)	768 (75.52)	1.68*** (1.29-2.18)	1099 (85.90)	1.79*** (1.42-2.24)
Ethnic group	White[$]	5508 (64.56)	1	1967 (71.56)	1	8312 (69.80)	1	11558 (76.67)	1
	Black	829 (67.67)	1.21 (0.97-1.51)	1196 (77.59)	1.53*** (1.28-1.83)	1177 (72.22)	1.22** (1.07-1.39)	1777 (84.81)	1.93*** (1.65-2.26)
	South Asian	483 (74.74)	1.71*** (1.27-2.31)	675 (87.11)	2.81*** (1.75-4.53)	680 (81.18)	1.99*** (1.42-2.79)	905 (93.26)	4.56*** (2.74-7.58)
	Mixed	153 (76.47)	1.87* (1.16-3.03)	243 (75.72)	1.47 (0.93-2.31)	293 (72.35)	1.22 (0.87-1.71)	426 (82.63)	1.71** (1.26-2.33)
	Other	911 (68.17)	1.21 (0.99-1.47)	1302 (77.50)	1.44*** (1.22-1.69)	1629 (68.26)	0.95 (0.75-1.21)	1941 (80.68)	1.35* (1.01-1.80)
	Not stated	10832 (47.78)	0.52*** (0.43-0.64)	11,140 (61.79)	0.65*** (0.53-0.79)	6625 (52.75)	0.51*** (0.41-0.64)	5916 (66.78)	0.65*** (0.52-0.80)
Deprivation level†	Least[$]	5890 (56.60)	1	7409 (68.62)	1	5858 (66.51)	1	7384 (77.78)	1
	Middle	5959 (53.97)	0.91 (0.81-1.02)	7,175 (68.36)	1.01 (0.90-1.13)	6143 (63.47)	0.89* (0.79-0.99)	7408 (75.59)	0.88*** (0.83-0.94)
	Most	6613 (56.06)	0.99 (0.84-1.17)	7703 (66.62)	0.92 (0.80-1.06)	6461 (62.90)	0.86* (0.74-0.99)	7495 (74.14)	0.77*** (0.68-0.88)
Number (%) with smoking status recorded		**10392 (55.52)**		**15293 (67.90)**		**12023 (64.24)**		**17082 (75.84)**	
Total N		**18716**		**22523**		**18,716**		**22523**	

1 = Patients in Hammersmith & Fulham without diseases specifically incentivised for smoking cessation activities under national QOF; N = denominator (number of registered adult patients); % = percentage of patients with smoking status ascertained; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (490 pre/post QOF+); * = p<0.05; ** = p<0.01; *** = p<0.001

2. Smoking prevalence

Smoking prevalence at baseline was 20.0% (25.0% of men and 16.1% of women). After the introduction of QOF+ smoking prevalence fell to 16.2% (20.8% of men and 12.5% of women). Compared with the pre-QOF+ period, the AOR for smoking prevalence was 0.79 for men (CI 0.75 to 0.83, p<0.001) and 0.77 for women (CI 0.72 to 0.82, p<0.001). Smoking prevalence, stratified by gender before and after the introduction of QOF+, is given in Table 8.

Pre-QOF+ smoking rates for men were lower among patients aged under-30 years and in those aged over-70 years compared with those aged 30 to 49 years (20.2% of men under-30 years vs 27.5% of men aged 30 to 49, AOR 0.68, CI 0.55 to 0.83, p<0.001; 11.7% of men over-70 years, AOR 0.36, CI 0.27 to 0.53, p<0.001). Women aged over-70 years were the only age group in this cohort less likely to smoke than women aged 30 to 49 years (6.9% vs 16.7%, AOR 0.38, CI 0.26 to 0.56, p<0.001).

Smoking rates were lower in Black, South Asian and Other men compared with White men (21.8% of Black men smoked vs 25.5% of White men, AOR 0.73, CI 0.57 to 0.94, p<0.05; 15.27% of South Asian men smoked, AOR 0.49, CI 0.36 to 0.69, p<0.001; 20.9% of Other men smoked, AOR 0.75, CI 0.62 to 0.89, p<0.001). Women from Black, South Asian and Other groups were also less likely to smoke than White women, with the South Asian women being least likely to smoke of all groups (3.3% vs 18% of White women, AOR 0.15, CI 0.07 to 0.31, p<0.001).

Smoking rates were higher in the middle and most deprived groups compared with those from the most affluent areas. For example, 28.6% of men in the most deprived areas smoked compared with 20.3% of men in the least deprived areas (AOR 1.42, CI 1.42 to 1.99, p<0.001).

After QOF+, smoking rates reduced in all age groups, and remained significantly lower in men aged under-30 years and in men and women aged over-70 years compared with those aged 30 to 49 years.

Smoking rates dropped among White men such that they were now not significantly greater than those for Black men and men with Mixed ethnicity now were more likely to smoke than White men (28.1% vs 21.3%, AOR 1.34, CI 1.07 to 1.66, $p<0.05$). South Asian men and men with Other ethnicity continued to have lower rates of smoking than White men (13.2% for South Asian men vs 21.3% for White men, AOR 0.52, CI 0.39 to 0.71, $p<0.001$; 18.1% for Other men, AOR 0.73, CI 0.39 to 0.93, $p<0.001$). Smoking rates among Black, South Asian and Other women remained lower than those of White women. For example, only 2.1% of South Asian women smoked compared with 14.6% of White women (AOR 0.13, CI 0.06 to 0.24, $p<0.005$). Smoking rates remained higher among the middle and most deprived groups compared with those from the most affluent areas following the introduction of QOF+.

Table 8: Patient characteristics associated with having a latest smoking code of 'current smoker' pre/post QOF+ in Hammersmith & Fulham

		Pre-QOF+				Post-QOF+			
		Men		Women		Men		Women	
		N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)
Age group	<30	3899 (20.18)	0.68*** (0.55-0.83	1923 (16.51)	1.06 (0.92-1.23)	3531 (17.08)	0.65*** (0.54-0.78)	3781 (11.16)	0.88 (0.73-1.08)
	30 to 49[$]	8091 (27.52)	1	10960 (16.67)	1	8357 (21.79)	1	11735 (13.41)	1
	50 to 69	3657 (26.39)	1.07 (0.97-1.18)	4373 (15.73)	1.09 (0.99-1.21)	4781 (22.97)	0.94 (0.88-1.01)	5364 (12.62)	1.08 (0.98-1.21)
	70+	515 (11.65)	0.38*** (0.27-0.53)	754 (6.90)	0.38*** (0.26-0.56)	728 (13.19)	0.52*** (0.43-0.62)	1071 (7.00)	0.50*** (0.36-0.69)
Ethnic group	White[$]	5373 (25.54)	1	7822 (17.97)	1	8243 (21.33)	1	11525 (14.56)	1
	Black	810 (21.85)	0.73* (0.57-0.94)	1175 (9.28)	0.41*** (0.31-0.54)	1165 (22.15)	0.96 (0.79-1.15)	4775 (8.51)	0.48*** (0.38-0.61)
	South Asian	478 (15.27)	0.49*** (0.36-0.69)	663 (3.32)	0.15*** (0.07-0.31)	677 (13.15)	0.52*** (0.39-0.71)	903 (2.10)	0.12*** (0.06-0.24)
	Mixed	152 (30.26)	1.17 (0.82-1.68)	240 (19.58)	0.95 (0.60-1.52)	292 (28.08)	1.34* (1.07-1.66)	425 (12.00)	0.69 (0.46-1.03)
	Other	885 (20.90)	0.75** (0.62-0.89)	1277 (9.55)	0.46*** (0.36-0.60)	1504 (18.09)	0.82** (0.73-0.93)	1880 (6.81)	0.41*** (0.33-0.52)
	Not stated	8464 (25.83)	1.01 (0.85-1.21)	9833 (17.02)	0.93 (0.78-1.11)	5516 (21.01)	1.00 (0.84-1.17)	5443 (13.25)	0.88 (0.78-1.01)
Deprivation level†	Least[$]	5006 (20.38)	1	6846 (13.94)	1	5384 (16.51)	1	7161 (10.29)	1
	Middle	5140 (25.49)	1.38** (1.14-1.66)	6713 (16.52)	1.25*** (1.13-1.38)	5702 (20.66)	1.35*** (1.15-1.60)	7241 (13.19)	1.38*** (1.25-1.52)
	Most	5,16 (28.58)	1.68*** (1.42-1.99)	7235 (17.83)	1.45*** (1.27-1.64)	6096 (24.62)	1.74*** (1.48-2.03)	7328 (14.14)	1.60*** (1.42-1.81)
Number (%) of smokers		**4039 (24.99)**		**3380 (16.09)**		**3618 (20.80)**		**2748 (12.52)**	
Total N		**16162**		**32320**		**17,397**		**21951**	

N = denominator (number of patients with a smoking code); % = percentage of smokers; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (416 pre-QOF+; 436 post-QOF+); * = p<0.05; ** = p<0.01; *** = p<0.001

3. Smoking advice

Before the introduction of QOF+, 35.4% of smokers in the complete case cohort were given advice (32.7% of men and 35.4% of women). After the introduction of QOF+ this proportion increased to 54.0% (54.0% of men and 54.1% of women). The AOR for men being given advice after the introduction of QOF+ compared with the prior period was 2.29 (CI 1.45 to 3.61, $p<0.001$) and 2.09 for women (CI 1.38 to 3.17, $p<0.01$. The proportions of smokers receiving advice pre/post-QOF+, stratified by gender, are given in Table 9.

Prior to QOF+, there was little variation in the chance of smokers getting advice. Men aged over-70 years were somewhat more likely to receive advice compared with men aged 30 to 49 years (46.7% vs 34.56%, AOR 1.69, CI 1.06 to 2.69, $p<0.05$). Men with Mixed ethnicity were statistically more likely to receive smoking cessation advice than White men (58.7% vs 36.0%, AOR 2.60, CI 1.64 to 4.12, $p<0.001$), but men whose ethnicity was not stated were less likely (29.1% vs 36.0%, AOR 0.72, CI 0.56 to 0.93, $p<0.05$). There were no statistically significant differences in rates of smoking advice among the different demographic groups for women, or for either gender for different deprivation areas.

After the introduction of QOF+ smoking cessation advice to smokers was still provided relatively equitably. There were now no statistically significant differences in rates of advice for different age groups for men, but women aged under-30 years were more likely to receive advice than those aged 30 to 49 years (63.7% vs 52.9%, AOR 1.73, CI 1.29 to 2.30, $p<0.001$). There remained no significant difference in rates of advice to patients from different ethnic groups of those living in areas with different levels of deprivation.

Table 9: Patient characteristics associated with smokers receiving cessation advice or referral pre/post QOF+ in Hammersmith & Fulham

		Pre-QOF+				Post-QOF+			
		Men		Women		Men		Women	
		N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)
Age group	<30	787 (34.56)	1.08 (0.79-1.48)	813 (36.65)	0.93 (0.68-1.28)	603 (54.23)	1.01 (0.79-1.28)	422 (63.74)	1.73*** (1.29-2.30)
	30 to 49$	2,227 (31.43)	1	1827 (33.94)	1	1821 (52.61)	1	1,574 (52.86)	1
	50 to 69	965 (33.16)	0.91 (0.79-1.04)	688 (37.50)	0.83 (0.68-1.00)	1098 (55.65)	0.93 (0.76-1.13)	677 (50.96)	1.09 (0.86-1.38)
	70+	60 (46.67)	1.69* (1.06-2.69)	52 (40.38)	1.18 (0.58-2.40)	96 (58.33)	1.06 (0.70-1.59)	75 (54.67)	1.17 (0.62-2.23)
Ethnic group	White$	1372 (36.01)	1	1406 (36.77)	1	1758 (55.75)	1	1678 (55.01)	1
	Black	177 (40.11)	1.19 (0.83-1.71)	109 (45.87)	1.47 (1.00-2.18)	258 (58.53)	1.09 (0.79-1.51)	151 (55.63)	0.94 (0.71-1.26)
	South Asian	73 (42.47)	1.18 (0.57-2.47)	22 (40.91)	1.21 (0.49-2.95)	89 (46.07)	0.70 (0.46-1.06)	19 (57.89)	1.02 (0.34-3.13)
	Mixed	46 (58.70)	2.60*** (1.64-4.12)	47 (53.19)	2.02 (0.87-4.69)	82 (65.85)	1.50 (0.72-3.13)	51 (64.71)	1.39 (0.71-2.71)
	Other	185 (32.97)	0.89 (0.63-1.26)	122 (31.97)	0.80 (0.52-1.24)	272 (56.62)	1.03 (0.74-1.43)	128 (58.59)	1.11 (0.75-1.63)
	Not stated	2186 (29.09)	0.72* (0.56-0.93)	1674 (33.27)	0.84 (0.68-1.04)	1159 (49.35)	0.78 (0.61-1.00)	721 (50.07)	0.79 (0.62-1.01)
Deprivation level†	Least$	1020 (31.37)	1	954 (32.91)	1	889 (52.42)	1	737 (52.92)	1
	Middle	1310 (32.82)	1.07 (0.87-1.32)	1109 (399.00)	1.14 (0.89-1.46)	1178 (54.41)	1.09 (0.86-1.37)	955 (56.13)	1.13 (0.87-1.46)
	Most	1662 (32.85)	1.05 (0.81-1.36)	1290 (479.00)	1.18 (0.84-1.65)	1501 (55.10)	1.10 (0.81-1.48)	1036 (53.67)	1.01 (0.73-1.38)
Number (%) of smokers		**1320 (32.68)**		**1197 (35.41)**		**1952 (53.95)**		**1487 (54.11)**	
Total N		**4039**		**3380**		**3618**		**2748**	

N = denominator (smokers); % = percentage of smokers receiving advice or referral; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (74 pre-QOF+; 70 post-QOF+); * = p<0.05; ** = p<0.01; ** = p<0.001

4. Differential effect of QOF+ in the complete case cohort on individual groups

Table 10 shows the within-group comparisons for the effect QOF+ for men and women of different age groups, ethnic groups and deprivation levels, in each case adjusted for the other variables and for practice clustering. As there were statistically significant improvements for almost all age groups and ethnic groups, and for all levels of deprivation, in the following paragraphs I shall describe the groups who appeared to benefit the most and those who appeared not to benefit from QOF+.

