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The Human and Economic Value of Pharmaceutical Innovation and Opportunities for the NHS

A