Smoking status

The youngest age groups saw the biggest improvements in recording rates (for men aged under-30 years, AOR 2.54, CI 2.33 to 2.77, $p<0.001$; for women under-30 years, AOR 2.48, CI 2.28 to 2.71, $p<0.001$). South Asian patients saw a greater relative benefit (AOR for women 2.61, CI 1.87 to 3.64, $p<0.001$). Men aged over-70 years were not significantly more likely to be asked about smoking after QOF+ than previously. Men with Mixed ethnicity were as likely to be asked about smoking after QOF+ as before.

Smoking prevalence

Women aged under-30 years and men aged 30 to 49 years saw the biggest improvements following the introduction of QOF+ (AOR for women under-30 0.64, CI 0.56 to 0.72, $p<0.001$; AOR for men aged 30 to 49 0.73, CI 0.58 to 0.79, $p<0.001$). Patients aged over-70 years were the only group not to have reduced their smoking rates significantly after the introduction of QOF+. Black and South Asian patients and men with Mixed or Other ethnicity had similar rates of smoking before and after the introduction of QOF+.

Smoking advice

Women under-30 received the biggest improvement in smoking cessation advice levels (AOR 2.03, CI 2.38 to 3.88, $p<0.001$). Patients aged over-70 years were not significantly more likely to be given smoking cessation advice after the introduction of QOF+. South Asian patients and those with Mixed ethnicity also received similar levels of advice after QOF+ as before. Improvements for the different deprivation groups were similar.

Table 10: Within-group analysis: effect of QOF+ on smoking outcomes in Hammersmith & Fulham[1]

		Smoking status ascertained post QOF+				Smokers post QOF+				Smoking advice to smokers post QOF+			
		Men		Women		Men		Women		Men		Women	
		AOR	CI	AOR	CI	AOR	CI	AOR	CI	AOR	CI	AOR	CI
Age group	<30	2.34***	2.14-2.56	2.26***	2.07-2.47	0.83**	0.74-0.93	0.66***	0.58-0.75	2.22***	1.78-2.77	2.95***	2.30-3.79
	30 to 49	1.21***	1.14-1.29	1.16***	1.10-1.24	0.76***	0.71-0.82	0.80***	0.74-0.86	2.38***	2.09-2.72	2.11***	1.83-2.43
	50 to 69	1.07	0.98-1.16	1.16**	1.06-1.28	0.81***	0.72-0.90	0.79***	0.70-0.89	2.11***	1.75-2.56	1.51***	1.20-1.89
	70+	0.86	0.65-1.13	1.15	0.88-1.51	1.02	0.70-1.49	1.08	0.72-1.62	1.70	0.81-3.57	2.76*	1.13-6.71
Ethnic group	White	1.28***	1.19-1.38	1.27***	1.19-1.36	0.77***	0.71-0.84	0.79***	0.73-0.86	2.22***	1.92-2.57	2.13***	1.84-2.47
	Black	1.49***	1.23-1.81	1.84***	1.52-2.23	0.99	0.79-1.23	0.93	0.71-1.21	2.03**	1.36-3.02	1.47	0.88-2.47
	South Asian	1.72***	1.30-2.29	2.50***	1.77-3.52	0.82	0.58-1.15	0.65	0.35-1.22	1.30	0.67-2.51	2.13	0.52-8.72
	Mixed	1.06	0.68-1.64	1.71**	1.16-2.51	0.88	0.56-1.39	0.59*	0.38-0.92	1.37	0.62-3.01	1.63	0.69-3.84
	Other	1.23*	1.03-1.46)	1.31**	1.10-1.57	0.83	0.67-1.03	0.70**	0.54-0.90	2.54***	1.71-3.77	3.18***	1.87-5.40
	Not stated	1.44***	1.35-1.54	1.40***	1.31-1.50	0.76***	0.70-0.83	0.74***	0.68-0.82	2.43***	2.09-2.82	2.07***	1.73-2.47
Deprivation level	Least	1.35***	1.25-1.46	1.35***	1.25-1.46	0.79***	0.71-0.87	0.76***	0.68-0.85	2.20***	1.81-2.66	2.25***	1.83-2.76
	Middle	1.42***	1.31-1.53	1.32***	1.23-1.43	0.77***	0.70-0.85	0.79***	0.71-0.87	2.33***	1.98-2.76	2.24***	1.86-2.69
	Most	1.35***	1.26-1.46)	1.39***	1.29-1.50	0.81***	0.75-0.88	0.76***	0.690.84	2.32***	2.00-2.69	1.89***	1.59-2.25

1 = Adjusted odds ratios (AOR)(adjusted by age group, ethnicity, IMD and practice clustering) for outcome for each group post-QOF+ compared with pre-QOF+

Sensitivity analysis results

1. Smoking status ascertained

On 31 June 2008 there were 109,072 patients eligible for inclusion in the study registered at participating general practices in Hammersmith & Fulham (47,375 men and 61,697 women). From 1 July 2008 to 31 March 2011 (after the introduction of QOF+) the number of patients in the cohort increased to 151,511 (66,287 men and 85,224 women). Prior to the introduction of QOF+ ethnicity data were available for only 20.1% of patients in the open cohort compared with 74.0% after. Only two patients were exception reported for smoking indicators in the pre-QOF+ period, compared with 406 patients after the introduction of QOF+. For both time points these patients represent a very small proportion of the study sample.

Before QOF+, 61.7% of patients had their smoking status ascertained (56.2% of men and 65.9% of women). After the introduction of QOF+ the proportion of patients who had their smoking status recorded was 75.6% (70.1% of men and 79.9% of women), a significant increase compared with the pre-QOF+ period (AOR for men 1.32, CI 1.17 to 1.48, $p<0.001$; AOR for women 1.64, CI 1.45 to 1.85, $p<0.001$), and the only groups not to see an increase were patients with Other ethnicity and White women. The proportions of patients with smoking ascertained before and after the introduction of QO+, subdivided by ethnic group and gender, are shown in Table 11.

Before QOF+ men aged 50 to 69 years and men over-70 years were less likely to have smoking status ascertained than men aged 30 to 49 years (40.5% vs 60.1% for men aged 50 to 69 years, AOR 0.53, CI 0.45 to 0.61, $p<0.001$; 45.7% for men over-70 years, AOR 0.68, CI 0.51 to 0.91, $p<0.01$). Black men were less likely to have smoking status recorded

compared with White men (76.2% vs 79.8%, AOR 0.81, CI 0.68 to 0.96, p<0.05). South Asian and Other women were more likely to have their status recorded compared with White women (88.9% of South Asian women had their status recorded compared with 83.3% of White women, AOR 1.61, CI 1.31 to 1.96, p<0.001; 87.8% of Other women, AOR 1.46 to 1.75, p<0.001). Patients with no stated ethnicity were much less likely to be asked. There was no difference between the three deprivation categories in the chance of either men or women being asked about smoking in this cohort.

After QOF+ men aged 50 to 69 years and over-70 years were still less likely to be asked about smoking than those aged 30 to 49 years despite a greater proportion being asked in each of the age groups. However women aged under-30 years were now more likely to be asked than women aged 30 to 49 years (82.3% vs 79.1%, AOR 1.12, CI 1.04 to 1.21, p<0.001).

Black men were as likely as White men to be have their smoking status recorded after the introduction of QOF+ but South Asian men were now more likely than White men to have their status recorded (86.1% vs 78.4, AOR 1.75, CI 1.13 to 2.70, p<0.001). Women from all the ethnic groups except Not Stated were more likely to have smoking status recorded than White women. For example, 88.0% of Black women had their status recorded compared with 82.8% of White women (AOR 1.63, CI 1.43 to 1.86, p<0.001). Men and women with unstated ethnicity were still less likely to be asked than White patients, although the proportions asked had improved considerably compared with the pre-QOF+ period. However, after QOF+ the most deprived patients were less likely to be asked than those from more affluent areas (both genders).

Table 11: Patient characteristics in the Hammersmith & Fulham open cohort associated with being asked about smoking, before and after the introduction of QOF+[1]

		Pre-QOF+				Post-QOF+			
		Men		Women		Men		Women	
		N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)
Age group	<30	13734 (60.12)	0.88 (0.73-1.06)	21487 (64.71)	0.97 (0.80-1.18)	18963 (74.18)	0.97 (0.89-1.05)	30629 (82.28)	1.12** (1.04-1.21)
	30 to 49	21123 (62.62)	1	29459 (65.39)	1	33610 (75.17)	1	43002 (79.12)	1
	50 to 69	10812 (40.48)	0.53*** (0.45-0.61)	8595 (65.00)	1.14 (0.95-1.37)	11992 (50.94)	0.47*** (0.41-0.55)	9552 (75.80)	0.92 (0.82-1.02)
	70+	1706 (45.72)	0.68** (0.51-0.91)	2156 (58.40)	0.98 (0.78-1.23)	1722 (61.09)	0.67** (0.50-0.89)	2041 (78.69)	1.15 (0.91-1.45)
Ethnic group	White	15754 (79.75)	1	24637 (83.33)	1	35485 (78.40)	1	51680 (82.78)	1
	Black	1850 (76.16)	0.81* (0.68-0.96)	2740 (83.36)	1.04 (0.89-1.22)	4072 (77.82)	1.00 (0.92-1.09)	5227 (88.02)	1.63*** (1.43-1.86)
	South Asian	1194 (79.56)	0.99 (0.83-1.17)	1359 (88.89)	1.61*** (1.31-1.96)	2922 (86.11)	1.75* (1.13-2.70)	2559 (92.50)	2.64*** (1.75-4.00)
	Mixed	380 (82.89)	1.23 (0.77-1.95)	597 (83.42)	1.05 (0.79-1.41)	1001 (77.72)	0.98 (0.83-1.15)	1398 (86.41)	1.41*** (1.18-1.67)
	Other	2729 (81.90)	1.12 (0.99-1.26)	4080 (87.82)	1.46*** (1.22-1.75)	7215 (79.07)	1.01 (0.89-1.15)	10124 (87.20)	1.45*** (1.20-1.75)
	Not stated	25468 (36.00)	0.15*** (0.12-0.19)	28284 (44.39)	0.16*** (0.12-0.22)	15592 (41.73)	0.23*** (0.19-0.27)	14196 (58.10)	0.30*** (0.26-0.35)
Deprivation level†	Least	15336 (57.63)	1	21094 (67.06)	1	21585 (71.28)	1	29875 (80.86)	1
	Middle	15467 (56.04)	0.93 (0.80-1.07)	20085 (66.91)	1.03 (0.87-1.23)	21771 (70.41)	0.94 (0.84-1.05)	27915 (80.12)	0.94 (0.86-1.02)
	Most	15080 (55.49)	0.89 (0.73-1.08)	18511 (63.55)	0.87 (0.70-1.08)	21858 (62.21)	0.85* (0.73-0.98)	26176 (78.62)	0.80*** (0.71-0.89)
Number (%) of smokers		**26641 (56.23)**		**40657 (65.90)**		**46,493 (70.14)**		**68072 (79.87)**	
Total N		**47375**		**61697**		**66287**		**85224**	

1 = Patients in Hammersmith & Fulham without diseases specifically incentivised for smoking cessation activities under national QOF; N = denominator (number of registered adult patients); % = percentage of patients with smoking status ascertained; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (3498 pre-QOF+; 1258 post-QOF+); * = p<0.05; ** = p<0.01; *** = p<0.001

2. Smoking prevalence

Smoking prevalence at baseline was 21.0% (25.8% of men and 17.6% of women). After the introduction of QOF+ smoking prevalence fell to 18.7% (23.7% of men and 15.1% of women). Compared with the pre-QOF+ period the AOR for smoking prevalence was 0.88 for men (CI 0.83 to 0.93, $p<0.001$) and 0.84 for women (CI 0.80 to 0.88, $p<0.001$). Smoking prevalence, stratified by gender before and after the introduction of QOF+, is given in Table 12.

Pre-QOF+ smoking rates for men were lower among patients aged under-30 years and in those aged over-70 years compared with those aged 30 to 49 years, as found with the other studies (23.4% of men under-30 years vs 27.3% of men aged 30 to 49, AOR 0.79, CI 0.71 to 0.87, $p<0.001$; 14.5% of men over-70 years, AOR 0.44, CI 0.36 to 0.53, $p<0.001$). Women aged under-30 years were more likely to smoke than those aged 30 to 49 years (19.5% vs 16.9%, AOR 1.16, CI 1.06 to 1.27, $p<0.01$). Women aged over-70 years were less likely to smoke than women aged 30 to 49 years (8.4% vs 19.5%, AOR 0.44, CI 0.36 to 0.52, $p<0.001$).

Smoking rates were lower in Black and South Asian men compared with White men (24.7% of Black men smoked vs 23.1% of White men, AOR 0.81, CI 0.69 to 0.96, $p<0.05$; 18.6% of South Asian men smoked, AOR 0.61, CI 0.46 to 0.80, $p<0.001$). Women from Black, South Asian and Other groups were also less likely to smoke than White women, with the South Asian women being least likely to smoke of all groups (3.81% vs 19.8% of White women, AOR 0.16, CI 0.09 to 0.27, $p<0.001$).

Smoking rates were again higher in the middle and most deprived groups compared with those from the most affluent areas.

After QOF+, smoking rates remained significantly lower in men aged under-30 years but rates in men aged 50 to 69 years were now higher than those aged 30 to 49 years (25.9% vs 22.5%, AOR 1.09, CI 1.02 to 1.17. Smoking rates remained higher in women aged under-30 years compared with women aged 30 to 49 years (16.9% vs 14.6%, AOR 1.17, CI 1.08 to 1.26, $p<0.001$). Smoking prevalence remained lower in men and women aged over-70 years compared with those aged 30 to 49 years.

Black men were no more likely to smoke than White men after the introduction of QOF+ and men with Mixed ethnicity were now more likely to smoke than White men (28.7% vs 24.1%, AOR 1.14, CI 1.01 to 1.29, $p<0.05$). South Asian men continued to have lower rates of smoking than White men (17.5% vs 24.1%, AOR 0.61, CI 0.43 to 0.88, $p<0.01$). Smoking rates among Black, South Asian and Other women remained lower than those of White women. For example, 8.5% of Black women smoked compared with 17.2% of White women (AOR 0.40, CI 0.34 to 0.48, $p<0.005$). Smoking rates again remained higher among those from the middle and most deprived areas compared with those from the most affluent areas following the introduction of QOF+.

3. Smoking advice

Before the introduction of QOF+, 37.4% of smokers in the open cohort were given advice (36.2% of men and 38.7% of women). After the introduction of QOF+ this proportion increased to 59.9% (59.9% for both men and women). The AOR for men being given advice after the introduction of QOF+ compared with the prior period was 2.33 (CI 1.30 to 4.14, $p<0.01$) and 2.13 for women (CI 1.28 to 3.54, $p<0.01$. The proportions of smokers receiving advice pre/post-QOF+, stratified by gender, are given in Table 13.

Table 12: Patient characteristics in the Hammersmith & Fulham open cohort associated with having a latest smoking code of 'current smoker' pre/post QOF+

		Pre-QOF+				Post-QOF+			
		Men		Women		Men		Women	
		N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)
Age group	<30	10611 (23.39)	0.79*** (0.71-0.87)	17494 (19.51)	1.16** (1.06-1.27)	17710 (22.48)	0.90* (0.83-0.98)	29692 (16.86)	1.17*** (1.08-1.26)
	30 to 49	17393 (27.25)	1	23977 (16.91)	1	32460 (24.06)	1	41587 (14.55)	1
	50 to 69	6400 (27.70)	1.02 (0.93-1.12)	7215 (16.87)	0.99 (0.91-1.07)	8666 (25.86)	1.09* (1.02-1.17)	8971 (13.60)	0.92 (0.83-1.02)
	70+	989 (14.46)	0.44*** (0.36-0.53)	1516 (8.38)	0.44*** (0.36-0.52)	1324 (14.80)	0.54*** (0.46-0.63)	1848 (7.90)	0.47*** (0.40-0.57)
Ethnic group	White	15397 (23.12)	1	24189 (19.81)	1	34989 (24.12)	1	51305 (17.21)	1
	Black	1801 (24.65)	0.81* (0.69-0.96)	2682 (9.84)	0.39*** (0.32-0.49)	4004 (25.20)	0.93 (0.81-1.07)	5192 (8.46)	0.40*** (0.34-0.48)
	South Asian	1168 (18.56)	0.61*** (0.46-0.80)	1339 (3.81)	0.16*** (0.09-0.27)	2871 (17.49)	0.61** (0.43-0.88)	2582 (3.14)	0.15*** (0.09-0.26)
	Mixed	376 (31.38)	1.16 (0.90-1.51)	587 (18.40)	0.82 (0.62-1.10)	992 (28.73)	1.14* (1.01-1.29)	1387 (14.28)	0.72* (0.54-0.97)
	Other	2658 (25.40)	0.91 (0.80-1.04)	4010 (11.62)	0.52*** (0.44-0.62)	6980 (22.39)	0.88 (0.75-1.02)	9977 (10.69)	0.56*** (0.49-0.65)
	Not stated	13993 (26.18)	0.97 (0.85-1.11)	17395 (17.99)	0.90 (0.79-1.04)	10324 (23.53)	0.93 (0.81-1.08)	11655 (15.53)	0.90 (0.81-1.01)
Deprivation level†	Least	11328 (21.62)	1	17108 (15.86)	1	19388 (19.64)	1	28722 (13.64)	1
	Middle	11643 (26.32)	1.32*** (1.16-1.49)	16582 (18.38)	1.23*** (1.15-1.32)	19825 (23.25)	1.26*** (1.14-1.39)	26994 (15.31)	1.19*** (1.09-1.29)
	Most	11369 (29.97)	1.61*** (1.40-1.86)	14865 (19.00)	1.37*** (1.26-1.48)	20096 (27.98)	1.63*** (1.47-1.82)	25232 (16.71)	1.40*** (1.31-1.50)
Number (%) of smokers		**9138 (25.82)**		**8811 (17.55)**		**14229 (23.65)**		**12424 (15.13)**	
Total N		**35393**		**50,202**		**60160**		**82098**	

N = denominator (number of patients with a smoking code); % = percentage of smokers; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD, practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (2700 pre-QOF+; 2001 post-QOF+); * = p<0.05; ** = p<0.01; *** = p<0.001

Prior to QOF+, there was again little variation seen in the chance of smokers getting advice. Men and women with unstated ethnicity were statistically less likely to receive smoking cessation advice than White patients (for men, 26.6% vs 41.8%, AOR 0.49, CI 0.39 to 0.62, p<0.001; for women 29.7% vs 43.3%, AOR 0.55, CI 0.44 to 0.69, p<0.001). However, men and women in the most deprived areas were more likely to receive advice than those in the most affluent (for men, 58.7% vs 32.5%, AOR 1.38, CI 1.10 to 1.75, p<0.01; for women, 42.0% vs 35.5%, AOR 1.34, CI 1.03 to 1.75, p<0.05).

After the introduction of QOF+ smoking cessation advice to smokers was still provided relatively equitably. However men aged 50 to 69 years were now less likely to receive advice compared to those aged 30 to 49 years (52.1% vs 64.1%, CI 0.64 to 0.87, p<0.001) and women aged under-30 were more likely to receive advice (67.5% vs 54.8%, AOR 1.59, CI 1.39 to 1.81, p<0.001). Patients with unstated ethnicity continued to be less likely to receive advice compared with White patients. The relative advantage patients from the most deprived areas had in receiving advice prior to the introduction of QOF+ had now gone, with patients from all deprivation groups receiving similar rates of advice.

Table 13: Patient characteristics associated with smokers in the Hammersmith & Fulham open cohort receiving cessation advice or referral pre/post QOF+

		Pre-QOF+				Post-QOF+			
		Men		Women		Men		Women	
		N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)	N (%)	AOR (CI)
Age group	<30	2482 (38.52)	1.09 (0.85-1.40)	3413 (42.46)	1.25 (0.97-1.61)	3982 (64.06)	1.15 (0.98-1.34)	5007 (67.45)	1.59*** (1.39-1.81)
	30 to 49	4740 (35.34)	1	4054 (35.57)	1	7810 (60.20)	1	6051 (54.80)	1
	50 to 69	1773 (34.97)	1.05 (0.87-1.27)	1217 (38.37)	1.15 (0.95-1.41)	2241 (52.12)	0.75*** (0.64-0.87)	1220 (54.92)	1.05 (0.90-1.22)
	70+	143 (39.86)	1.27 (0.84-1.93)	127 (39.37)	1.29 (0.76-2.20)	196 (51.53)	0.73 (0.50-1.06)	146 (52.74)	0.99 (0.69-1.41)
Ethnic group	White	4021 (41.81)	1	4792 (43.28)	1	8441 (62.08)	1	8829 (62.02)	1
	Black	444 (45.05)	1.07 (0.80-1.42)	264 (47.35)	1.16 (0.88-1.52)	1009 (64.32)	1.10 (0.97-1.26)	439 (64.01)	1.14 (0.91-1.43)
	South Asian	217 (39.63)	0.82 (0.45-1.49)	51 (45.10)	1.13 (0.54-2.33)	502 (63.15)	1.05 (0.81-1.36)	81 (66.67)	1.26 (0.77-2.06)
	Mixed	118 (55.93)	1.67 (0.97-2.86)	108 (55.56)	1.66 (1.00-2.75)	285 (69.82)	1.46 (0.91-2.34)	198 (68.18)	1.31 (0.88-1.96)
	Other	675 (44.74)	1.10 (0.87-1.39)	466 (41.85)	0.94 (0.71-1.25)	1563 (63.98)	1.05 (0.91-1.22)	1067 (66.64)	1.22 (1.00-1.49)
	Not stated	3663 (26.56)	0.49*** (0.39-0.62)	3130 (29.74)	0.55*** (0.44-0.69)	2429 (45.99)	0.54*** (0.43-0.67)	1810 (43.26)	0.51*** (0.41-0.63)
Deprivation level†	Least	2449 (32.46)	1	2713 (35.50)	1	3808 (59.98)	1	3919 (60.37)	1
	Middle	3064 (34.76)	1.14 (0.97-1.33)	3048 (38.22)	1.15 (0.98-1.35)	4609 (60.73)	1.04 (0.89-1.21)	4132 (60.96)	1.03 (0.87-1.22)
	Most	3407 (39.65)	1.38** (1.10-1.75)	2825 (42.02)	1.34* (1.03-1.75)	5622 (59.57)	0.97 (0.78-1.21)	4217 (58.43)	0.91 (0.72-1.14)
Number (%) of smokers		**3308 (36.20)**		**3408 (38.68)**		**8522 (59.89)**		**7440 (59.88)**	
Total N		**9138**		**8811**		**14229**		**12424**	

N = denominator (smokers in the full cohort); % = percentage of smokers receiving advice or referral; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (443 pre-QOF+; 346 post-QOF+); * = p<0.05; ** = p<0.01; ** = p<0.0001

4. Differential effect of QOF+ on individual groups of patients

Table 14 shows the relative chance of benefitting from the introduction of QOF+ for men and women of different age groups, ethnic groups and deprivation levels, in each case adjusted for the other variables. As previously found with the complete case cohort, there were statistically significant improvements for almost all age groups and ethnic groups, and for all levels of deprivation, so exceptions are described in the paragraphs below.

Smoking status

Patients aged under-30 appeared to benefit the most from QOF+ for the recording of smoking status (AOR for men under-30 years 3.21, CI 3.06 to 3.36, $p<0.001$; AOR for women under-30 years 3.82, CI 3.67 to 3.98, $p<0.001$), although all age groups saw large improvements. South Asian patients also saw the greatest improvements (AOR for South Asian men 2.16, CI 1.83 to 2.56, $p<0.001$; AOR for South Asian women 2.33, CI 1.90 to 2.86, $p<0.001$). Men with Mixed ethnicity were the only group to be only as likely to be asked about smoking after QOF+ as before.

Smoking prevalence

Women aged 50 to 69 years saw the biggest reductions in smoking rates (AOR 0.78, CI 0.71 to 0.85, $p<0.001$). Patients aged over-70 years were again the only group not to have reduced their smoking rates significantly after the introduction of QOF+. Black men, men with Mixed ethnicity, Other women, and South Asian patients had similar rates of smoking before and after the introduction of QOF+.

Smoking advice

All groups benefitted from the introduction of QOF+ and were significantly more likely to receive advice compared with the pre-QOF+ period. The youngest patients saw the most improvement (AOR for men aged under-30 2.85, CI 2.57 to 3.16, $p<0.001$; AOR for women aged under-30 2.81, CI 2.57 to 3.07, $p<0.001$). South Asian men again benefitted most from QOF+ on smoking advice levels (AOR = 2.61, CI 1.88 to 3.62, $p<0.001$). Women with Other ethnicity saw the greatest improvements (AOR = 2.78, CI 2.22 to 3.47, $p<0.001$). The most affluent group was somewhat more likely to have seen an improvement in rates of smoking advice post-QOF+ (AOR 3.12, CI 2.80 to 3.47, $p<0.001$).

Table 14: Within-group analysis for the Hammersmith & Fulham open cohort: effect of QOF+ on smoking outcomes[1]

		Smoking status ascertained post QOF+				Smokers post QOF+				Smoking advice to smokers post QOF+			
		Men		Women		Men		Women		Men		Women	
		AOR	(CI)	AOR	CI	AOR	CI	AOR	CI	AOR	CI	AOR	CI
Age group	<30	2.21***	2.10-2.33	2.60***	2.49-2.72	0.93*	0.87-0.98	0.82***	0.78-0.86	2.59***	2.33-2.88	2.52***	2.30-2.77
	30 to 49	1.17***	1.12-1.22	1.28***	1.24-1.33	0.85***	0.82-0.89	0.86***	0.83-0.90	2.49***	2.30-2.69	1.95***	1.79-2.13
	50 to 69	0.93*	0.87-0.99	1.17***	1.09-1.26	0.88**	0.82-0.96	0.77***	0.70-0.85	1.62***	1.42-1.86	1.74***	1.46-2.06
	70+	0.91	0.76-1.07	1.39***	1.18-1.63	1.04	0.81-1.34	0.94	0.72-1.23	1.44	0.89-2.34	1.70*	1.01-2.86
Ethnic group	White	1.14***	1.09-1.19	1.35***	1.30-1.41	0.89***	0.85-0.93	0.83***	0.80-0.87	2.31***	2.13-2.49	2.18***	2.02-2.34
	Black	1.51***	1.33-1.71	2.53***	2.24-2.87	1.01	0.88-1.15	0.86	0.73-1.01	2.21***	1.75-2.78	1.95***	1.42-2.67
	South Asian	2.22***	1.88-2.64	2.50***	2.02-3.09	0.93	0.77-1.11	0.78	0.55-1.12	2.81	2.00-3.94	2.38*	1.13-5.00
	Mixed	1.08	0.82-1.43	2.07***	1.61-2.66	0.87	0.67-1.14	0.73*	0.56-0.95	1.86**	1.19-2.93	1.64	1.00-2.70
	Other	1.26***	1.13-1.40	1.64***	1.49-1.81	0.84**	0.76-0.94	0.89	0.79-1.00	2.18***	1.81-2.63	2.78***	2.22-3.48
	Not stated	1.50***	1.44-1.56	1.92***	1.84-2.00	0.85***	0.80-0.90	0.82***	0.77-0.87	2.43***	2.17-2.71	1.90***	1.68-2.15
Deprivation level	Least	1.24***	1.18-1.30	1.63***	1.55-1.70	0.88***	0.83-0.94	0.85***	0.80-0.90	2.74***	2.45-3.05	2.51***	2.26-2.79
	Middle	1.37***	1.30-1.44	1.63***	1.56-1.71	0.86***	0.81-0.90	0.81***	0.77-0.86	2.56***	2.33-2.83	2.28***	2.06-2.52
	Most	1.36***	1.30-1.43	1.67***	1.60-1.75	0.90***	0.85-0.95	0.84***	0.79-0.89	1.91***	1.75-2.09	1.70***	1.53-1.88

1 = Adjusted odds ratios (AOR)(adjusted by age, ethnicity, IMD and practice clustering) for outcome for each group post-QOF+ compared with pre-QOF+

Key points

The introduction of QOF+ was associated with large increases in the proportion of patients without smoking-related diseases having their smoking status recorded, a reduction in smoking prevalence and an increase in the proportion of smokers receiving smoking cessation advice. Advice appeared to have been provided largely equitably across the different demographic groups, with a few exceptions, summarised below.

Overall, most groups saw improvements in the recording of smoking status but patients aged under-30 years were less likely to be asked about smoking, and patients over-70 years more likely to be asked, in the complete case cohort. These findings were reversed in the sensitivity analysis with the open cohort design, suggesting younger newly registered patients were more likely to be asked about smoking than older patients. South Asian men and women from all ethnic groups other than White were more likely to have their smoking status recorded before and after the introduction of QOF+. This result was the same in the sensitivity analysis.

Men aged under-30 years and patients over-70 years were less likely to smoke than patients aged 30 to 49 years. South Asian and Other men were less likely to smoke than White men and Black, South Asian and Mixed ethnicity women were less likely to smoke than White women, and this held after the introduction of QOF+ in both cohorts.

Patients in the middle and more deprived areas were more likely to smoke than those in the least deprived areas, and this was the case after the introduction of QOF+ despite reductions in smoking prevalence in all deprivation groups. Smoking advice increased after the introduction of QOF+ and all groups benefitted from the increase.

Within-group comparisons showed that most groups benefitted from QOF+ for the smoking outcomes studied, with the main exception being patients aged over-70 years for whom outcomes were similar before and after the introduction of QOF+, or only slightly improved compared with the other age groups, probably due to the very low prevalence of smoking in this age group.

Strengths and weaknesses of the studies

The studies used data from a large number of patients without smoking-related diseases registered at general practices in an ethnically diverse area of North West London. Findings from the studies may be generalisable to other health systems with universal coverage that provide financial incentives for primary prevention activities. As with the Wandsworth study, all practices in the study used electronic medical records to record clinical information.

Pre-QOF ethnicity coding was poor for these patients, possibly because national QOF did not attach much financial incentive to their recording, or because they attended the general practice infrequently. After the introduction of QOF+ ethnicity recording for this group improved considerably.

As previously discussed in Chapter 6, I included patients without an ethnic group category into a group where ethnicity was 'not stated' in order to avoid bias of multiple imputation. but this group would have included people from all the other ethnic groups and may have introduced bias as well. A sensitivity analysis conducted after excluding the 'not-stated' group could also be used to address this problem.

My results were based on outcomes recorded in the medical record over the 27 months prior to the introduction of QOF+ and the 33 months after the introduction of QOF+, the duration of funding for QOF+. Practices would have had an extra six months to achieve smoking

outcomes post-QOF+, but this was the period of time specified by QOF+ business rules, whereas 27 months was specified by national QOF business rules, so the comparison is valid.

I found that smoking prevalence overall was similar to estimated national prevalence at baseline (20.0% vs 21.0%) but lower than estimated national prevalence over the follow up period (16.2% vs 20.0). APHO local prevalence data is modeled from data from health surveys but is not age-standardised and does not take into account local initiatives. In addition, as mentioned in the Wandsworth study, smoking status recorded in general practice is self-reported and not verified by CO reading or urinary cotinine, so subject to reporting bias. Most likely the majority of people who stop smoking access help through NHS stop smoking services provided through clinics and pharmacies, of which Hammersmith & Fulham has many, as detailed in the background section. It is not possible to disentangle the differential effects of GP stop smoking advice and NHS stop smoking services in the reduction of smoking prevalence seen in this study.

My sample includes patients who would have been exception reported when calculating QOF+ payments. However, as for the Wandsworth study, this may provide a more complete picture of the delivery of cessation interventions in primary care.[232] A few patients with chronic kidney disease (CKD) may have been included in the study sample, as diagnosis codes for this condition were not extracted. However, the majority of patients with CKD have other co-morbidities such as diabetes and hypertension, conditions excluded from the study sample, so the numbers of patients with CKD included would be small (around 100) and not impact on the studies' findings.

I was unable to determine the quality of advice given, as these data were not available. However, it is likely to vary considerably between those practitioners who provide minimal advice or sign-posting to NHS stop smoking services, to those who provide evidence-based

brief intervention, taking into account the situation of the patient at the time. Qualitative research may be useful in answering this question. Also, quit rates could not be determined in this study, as these are not specifically coded in primary care. It is not possible to attribute changes in smoking outcomes to the financial incentive as this was an observational study. However, there were no major changes in national tobacco control policy at the time of the study, so QOF+ may have had an effect.

Chapter 8: Effect of financial incentives on ethnic disparities in smoking cessation interventions when pregnant women book for antenatal care in primary care: before-and-after open cohort study using data from Hammersmith & Fulham, London

Hypothesis

As stated in Chapter 4, the null hypothesis for this research is that financial incentives do not affect the provision of smoking cessation activities in primary care and therefore also do not affect smoking prevalence, regardless of demographic group. The alternative hypothesis is that financial incentives do affect these outcomes.

Main research question

What are the effects of financial incentives on smoking cessation activities undertaken in healthcare, and do they affect inequalities in the provision of smoking cessation activities in primary care?

Aims

In this study I plan to examine the effect of financial incentives on the provision of smoking cessation activities for women attending booking appointments for antenatal care. I also aim to examine inequalities in provision of smoking outcomes for pregnant women from different demographic groups based on age, gender, ethnicity and socio-economic status.

Objectives

To examine the effects of a local financial incentive scheme (QOF+) on smoking cessation activities, smoking prevalence, and inequalities in the provision of smoking cessation activities to different groups (defined by age, gender, ethnicity and socio-economic status) for pregnant women using data from general practices in Hammersmith & Fulham, London, UK.

Background

Hammersmith & Fulham prioritised smoking cessation activity in primary care through a local version of the UK's financial incentive scheme (the Quality and Outcomes Framework, QOF), named QOF+, as previously described. The scheme was introduced on 1 July 2008 and was in place until 31 March 2011. In addition to extending financial incentives for smoking cessation work to include all patients for recording smoking status and providing smoking cessation advice or referral, QOF+ also introduced specific financial incentives for the recording of smoking status for pregnant women. For pregnant women it is important to identify smokers in order to help them stop smoking and avoid damage to their unborn children, so their status has to be ascertained at booking (preferably before the 12th week of pregnancy). I wanted to evaluate the effect of the financial incentive for smoking cessation among pregnant women.

Methods

Setting and patients

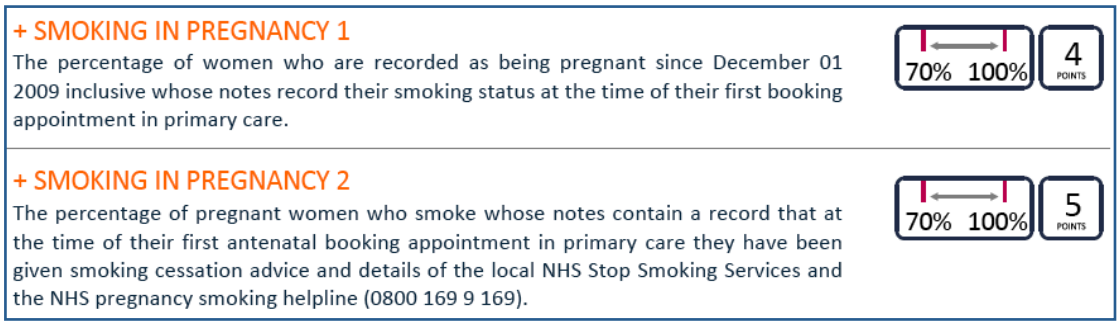
As I described in Chapter 7, The London Borough of Hammersmith & Fulham is situated in North West London has a population of approximately 182,500. The population is younger than average for London as a whole and is ethnically diverse, with around 22% of the population from Black and Minority Ethnic groups (Greater London Authority 2008 Ethnic Group population predictions), compared with around 11% for the UK as a whole.[220] The borough is rated as more deprived than England as a whole, with around 26.6% of it population living in the 20% most deprived areas in England, compared with an average for England of 19.8%.

Smoking levels in Hammersmith and Fulham are estimated to have stayed the same over the last two years according to the Association of Public Health Observatories. In 2008-9, the baseline year for this study, 6.3% of pregnant women in the borough smoked, better than the average for women smoking while pregnant in England (14.7%). In 2010-11 smoking rates had dropped still further in pregnant women (4.4% vs 13.7% of pregnant women in England as a whole).[221]

NHS stop smoking services available in Hammersmith and Fulham in community settings include one-to-one support with trained advisors throughout the borough, based at seven drop-in community clinics and at around 28 pharmacies, and a free phone number for advice. Smokers can access planned programmes of six free weekly sessions of behavioural support and prescriptions for NRT or tobacco-dependence medication such as Bupropion (http://www.kick-it.org.uk/).

Under QOF+ participating general practices were incentivised to record the smoking status of pregnant women at the time of their booking appointment for antenatal care, and to record that smoking cessation advice or referral had been provided at the booking appointment for those pregnant women who were smokers. For a list of the QOF+ smoking indicators for pregnant women see Figure 35.

Figure 35: QOF+ indicators for smoking in pregnancy



Study design

I carried out a before-and-after open cohort study using anonymised data extracted from 30 general practices in Hammersmith and Fulham. All the general practices had electronic medical records (EMR).[132] The data contained the medical records of adults (aged over 16 years) registered between 1 July 2008 and 31 March 2011.

Patients included in the study were all pregnant women, whether or not they had other chronic diseases. They were included in the study if they booked for antenatal care with participating general practices in Hammersmith & Fulham during the study period. For this study the baseline period was 33 months before the introduction of QOF+ on 1 July 2008, and the follow up period was for 33 months afterwards. I chose 33 months for the pre-QOF+ period in order to include similar numbers of pregnant women in both the baseline and the follow up.

I undertook two study designs in order to compare ascertainment rates of the indicators on the day of booking with rates during the 27 months prior to booking. However, I have reported only the results for the date of the antenatal booking appointment in this thesis, as this was the main study question. Results for the recording of indicators within 27 months of booking are shown in Appendix B.

Study variables

The following binary outcome measures were extracted from the data:

- Percentage of pregnant women (≥ 15 years) with smoking status recorded at the booking appointment, before (33 months before 1 July 2008), and after the introduction of QOF+ (1 July 2008 to 31 March 2011, 33 months);
- Percentage of those pregnant women whose smoking status was ascertained at the booking appointment who were smokers before and after the introduction of QOF+;
- Percentage of pregnant women who were smokers given smoking cessation advice at their booking appointment.

Hammersmith & Fulham Primary Care Trust staff assigned patients a deprivation score (Index of Multiple Deprivation, IMD[238]) based on their post-code before the data were anonymised and extracted to a research database held at the Department of Primary Care and Public Health, Imperial College London. London Queen Square Research Ethics Committee granted ethics approval for the use of the data for research.

Statistical analysis

I calculated the proportions of patients with the smoking outcomes at baseline and during the study period. I examined differences in these outcomes by age group, ethnic group, IMD, and practice size (both studies).

Bivariate analyses for these outcomes by age group, ethnicity, IMD, and were all statistically significant (not reported) but practice size was not. I therefore included all the predictor variables except practice size in a multiple logistic regression model taking into account practice clustering at the general practice level. I also conducted a within-group analysis,

adjusted for the other main variables, to determine whether QOF+ had influenced outcomes for some groups more or less than for others. I analysed the data with STATA version 11.

Results

1. Smoking status ascertained

At baseline there were 4,384 pregnant women, of whom 65.7% had smoking status recorded at the booking appointment during the 33 months up to the introduction of QOF+ on 1 July 2008 to 31 March 2011. In the 33 months following the introduction of QOF+ there were 6,592 pregnant women and these who had smoking status ascertained at booking had increased to 77.1% compared with the pre-QOF+ period, a significant increase (AOR 1.67, CI 1.43 to 1.96, $p<0.001$). When I looked at smoking status recorded at or within 27 months before booking the proportion with smoking status recorded was higher at 89.1% pre-QOF+ and 92.3% post-QOF+ (Appendix B, Table 1). The results for pregnant women having smoking status ascertained at booking before and after the introduction of QOF+, subdivided by ethnic group, are given in Table 15.

Table 15: Patient characteristics associated with having smoking status ascertained at booking before and after the introduction of QOF+ in Hammersmith & Fulham

		Smoking status ascertained at booking (Pre-QOF+)			Smoking status ascertained at booking (Post-QOF+)		
		N	%	AOR (CI)	N	%	AOR (CI)
Age group	<21	197	20.30	0.10*** (0.06-0.16)	206	41.26	0.15*** (0.11-0.21)
	21 to 30	1481	57.60	0.49*** (0.43-0.57)	2286	69.99	0.44** (0.38-0.52)
	31 to 40 $	2401	72.89	1	3654	83.36	1
	40+	305	72.43	1.12 (0.86-1.46)	446	79.37	0.78 (0.60-1.01)
Ethnic group	White $	2130	66.15	1	3977	75.16	1
	Black	444	69.59	1.56** (1.11-2.18)	779	82.93	2.10*** (1.67-2.64)
	South Asian	98	77.55	1.85** (1.20-2.85)	285	87.72	3.24*** (2.03-5.18)
	Mixed	93	68.82	1.49 (0.94-2.37)	180	77.22	1.43** (1.10-1.86)
	Other	433	73.67	1.67*** (1.32-2.11)	870	81.84	1.68*** (1.36-2.08)
	Not stated	1186	58.43	0.82 (0.65-1.03)	501	69.66	0.90 (0.73-1.11)
Deprivation†	Least $	1415	69.82	1	2026	80.26	1
	Middle	1496	64.97	0.88 (0.72-1.08)	2284	77.58	0.91 (0.75-1.10)
	Most	1373	61.18	0.80* (0.65-0.99)	2415	73.45	0.74** (0.61-0.90)
Total N		**4384**	**65.47**		**6592**	**77.14**	

N = denominator (number of registered pregnant women); % = percentage of pregnant women with smoking status ascertained; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (100 pre-QOF+; 131 post-QOF+* = p<0.05; ** = p<0.01; *** = p<0.001

Prior to QOF+ the younger two groups of pregnant women were less likely to be asked than those aged 31 to 40. Only 20.3% of women under-21 years were asked about smoking, and 57.6% of those aged 21 to 30 years, compared with 72.9% of women aged 31 to 40 years (AOR 0.10, CI 0.06 to 0.16 for those under-21 years; AOR 0.49, CI 0.43 to 0.57 for those aged 21 to 30 years). Black, South Asian and Other women were more likely to be asked about smoking than White women. For example, 77.6% of South Asian women were asked compared with 66.2% of White women (AOR 1.85, CI 1.20 to 2.85). Women from the most deprived group were slightly less likely to have smoking status recorded at booking compared with those from the least deprived group (61.2% vs 69.8%, AOR 0.80, CI 0.65 to 0.99).

After QOF+ younger women were still less likely to have smoking status recorded at booking, despite a large increase in recording overall, with 41.3% of those under-21 years being asked and 70.0% of those aged 21 to 30 years, compared with 83.4% of those aged 31 to 40 years (AOR 0.15, CI 0.11 to 0.21 for those under-21 years; AOR 0.44, CI 0.38 to 0.52 for those aged 21 to 30 years). Women from all ethnic groups except those without a stated ethnicity were now more likely to have smoking status recorded at booking compared with White women. For example, 87.7% of South Asian women had status recorded compared wit 75.2% of White women (AOR 3.24, CI 2.03 to 5.18). After QOF+ 73.5% of women in the most deprived areas had their smoking status recorded compared with 80.3% of those from the most affluent areas (AOR 0.74, CI 0.61 to 0.90).

2. Smoking prevalence

Smoking prevalence among pregnant women at baseline was 2.7% and after the introduction of QOF+ smoking prevalence fell to 1.8%. Compared with the pre-QOF+ period the AOR for smoking prevalence was 0.63 (CI 0.43 to 0.92). When the smoking prevalence in the 27 months prior to booking was examined for comparison the rates were 10.5% and 6.8% (Appendix B, Table 2) suggesting that many women had stopped smoking before their booking appointment. Smoking prevalence before and after the introduction of QOF+ is given in Table 16.

Table 16: Patient characteristics associated with having a smoking code of 'current smoker' at booking pre/post QOF+ in Hammersmith & Fulham

		Smokers (Pre-QOF+)			Smokers (Post-QOF+)		
		N	%	AOR (CI)	N	%	AOR (CI)
Age group	<21	40	10.00	5.78** (1.70-19.70)	85	10.59	6.65*** (2.78-15.91)
	21 to 30	852	4.69	2.56*** (1.82-3.60)	1600	2.31	1.70* (1.06-2.72)
	31 to 40 $	1748	1.77	1.00	3046	1.48	1.00
	40+	227	1.32	0.80 (0.25-2.57)	354	0.28	0.20 (0.03-1.48)
Ethnic group	White $	1408	3.34	1	2989	1.81	1
	Black	309	1.62	0.31** (0.16-0.61)	646	1.86	0.85 (0.40-1.79)
	South Asian	76	1.32	0.34 (0.04-2.80)	250	0.40	0.20 (0.02-1.55)
	Mixed	64	9.38	1.61 (0.50-5.18)	139	2.16	1.15 (0.42-3.18)
	Other	319	1.25	0.30* (0.09-0.98)	712	1.26	0.58 (0.30-1.14)
	Not stated	691	2.17	0.58 (0.28-1.21)	349	3.72	1.62 (0.85-3.09)
Deprivation†	Least $	988	1.82	1	1626	1.11	1
	Middle	972	2.26	1.20 (0.68-2.11)	1772	2.48	2.00* (1.08-3.73)
	Most	840	4.29	2.25* (1.16-4.38)	1580	1.77	1.33 (0.67-2.64)
Total		**2867**	**2.72**		**5085**	**1.81**	

N = number of pregnant women with smoking status ascertained; % = percentage of smokers; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (70 pre-QOF+; 107 post-QOF+* = p<0.05; ** = p<0.01; *** = p<0.001

Pre-QOF+ smoking rates were higher among younger women, with 10.0% of women under-21 years smoking, and 4.7% of women aged 21 to 30 years, compared with 1.8% of women aged 31 to 40 years (AOR 5.78, CI 1.70 to 19.70 for those under-21 years; AOR 2.56, CI 1.82 to 3.60 for those aged 21 to 30 years). Black and Other women were less likely to smoke than White women (1.6% of Black women smoked compared with 3.3% of White women, AOR 0.31, CI 0.16 to 0.61; 1.25% of Other women, AOR 0.30, CI 0.09 to 0.98). Smoking rates were higher in the most deprived areas compared with those from the most affluent areas (4.3% vs 1.8%, AOR 2.25, CI 1.16 to 4.38).

After QOF+, smoking rates remained higher in the younger groups of women, but disparities in rates of smoking across ethnic groups had attenuated, although for South Asian women

this may be due to small numbers of women who smoked, as the smoking prevalence was only 0.4% in this group compared with 1.8% in White women. Smoking rates were similar in the most and least deprived groups, but rates in the middle deprived group were now higher at 2.5% compared with 1.1% in the most affluent area (AOR 2.00, CI 1.08 to 3.73).

3. Smoking advice

Before the introduction of QOF+, 29.5% of pregnant smokers were given advice and after the introduction of QOF+ this proportion increased to 50.0%. The overall AOR for pregnant women who smoked being given advice after the introduction of QOF+ compared with the prior period was 2.33 (CI 1.35 to 4.02, $p<0.001$), showing that the financial incentive had a significant impact. These rates of advice are similar to those for women who were found to be smokers the 27-month period prior to booking (23.4% pre-QOF+ and 48.9% post-QOF, Appendix B, Table 3). The proportions of smokers receiving advice pre/post-QOF+ are given in Table 17. In the multiple logistic regression there were no significant results and many groups were dropped from the analysis due to small numbers, so the results of the analysis are not reported.

Table 17: Patient characteristics associated with smokers receiving cessation advice or referral at booking pre/post QOF+ in Hammersmith & Fulham

		Smokers (Pre-QOF+)		Smokers (Pre-QOF+)	
		N	%	N	%
Age group	<21	4	25.00	9	55.56
	21 to 30	40	25.00	37	51.35
	31 to 40	31	32.26	45	46.67
	40+	3	66.67	1	100.00
Ethnic group	White	47	31.91	54	51.85
	Black	5	40.00	12	50.00
	South Asian	1	0.00	1	0.00
	Mixed	6	33.33	3	33.33
	Other	4	25.00	9	33.33
	Not stated	15	20.00	13	64.54
Deprivation†	Least	18	38.89	18	55.56
	Middle	22	31.82	44	47.73
	Most	36	25.00	28	50.00
Total		**78**	**29.49**	**92**	**50.00**

N = Number of pregnant women who smoke; % = percentage of smokers receiving advice or referral;
† = missing IMD (2 pre-QOF+; 2 post-QOF+)

Prior to QOF+, although there were large differences in rates of advice these did not reach significance in the multiple logistic regression analysis due to small numbers. For women in the different age groups rates varied from 25.0% in the youngest to 66.7% in the oldest. Similarly, difference in the rates of advice to smokers of differing ethnicity ranged from 20.0% for those with unstated ethnicity to 40.0% for Black women. Rates varied from 25.0% in the most deprived group to 38.9% in the least deprived group.

After the introduction of QOF+ advice rates for younger patients were higher than for those aged 31 to 40 years (55.6% vs 46.7%). Rates of advice to smokers of different ethnicity ranged from 33.3% for women of Mixed or Other ethnicity to 64.5% of women with unstated ethnicity. There were smaller differences with deprivation, with 55.6% of women in the least

deprived areas receiving advice, 47.7% in the middle group and 50.0% in the most deprived group.

4. Differential effect of QOF+ on individual groups of patients

Table 18: Within-group analysis pregnant women study: effect of QOF+ in Hammersmith & Fulham on smoking outcomes[1‡]

		Smoking status ascertained post QOF+		Smokers post QOF+	
		AOR	(CI)	AOR	CI
Age group	<21	2.98***	1.85-4.80	1.37	0.34-5.54
	21 to 30	1.55***	1.34-1.79	0.52**	0.32-0.84
	31 to 40 [$]	1.77***	1.55-2.02	0.82	0.50-1.33
	40+	1.14	0.78-1.67	0.11	0.01-1.24
Ethnic group	White	1.59***	1.41-1.80	0.52**	0.35-0.78
	Black	2.15***	1.61-2.88	1.09	0.38-3.14
	South Asian	2.26*	1.20-4.26	0.54	0.03-9.04
	Mixed	1.51	0.82-2.78	0.20*	0.04-0.96
	Other	1.57**	1.18-2.10	0.93	0.27-3.20
	Not stated	1.76***	1.39-2.24	1.42	0.65-3.14
Deprivation level	Least	1.60***	1.35-1.89	0.55	0.28-1.08
	Middle	1.79***	1.53-2.09	1.21	0.70-2.09
	Most	1.63***	1.40-1.91	0.41**	0.24-0.68

[1]AOR for outcome for each group post-QOF+ compared with pre-QOF+ (adjusted for age group, ethnicity, IMD and practice clustering); ‡ = results from the multiple logistic regression analysis for smoking advice omitted due to small numbers

Table 18 shows the relative chance of benefitting from the introduction of QOF+ for pregnant women in different age groups, ethnic groups and deprivation levels, in each case adjusted for the other variables and for practice clustering. As previously found with the primary prevention study in Chapter 7, there were statistically significant improvements for almost all age groups and ethnic groups, and for all levels of deprivation, so exceptions are described in the paragraphs below.

Smoking status

Women aged under-21 years saw the greatest improvements in recording of smoking status (AOR 2.98, CI 1.85 to 4.80, $p<0.001$) of all the age groups. Women over 40 years had similar levels of ascertainment before and after the introduction of QOF+, as did women from the Mixed ethnic group.

Smoking prevalence

Only women aged 31 to 40 years had significantly reduced their smoking rates in the post-QOF+ period compared to the pre-QOF+ period. Women from most ethnic groups were smoking at similar levels pre/post-QOF+ with the exception of White women and those with Mixed ethnicity (AOR for White women 0.52, CI 0.35 to 0.78, $p<0.001$; AOR for Mixed ethnicity 0.20, CI 0.04 to 0.96, $p<0.05$). Women in the most deprived areas had significantly reduced their smoking rates (AOR 0.41, 0.24 to 0.68, $p<0.05$).

Smoking advice

The within-groups multiple logistic regression analysis results have not been reported as many groups were dropped from the analysis due to small numbers.

Key points

The introduction of QOF+ was associated with an increase in the proportion of pregnant women whose smoking status was ascertained at the booking appointment. However, the financial incentive did not affect existing disparities. For example, younger women and White patients were less likely to be asked about smoking both before and after its introduction.

There were relatively low rates of ascertainment of smoking status and advice given to smokers on the booking date compared with rates of recording in the 27 months prior to the booking appointment (of up to 92% post-QOF+), which may be explained by recording error.

Smoking prevalence among pregnant women fell after the introduction of QOF+, although younger women were still more likely to smoke than other age groups after the introduction of QOF+. The numbers of smokers were too small to pick up differences in rates of smoking between different ethnic groups, and women from more deprived areas were still more likely to smoke than those from more affluent areas. The proportion of those pregnant women who smoked given advice increased from 29.5% to 50.0% and advice was provided largely equitably.

Strengths and weaknesses of the study

This study has similar general strengths and weaknesses as those discussed in Chapter 7, with a few specific points. Results were based on outcomes recorded in the medical record over the 33 months prior to the introduction of QOF+ and the 33 months after the introduction of QOF+, the duration of funding for QOF+, so practices would have had the same amount of time to achieve smoking outcomes before and after the introduction of QOF.

The numbers of patients were much smaller than in the main studies, particularly the numbers of smokers. Therefore, the multiple logistic regressions for smoking cessation advice were underpowered with many groups being dropped from the analyses.

Rates of recording of smoking status and advice to smokers were lower than in the main QOF+ studies. Some of this can be explained by the more exacting requirement under QOF+ business rules for these outcomes to be recorded on the day of booking. However, I also found that smoking prevalence for both baseline and follow up periods was lower than expected from APHO estimates using modeled data.

These findings may have been due to recording error. Some of the booking appointments would likely be undertaken by community midwives who were not so familiar with the templates on the EMR, or may have been using the patients' hand-held notes which is the usual practice for antenatal care, with the findings on smoking added to the EMR at a later date. It is also possible that clinicians may not have inputted smoking status on the day of booking if it had not changed from an earlier time. Finally as previously discussed, smoking status recorded in general practice is self-reported and not verified by CO reading or urinary cotinine, so subject to reporting bias, especially as some pregnant women who smoke may have felt uncomfortable admitting this to midwives or other clinicians.

My sample includes patients who would have been exception reported when calculating QOF+ payments. However, as for the Wandsworth study, this may provide a more complete picture of the delivery of cessation interventions in primary care.[232]

It is not possible to attribute changes in smoking outcomes to the financial incentive as this was an observational study, as previously described. However, this is the first time healthcare workers have been financially incentivised for providing smoking cessation advice to pregnant women in the UK, and as there was no change in tobacco policy during this time, so QOF+ may have had an effect.

Chapter 9: Discussion

Key findings

In my systematic review of financial incentives for smoking cessation activities in primary care I found that most studies examined process measures such as recording of patients' smoking status and recording whether smoking cessation advice had been given to smokers, or that smokers had been referred to smoking cessation services, or prescribed stop-smoking medication. For these measures, almost all of the studies showed statistically significant improvements following the introduction of financial incentives. Only three experimental studies examined the impact of financial incentives on quit rates, and these showed mixed results, showing no effect of the financial incentive alone, but improved quit rates when combined with practitioner training and cost-free nicotine-replacement medication. Although QOF studies showed reductions in prevalence following the introduction of the financial incentive scheme, the designs of the studies meant it was not possible to attribute the reduction to QOF.

Only three studies examined the effect of financial incentives on inequalities in smoking cessation activities in primary care and they were all QOF studies. McGovern et al in their study of patients with CHD found that patients over the age of 75 years were less likely to be offered advice compared with younger patients after the introduction of QOF, as were women compared with men.[196] Millett et al in their study of patients with diabetes found that women were more likely to have their smoking status recorded after QOF and less likely to smoke than men were but the reduction in smoking prevalence after QOF was brought in was less for women than men. McGovern et al found that women were more likely to be offered

advice than men. In another study, of patients with CHD, Millett et al found that patients from Black and Asian groups benefitted more from the improvement in smoking outcomes associated with QOF compared with white British patients.[177] However, there was no significant difference in the changes in smoking rates between most and least deprived groups, whereas McGovern et al found more deprived groups were more likely to be asked about smoking than more affluent groups. Given this gap in the literature, I aimed to examine the effect of financial incentives on inequalities in smoking cessation in my studies of smoking outcomes in Wandsworth, and Hammersmith & Fulham.

In the Wandsworth study I found that a large percentage of patients with CVD had their smoking status ascertained and, if smokers, received smoking cessation advice after the introduction of QOF. Although patients with respiratory disease were less likely to have their smoking status ascertained than those with CVD, smokers in both these disease groups received similar levels of advice. The rates of ascertainment and advice were considerably lower among patients in the depression group and the group without smoking-related diseases, which suggests that practices may have been concentrating their smoking cessation efforts on the chronic diseases associated with larger financial rewards within QOF in 2007 (as described in Chapter 3) and where the absolute benefits of smoking cessation might be seen as greatest. This variation may also be because patients with cardiovascular conditions, respiratory diseases, chronic kidney disease or diabetes are regularly reviewed in primary care and so staff may have more opportunity to discuss smoking. Other factors which may impact on the provision of smoking cessation more generally include lack of time to discuss preventive healthcare during the appointment (typically 10 minutes in UK primary care) and concerns amongst general practitioners that discussing issues such as smoking when patients present with an unrelated problems may be seen as intrusive or as 'nagging'.[239]

There was encouragingly little variation between ethnic groups in the provision of smoking cessation advice or referral, with the notable exception of black Caribbean men with depression, who were much less likely to receive such advice than white British men.

Patients with CVD had lower smoking prevalence than patients in the other groups, and were more likely to receive smoking cessation advice than the other groups, with the exception of those with respiratory disease who received similar levels of advice. The differences in smoking outcomes were most marked for the group without the smoking-related long-term conditions for which smoking cessation is maximally rewarded by QOF, reflecting QOF's focus on secondary prevention.

Patients with respiratory diseases had a higher smoking prevalence than those with CVD despite the equal emphasis by QOF and despite receiving similar levels of cessation interventions. Smoking rates among patients with depression were extremely high and they were much less likely to receive a cessation intervention. This is concerning given that smoking habits are particularly difficult for depressed patients to break even with support.[240] My findings confirm those of other authors who have found higher rates of smoking among individuals with mental health problems.[85 224]

Following on from the Wandsworth study, I wanted to focus on the effect of financial incentives on smoking cessation activities for primary prevention in primary care. I was able to do this using general practice data from Hammersmith & Fulham which allowed me to look at the impact of enhanced financial incentives through QOF+ on the delivery of smoking cessation interventions and possible effects on inequalities.

In the first QOF+ study, looking at a complete case cohort of patients without smoking-related conditions previously incentivised through national QOF, I found that the introduction of an enhanced financial incentive was associated with large increases in the proportion of

patients who had their smoking status ascertained (increasing from 62.3% to 75.8% in the complete case cohort). As the baseline figures for ascertainment are similar to those for patients without smoking-related diseases in the Wandsworth study of around 59%, the improvement after the introduction of QOF+ is strongly suggestive of an effect of the enhanced financial incentive.

There was some increase in the differences seen in smoking ascertainment between age groups before QOF+. For example, women under-30 years were less likely to be asked about smoking status after the introduction of QOF+ in the complete case cohort, but more likely to be asked in the open cohort sensitivity analysis. The open cohort included patients newly registering and it may be that women in this age group were more mobile, and more likely to be asked when registering at a general practice. Disparities in rates of ascertainment with ethnic group, with White patients being less likely to be asked than those from other ethnic groups, particularly for women, remained after the introduction of QOF+. Whereas ascertainment was equitable between different deprivation groups prior to the introduction of QOF+, the more deprived groups were somewhat less likely to have smoking status recorded after its introduction.

Smoking rates were lower after the introduction of QOF+ compared with the pre-QOF+ period (reducing from 20.0% to 16.2%). However, existing differences in smoking prevalence with respect to age, ethnicity and deprivation remained after the introduction of QOF+, and results were similar in the sensitivity analysis. The design of this study means it is not possible to attribute reduction in smoking prevalence directly to QOF+. There had not been any radical change in tobacco policy over the study period (the ban on smoking in public places had been introduced earlier, in 2007), although in 2008 NICE published guidance to local authorities in providing smoking cessation services with a focus on manual

workers, pregnant women and 'hard to reach' groups.[241] It is possible that the focus on asking patients about smoking who would not normally have been targeted by National QOF may have had an effect.

Rates of recorded smoking advice to smokers increased hugely after the introduction of QOF+ (increasing from 35.4% to 54.0%). Advice appeared to have been provided largely equitably across the different demographic groups. Women under-30 years were more likely to be given advice then those aged 30 to 49 years.

Looking at the within-groups comparisons in the main study, most groups benefitted from the introduction of QOF+ across all outcomes. Exceptions included men aged over-70 years for recording of smoking status, and both men and women over-70 years for whom outcomes were similar before and after the introduction of QOF+ for smoking prevalence and advice to smokers. The youngest patients and South Asian patients had the greatest increase in the chance of being asked about smoking after the introduction of QOF+. White patients, those with unstated ethnicity and women with Mixed or Other ethnicity saw the greatest reductions in smoking prevalence after the introduction of QOF+, although overall were more likely to smoke than other ethnic groups. South Asian and Mixed patients, and Black women had similar levels of advice before and after the introduction of QOF+ whereas all other groups had much improved rates of advice after its introduction.

In the second QOF+ study, looking at the effect of the financial incentive on smoking indicators for pregnant women booking for antenatal care in primary care, I found that the introduction of a financial incentive was associated with an increase in the proportion of pregnant women whose smoking status was ascertained at the booking appointment (increasing from 65.5% to 77.1%). Higher rates of ascertainment were found both before and after the introduction of QOF+ if the time period 27 months prior to booking is examined (up

to 92% post-QOF, Appendix B). This may reflect recording error, either because midwives were not used to the EMR, or they used paper records and the data were transferred to the EMR at a later date, or other clinicians did not update the record on the booking date when they saw that smoking status had previously been recorded, if it had not changed. The financial incentive did not appear to affect existing disparities. For example, younger women and White patients were less likely to be asked about smoking both before and after its introduction.

Smoking prevalence among pregnant women were also lower following the introduction of QOF+ compared with the pre-QOF+ period (smoking rates dropped from 2.7% to 1.8% among those whose smoking status was ascertained at booking). These figures are lower than expected from APHO estimates and may reflect under-recording as previously discussed. However, when smoking codes during the 27 months prior to booking were examined this gave a prevalence of 10.5% pre-QOF+ and 6.8% post-QOF+ and these are likely to be over-estimates as women are more likely stop smoking when they find out they are pregnant, although this varies with socio-economic status, with the most deprived women being less likely to stop than the most affluent.[242] Younger pregnant women were still more likely to smoke than other age groups before and after the introduction of QOF+. The numbers of pregnant smokers were too small to pick up statistically significant differences in rates of smoking between different ethnic groups following QOF+ despite rates varying from 0.4% in South Asian women to 3.7% in women with unstated ethnicity. Women from more deprived areas were more likely to smoke than those from more affluent areas at both time points.

The proportion of pregnant women who smoked who were given advice also increased following the introduction of QOF+, from 29.5% to 50.0% and advice was provided largely equitably between groups. Although, it is not possible to attribute these positive changes

directly to QOF+, as previously described, this is the first time healthcare workers have been financially incentivised for providing smoking cessation advice to pregnant women in the UK. However, the reduction in smoking prevalence likely reflects the existing downward trend as prevalence was calculated on the date of booking for antenatal care.

For the within-groups comparison in the pregnant women study, most groups benefitted from the introduction of QOF+ in their chance of being asked about smoking, with the exception of women aged over-40 years and those with Mixed ethnicity. Pregnant women aged 21 to 30 years saw the greatest reduction in smoking prevalence, as did White women and those with Mixed ethnicity, and those from the most deprived areas. Smoking advice rates improved the most for women aged 21 to 30 years and women with unstated ethnicity, and the least for women in the most deprived areas, but as the numbers of smoking pregnant women were small several groups were dropped from the analysis.

Previous research

The findings from my systematic review confirm with those from other systematic reviews showing that financial incentives tend to improve the recording of process measures in smoking cessation,[138 184 190] but my study identified a larger number of studies in addition to those identified by previous authors as the review was more recent and because as I included observational studies in the review. In my studies using primary care data from Wandsworth, I found that the recording of smoking status for patients with cardiovascular disease was 89%, 72% for respiratory disease and 60% for depression and other conditions. Other QOF studies have shown similarly high levels of recording for smoking-related conditions after the introduction of QOF. For those that looked at all registered patients recording levels were lower (39% in 2005 in the paper by Coleman et al[160], 79.5% in 2010 in Simpson et al's paper[181]) probably because of the lower incentives provided for primary prevention in

patients without smoking-related chronic diseases, or because patients in this group were less likely to attend the general practice for routine appointments.

In the Hammersmith & Fulham studies where I was able to compare outcomes before and after the introduction of QOF+, I found improvement in the percentage of patients asked about smoking of 13.5% in the main study (from 62.3% to 75.5%) and 18.6% in the study with pregnant women (from 65.7% to 77.1%). These improvements seen in the H&F studies are at the lower end of improvements in recording seen in the before-and-after QOF studies identified in the systematic review, which ranged from 19%[194] to 52%.[198] However, I studied only patients without smoking-related illnesses who might not attend their GP surgery for other reasons when smoking could be discussed, whereas other studies included either only patients with smoking-related diseases, or all patients, including those with smoking-related conditions.

Smoking prevalence reduced by 3.8% in the Hammersmith & Fulham main study (from 20.0% to 16.2%). These are similar to reductions seen by other QOF studies. For example, Millett et al found a 3.8% reduction in smoking prevalence in their study of patients with diabetes (from 20.0% in 2003 to 16.8% in 2005).[180] Simpson et al found a reduction of 6% in their study of all registered patients (from 28.4% in 2001/2 to 22.4% in 2006/7).[181] Although the 0.9% reduction in prevalence among pregnant women (from 2.7% to 1.8%) was smaller than for QOF studies looking at either all patients or groups with chronic diseases, the prevalence among pregnant women was small to start with and there were no studies identified in the systematic review looking at the effect of financial incentives on pregnant women with which to compare the change in prevalence.

Rates of advice recorded in the Wandsworth study were between 80% (for patients with depression) and 93% for those with cardiovascular conditions). Similar rates of advice were

seen in the QOF studies identified in the systematic reviews, but lower rates for the trials and before-and-after studies in other setting. For example, Chang et al found rates increased by 5.6% to 26.8% after the change in financial incentive in Taiwan.[201] Rates of advice increased by 18.6% in the Hammersmith & Fulham main study (from 35.4% to 54.0%). This is somewhat higher than improvements in recorded smoking advice in other QOF studies, which varied between 12.2% in the study of patients with diabetes by Tahrani et al (from 83.8% in 2004 to 95.0% in 2006)[198] to 16.4% in the study by Campbell et al looking at patients with CHD, asthma and diabetes (from 80.6% in 2003 to 97.0% in 2005),[168], both published in 2007.

I found differences between different demographic groups for smoking outcomes. Patients from ethnic minority groups were more likely to be asked and advised about smoking on the whole than White patients, and were less likely to smoke, but received relatively equitable rates of stop smoking advice. The main exception to this was that Black Caribbean men with depression had higher rates of smoking and were less likely to receive smoking cessation advice.

The Wandsworth study examined differences in smoking outcomes by disease group and ethnicity, stratified by gender and adjusted by age group, deprivation and practice size so did not specifically examine differences between patients in different age group or deprivation levels. The Hammersmith & Fulham studies, although also stratified by gender, did look at differences with age and deprivation as well as ethnicity. Similar outcomes were found for ethnicity in these studies as for Wandsworth but I found additional differences with the other variables. For instance, in the complete case cohort, patients over-70 years were more likely to be asked about smoking and those under-30 years were less likely, but patients in both the age groups were less likely to smoke than those aged 30 to 49 years and that did not change

with QOF+, whereas pregnant women under-21 years were much more likely to smoke than those aged 31 to 40 years. Patients from more deprived areas were also more likely to smoke than those from the least deprived areas before and after the financial incentive.

Other researchers have found similar differences after the introduction of national QOF on inequalities. For example, Millett et al examined differences with ethnicity in the likelihood of patients with CHD being asked about smoking pre/post-QOF and found a greater improvement for South Asian patients compared with white British patients.[177] In another study of patients with diabetes, Millett et al found variations in outcomes with respect to gender, age and ethnicity after the introduction of QOF.[180] Improvements in the recording of smoking status were greater for women compared to men and for ethnic groups (except Bangladeshi) compared with white British patients. McGovern et al in their QOF study of patients with CHD found that older patients were less likely to be asked about smoking pre-QOF but after the introduction of QOF this difference was attenuated.[196] They found that people from more deprived areas benefitted more than those from the least deprived. They also found that female smokers were more likely to be offered advice compared with males. However, smokers over the age of 75 years were less likely to be offered advice compared with younger smokers.

My findings regarding inequalities in smoking prevalence and advice across ethnic groups have confirmed those of Lyratzopoulos et al[243] who studied UK primary care patients attending for cardiovascular risk screening and found that South Asian patients were significantly less likely to smoke than people of other ethnicities. However, these findings, and those in my study, may mask differences in risk factors within the South Asian group. For instance smoking rates being higher among Bangladeshi and Pakistani men compared with Indian men, as shown in the Wandsworth study and also in research by Bhopal et al.[244]

[245] In addition, the results of my studies are similar to those from a recent study that examined ethnic group differences in smoking prevalence using data from the Health Survey for England. [228] This found higher smoking rates among Bangladeshi and black Caribbean men and I found this to be the case for black Caribbean men with depression and black Caribbean and Bangladeshi men in the group without these chronic diseases. The authors also found that white British and black Caribbean women are more likely to smoke than women from other ethnic groups and my findings in both studies confirmed this. A recent US survey found non-Hispanic white people were more likely to smoke than those from other ethnic groups but there was little variation between ethnic groups in the chance of being offered smoking cessation advice.[246-248] My results confirm research looking at process measures of care, which found provision of smoking cessation advice to be fairly equitable by ethnic group.[177 178 249]

Several researchers have documented the trend of reduced prevalence of smoking in pregnancy[250-253] and my findings confirm this. There has been very little research looking at variation in smoking prevalence by ethnic group in pregnancy. One report produced by the US Centers for Disease Control and Prevention in 2001[254] noted declines in all ethnic groups but that smoking rates were highest for American Indians and non-Hispanic Whites, and among pregnant teenagers. Similar finding were also reported by Salihu et al.[255] There has been more research on differences with socio-economic group. For instance, Penn found higher rates of smoking among less educated pregnant women and those in unskilled manual or unemployed groups.[252] Mohsin et al in their study in New South Wales, Australia, found greater reductions in smoking among more affluent pregnant women from more compared with those from more disadvantaged backgrounds.[251] I did not find any papers examining the effects of financial incentives on smoking cessation work with pregnant women.

Strengths and limitations

I utilized a broad search strategy for the systematic review and hence was able to identify a large number of studies to include. Most of these were evaluations of the UK QOF and showed improvement in the recording of smoking status and advice given to smokers. However, only a few studies examined quit rates, and these showed more of an effect when financial incentives were provided along with practitioner training and free or subsidized smoking-cessation medication. The QOF studies showed a drop in smoking prevalence, but could not take into account changes resulting from tobacco control policy occurring over the study period. I was not able to determine an optimum quantity for the financial incentive due to the variation in amount over all the studies. There was only one cost-effectiveness study identified but this showed that the addition of a financial incentive was beneficial as long as it was accompanied with GP training and subsidized stop-smoking medication.

In the Wandsworth and Hammersmith & Fulham studies, I was able to analyse data from a large number of patients registered at general practices in two ethnically diverse areas of London with relatively complete ethnicity coding. The findings may be generalisable to other health systems with universal coverage that provide financial incentives for prevention activities. All practices in the study used electronic medical records to record clinical information.

The data on recording of advice given to smokers in the Wandsworth study may have been subject to recording bias in that patients with conditions not incentivised by the version of QOF in 2007 might have received smoking cessation advice but this advice may not have been coded. I was also unable to determine the quality of advice given, as these data were not available.

Similarly, there may have been a recording bias in the Hammersmith & Fulham study of pregnant women. Rates of recording of smoking status and advice to smokers were lower than in the main QOF+ studies. Some of this can be explained by the more exacting requirement under QOF+ business rules for these outcomes to be recorded on the day of booking. However, smoking prevalence for both baseline and follow up periods was lower than expected from APHO estimates. Some of the booking appointments would have been undertaken by community midwives who might not be familiar with the templates on the EMR, or may have recorded outcomes in the patients hand-held notes with the results added to the EMR at a later date. General practice clinicians may not have inputted smoking status on the day of booking if it had not changed from an earlier time.

My samples for all the studies included patients who would have been exception reported when calculating QOF or QOF+ payments. Although the number increased following the introduction of the financial incentive the numbers were small and in any case may provide a more complete picture of the delivery of cessation interventions in primary care.[232]

I was not able to judge the quality of advice given in both the Wandsworth and the Hammersmith & Fulham studies, as these data were not available in either dataset. I was also unable to determine quit rates, as these are not specifically coded on patients' EMRs. However, the drop in prevalence is suggestive of an effect. Smoke-free legislation was introduced into England from 1 July 2007, and this may have impacted on the results observed in the Wandsworth study. However, there was no change in national tobacco control policy during the Hammersmith & Fulham study, although guidance to local authorities on smoking cessation was published in 2008.

The numbers of patients in the second Hammersmith & Fulham study of pregnant women were much smaller than in the main studies, particularly the numbers of smokers. Therefore,

the multiple logistic regressions for smoking cessation advice were underpowered and differences in advice rates between groups were not statistically significant.

I found that smoking prevalence overall was different in both areas than that expected from modeled estimates by the Association of Public Health Observatories. However, as discussed in the individual studies, such modeled data do not take into account local initiatives for smoking cessation. Estimates are based on the social and demographic characteristics of an area and are not age-standardised. Prevalence estimates based on general practice data may be more relevant at the local level but may be out of date for patients who attend infrequently. In addition, smoking status is self-reported and not verified by CO reading or urinary cotinine.

It is not possible to attribute changes in smoking outcomes to the financial incentives in any of the studies as they were observational studies. More robust methods to evaluate the impact of QOF such as randomised controlled trials were not possible as QOF was brought in nationally. I had hoped to compare data from Hammersmith & Fulham with national data from the GP Research Database (GPRD) but did not have access to GPRD data within the time available for the PhD. However, previous research suggests marked improvement in smoking and other outcome measures were associated with the introduction of QOF,[233 234] and that this may also have affected ethnic groups differently.[235] Also, for the pregnant women study, this is the first time healthcare workers have been financially incentivised for providing smoking cessation advice to pregnant women in the UK, and there was no change in tobacco policy during this time, so QOF+ may have had an effect.

Financial incentive schemes can have unintended outcomes as described in Chapter 3, including gaming,[215] adverse patient selection,[216] and relative neglect of unrewarded activities.[217] I did not examine these outcomes in my studies.

Implications for policy and practice

My research has shown that enhanced financial incentives in primary care for smoking cessation are associated with increased recording of smoking status and advice to smokers. However, whether this reflects more people being asked and advised or just better recording made possible through investment in computer systems and data entry is unclear.[173] Financial incentives appear to be associated with reductions in smoking prevalence and this happens even for people without smoking-related diseases. There is also some effect on reducing inequalities in smoking cessation. Reducing smoking prevalence in all groups will have a large population impact on health outcomes, but from the Marmot review and Whitehall studies we know that efforts need to continue to reduce prevalence among disadvantaged groups in order to reduce health inequalities.[46] This provides a compelling reason for extending these incentives for smoking cessation for primary prevention within national QOF indicators and making additional incentives available for targeted smoking cessation work for hard to reach groups, such as with people severe mental health problems. Now that Public Health England is due to oversee the public health domain of QOF then further incentives for prevention work should be considered, and within this, a focus on smoking cessation work for high prevalence groups to reduce inequalities. As smoking is the most important cause of premature mortality and inequalities in health it is important that this indicator is not considered for removal from national QOF in the future, even if maximal levels of achievement are reached (as shown for cardiovascular disease in my Wandsworth study) as there tends to be a fall-off in achievement when indicators are removed.[256]

Policy makers should be aware that few cost-effectiveness studies on financial incentives have been undertaken in the UK and that such incentives need to be continued long-term to

avoid the drop off effect described in the literature. We also need to see what the effect is of rewarding relative improvements or reducing inequalities rather than solely rewarding absolute achievement as is currently the case. Although I found low rates of exception reporting in my studies, QOF targets may become more exacting in future, as recently announced by the Department of Health,[257] so we also should regularly review exception reporting to ensure that patients who are harder to reach continue to receive smoking cessation advice and referral.[173]

Although population level tobacco control interventions have been shown to have a bigger impact on quit rates than individual level smoking cessation treatment,[183] NHS smoking cessation services have been shown to be effective[107 108] and to reduce health inequalities by improving the proportion of smokers from more deprived areas who quit, even though people from this group find it more difficult to quit than those from more affluent areas.[6] As around 80% of the population is estimated to visit their GP each year, even asking about smoking can improve quit rates.[116] Encouraging smoking cessation work in primary care through financial incentives should improve rates further and translate to a large public health impact.

There has been little research into the impact smoking cessation advice in primary care can make on inequalities. My research shows that specific groups such as young people, people with severe mental health problems, and people from more deprived areas seem to benefit less from financial incentives for smoking cessation. These groups may require case-finding and more tailored interventions.[59] However, my study only included people registered with GPs so it is possible that health inequalities will widen for those living at the margins (such as migrants not entitled to routine primary care and the homeless). A concern is that financial incentives can exacerbate socio-economic inequalities as more affluent patients tend to access and benefit from public health interventions more readily than more deprived patients, the so-called 'Inverse Equity Hypothesis,' postulated by Victora et al.[258] This hypothesis

distinguishes between short term possible increases in disparities and longer term reductions as interventions diffuse into poorer groups

The systematic review showed evidence for the effectiveness of financial incentives on quit rates was mixed and I was not able to examine this, as quit rates are not recorded in primary care. Better data linkage with NHS smoking cessation services could improve monitoring of quit rates and then general practice data could contribute more usefully to national smoking cessation statistics.

This research has also shown that local versions of QOF may be effective in meeting the needs of the local population. However, they are vulnerable to the current financial climate and shown by the discontinuation of QOF+ when efficiency savings were needed in Hammersmith & Fulham.

There may be implications for workload if financial incentives for smoking cessation are extended to primary prevention. Ascertainment of smoking status could be made by telephone and internet brief intervention may suit some patients better than face-to-face advice.[259] Personalised text messaging support is an effective and cost-effective means of delivering smoking cessation advice. Free et al have examined the effect of an automated text-messaging cessation programme called 'txt2stop' in an large RCT, with six-month follow up and found significantly improved quit rates in the intervention group compared with the control group (10.7% intervention group vs 4.9% control group, relative risk 2.20 (CI 1.80 to 2.68), $p<0.0001$).[260]

My research shows an additional effect of financial incentives, with their associated improvements in computer records and templates, on improved ethnicity coding. This should allow local authorities to focus on ethnic groups with high smoking prevalence, such as Bangladeshi and Pakistani men, for tailored smoking cessation advice. It may also help

improve other services for ethnic groups by contributing to joint strategic needs assessments. Ongoing follow-up evaluation of QOF needs to continue to see if inequalities improve long-term.

Future research

The systematic review should be repeated regularly to pick up new studies examining the effect of financial incentives on smoking cessation work in healthcare. It will also be useful to determine whether smoking outcomes change if incentives are changed or discontinued, as Lester et al have found that performance falls off when this occurs.[256]

I would suggest conducting further research using time trend analysis for follow up of smokers to see the impact of financial incentives on smoking outcomes overall and among different demographic groups to examine the inverse equity hypothesis. I would also like to compare Hammersmith & Fulham data with GPRD data, or other boroughs similar to Hammersmith & Fulham, over the same time period to look for the difference the local smoking cessation incentives have made as a comparison group is lacking in the studies carried out so far. Linking QOF and QOF+ data with HES data and incorporating statistical modeling would be helpful to examine the impacts of financial incentives for smoking on longer-term outcomes such as myocardial infarction, stroke and TIA.

My systematic review and those of other authors have identified a lack of cost-effectiveness studies for financial incentives for smoking cessation work. These should be carried out as a priority.

Qualitative research on health practitioners' views of the of QOF, or any pay for performance scheme, on its impact on the nurse-patient or doctor-patient relationship (both on attention to

the patient given the reliance on the computer and recording of information, on concerns about potentially hijacking the patient's agenda in the consultation in order to gain QOF points), would be interesting areas of investigation. Qualitative research with practitioners, patients and extracting text portions of the EMR associated with the recording of smoking status and advice for smokers may help determine the quality of advice given in primary care, which I was unable to examine in my studies.

Conclusions

Financial incentives are associated with large improvements in the ascertainment of smoking status and recording of advice to smokers. This is most evident among patients with smoking-related diseases when no comparable incentive is provided for achieving smoking indicators for patients without these diseases. However, when specific incentives are provided for primary prevention a similar improvement in smoking outcomes is seen. For pregnant women this improvement also holds, although the numbers of pregnant women who smoke are small and the impact of a financial incentive may have been made prior to the women attending for their booking appointments.

Disparities with respect to age and ethnicity persisted after the introduction of financial incentives for smoking cessation. These disparities are most obvious for the youngest and the oldest patients, for White patients, and for those ethnic groups with particular conditions, most notably black Caribbean men with depression.

Financial incentives for smoking cessation work in primary care have a part to play in the prevention of smoking related diseases. They may improve outcomes when combined with NHS smoking cessation services and subsidised access to nicotine-addiction treatments such as NRT, Bupropion and Verenicline. However, tobacco control policies may have a bigger impact overall. Increasing the price and availability of tobacco products has been shown to

dissuade young people from taking up smoking in the first place. The same measures can contribute to reducing the health gap between rich and poor by prompting cessation in people from more deprived areas where health outcomes are worst.

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Appendix A: Downs and Black checklist for measuring study quality

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Score 1 for 'yes', 0 for 'no' or 'unable to determine', except item 5 (see below)

Reporting

1. Is the hypothesis/aim/objective of the study clearly described?

2. Are the main outcomes to be measured clearly described in the Introduction or Methods section?

3. Are the characteristics of the patients included in the study clearly described?

4. Are the interventions of interest clearly described?

5. Are the distributions of principal confounders in each group of subjects to be compared clearly described? (Yes = 2, Partially = 1, No = 0)

6. Are the main findings of the study clearly described?

7. Does the study provide estimates of the random variability in the data for the main outcomes?

8. Have all important adverse events that may be a consequence of the intervention been reported?

9. Have the characteristics of patients lost to follow up been described?

10. Have actual probability values been reported?

External validity

11. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?

12. Were those subjects who were prepared to participate representative of the entire population from which they were recruited?

13. Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?

Internal validity - bias

14. Was an attempt made to blind study subjects to the intervention they have received?

15. Was an attempt made to blind those measuring the main outcomes of the intervention?

16. If any of the results of the study were based on 'data dredging', was this made clear?

17. In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls?

18. Were the statistical tests used to assess the main outcomes appropriate?

19. Was compliance with the intervention/s reliable?

20. Were the main outcome measures used accurate (valid and reliable)?

Internal validity - confounding (selection bias)

21. Were the patients in different intervention groups (trial and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?

22. Were the patients in different intervention groups (trial and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?

23. Were study subjects randomised to intervention groups?

24. Was the randomised intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?

25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?

26. Were losses to follow-up taken into account?

Power

27. Did the study have sufficient power to detect a clinically important effect whwere the probability value for a difference being due to chance is less than 5%? (Modified from original paper to 1 if a sample size calculation had been reported and 0 if it had not)

Appendix B: Alternative analysis for smoking in pregnancy study

Table 1: Patient characteristics associated with having smoking status ascertained at or within 27 months of booking before and after the introduction of QOF+

		Smoking status ascertained at or <27 months of booking (Pre-QOF+)			Smoking status ascertained at or <27 months of booking (Post-QOF+)		
		N	%	AOR (CI)	N	%	AOR (CI)
Age group	<21	197	80.20	0.58*** (0.40-0.83)	206	85.44	0.52** (0.32-0.86)
	21 to 30	1481	88.25	0.79** (0.66-0.94)	2286	91.60	0.75** (0.63-0.90)
	31 to 40 $	2401	90.34	1	3654	93.32	1
	40+	305	88.85	1.00 (0.72-1.40)	446	90.36	0.71 (0.49-1.03)
Ethnic group	White $	2130	92.16	1	3977	91.78	1
	Black	444	93.02	1.3 (0.83-2.03)	779	95.38	2.15*** (1.47-3.15)
	South Asian	98	96.94	2.63 (0.87-7.93)	285	96.49	2.84* (1.19-6.79)
	Mixed	93	89.25	0.8 (0.37-1.72)	180	92.22	1.18 (0.72-1.92)
	Other	433	96.54	2.88** (1.54-5.39)	870	96.09	2.49** (1.49-4.20)
	Not stated	1186	78.67	0.34*** (0.25-0.46)	501	82.44	0.45*** (0.36-0.58)
Deprivation †	Least $	1415	90.46	1	2026	92.89	1
	Middle	1496	89.04	0.99 (0.70-1.41)	2284	92.73	0.96 (0.74-1.24)
	Most	1373	88.13	0.89 (0.63-1.25)	2151	91.17	0.72* (0.56-0.93)
Total N		**4384**	**89.07**		**6592**	**92.28**	

N = denominator (number of registered pregnant women); % = percentage of pregnant women with smoking status ascertained; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (100 pre-QOF+; 131 post-QOF+; * = p<0.05; ** = p<0.01; *** = p<0.001

Effect of QOF+ on the recording of smoking status: AOR 1.07, CI 0.87 to 1.29, p=0.65

Table 2: Patient characteristics associated with having a smoking code of 'current smoker' at or within 27 months of booking pre/post QOF+

		Smoker at or <27 months of booking (Pre-QOF+)			Smoker at or <27 months of booking (Post-QOF+)		
		N	**%**	**AOR (CI)**	**N**	**%**	**AOR (CI)**
Age group	<21	158	25.32	3.90*** (2.42-6.28)	176	18.75	5.23*** (3.08-8.88)
	21 to 30	1,306	15.01	2.16*** (1.68-2.77)	2,094	10.70	3.05*** (2.39-3.90)
	31 to 40 $	2,167	7.20	1	3,410	3.90	1
	40+	127	7.01	1.01 (0.65-1.55)	403	5.21	1.43 (0.86-2.36)
Ethnic group	White $	1,962	11.82	1	3,650	7.62	1
	Black	413	5.57	0.29*** (0.18-0.45)	743	5.38	0.49* (0.28-0.86)
	South Asian	95	5.26	0.40* (0.16-0.96)	275	1.14	0.10** (0.20-0.47)
	Mixed	83	20.48	1.23 (0.76-2.02)	166	8.43	0.87 (0.49-1.54)
	Other	418	6.22	0.40*** (0.25-0.65)	836	4.67	0.49*** (0.36-0.65)
	Not stated	931	11.60	0.84 (0.64-1.09)	413	8.72	0.94 (0.59-1.50)
Deprivation†	Least $	1,280	6.72	1	1,882	4.73	1
	Middle	1,332	11.71	1.71*** (1.37-2.14)	2,118	7.27	1.38* (1.04-1.83)
	Most	1,210	13.72	1.97*** (1.41-2.75)	1,961	8.31	1.48** (1.16-1.89)
Total N		**3,902**	**10.53**		**6,083**	**6.76**	

N = denominator (number of registered pregnant women); % = percentage of pregnant women with smoking status ascertained; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD (83 pre-QOF+; 121 post-QOF+; * = p<0.05; ** = p<0.01; *** = p<0.001

Effect of QOF+ on smoking prevalence: AOR 0.62, CI 0.52 to 0.74, p<0.001

Table 3: Patient characteristics associated with smokers receiving cessation advice or referral at or within 27 months of booking pre/post QOF+

		Smoking status ascertained at or <27 months of booking (Pre-QOF+)			Smoking status ascertained at or <27 months of booking (Post-QOF+)		
		N	**%**	**AOR (CI)**	**N**	**%**	**AOR (CI)**
Age group	<21	40	27.50	1.57 (0.90-2.76)	33	57.58	1.59 (0.67-3.78)
	21 to 30	196	21.43	0.95 (0.75-1.35)	224	46.88	1.03 (0.70-1.51)
	31 to 40 $	156	23.72	1	133	46.62	1
	40+	19	31.58	0.97 (0.51-1.85)	21	71.43	2.90 (1.00-2.30)
Ethnic group	White $	232	20.26	1	278	48.56	1
	Black	23	39.13	1.04 (0.68-1.59)	40	50.00	1.12 (0.54-2.30)
	South Asian	5	0.00	0.54 (0.19-1.49)	4	25.00	‡
	Mixed	17	35.29	2.54*** (1.53-4.22)	14	45.86	0.72 (0.26-2.05)
	Other	26	30.77	0.85 (0.50-1.45)	39	41.03	0.79 (0.39-1.60)
	Not stated	108	24.07	0.78 (0.51-1.18)	36	63.89	1.79* (1.02-3.13)
Deprivation†	Least $	86	26.74	1	89	49.44	1
	Middle	156	21.15	1.11 (0.78-1.59)	154	46.75	0.94 (0.53-1.69)
	Most	166	23.49	2.65*** (1.76-4.00)	163	50.92	1.04 (0.58-1.84)
Total N		**411**	**23.36**		**411**	**48.90**	

N = denominator (number of registered pregnant women); % = percentage of pregnant women with smoking status ascertained; AOR = Adjusted Odds Ratio (adjusted for age group, ethnicity, IMD and practice clustering); CI = 95% Confidence Interval; $ = Reference group; † = missing IMD; (3 pre-QOF+; 5 post-QOF+; ‡ = dropped due to small numbers; * = p<0.05; ** = p<0.01; *** = p<0.001

Effect of QOF+ on advice to smokers: AOR 3.35, CI 2.15 to 5.22, p<0.001

Appendix C: Publications arising from this work

Publications arising directly from this work

Hamilton FL, Greaves F, Majeed A, Millett C. Effectiveness of providing financial incentives to healthcare professionals for smoking cessation activities: systematic review. *Tobacco control* 2013;22(1):3-8.

Hamilton FL, Laverty AA, Vamos EP, Majeed A, Millett C. Effect of financial incentives on ethnic disparities in smoking cessation interventions in primary care: cross-sectional study. *J Public Health (Oxf)* 2013;35(1):75-84.

These papers are reproduced on the following pages.

Publications related to this work

Hamilton FL, Bottle A, Vamos EP, Curcin V, Anthea, Molokhia M, et al. Impact of a pay-for-performance incentive scheme on age, sex, and socioeconomic disparities in diabetes management in UK primary care. *The Journal of ambulatory care management* 2010;33(4):336-49.

Vamos EP, Pape UJ, Bottle A, Hamilton FL, Curcin V, Ng A, et al. Association of practice size and pay-for-performance incentives with the quality of diabetes management in primary care. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne* 2011;183(12):E809-16.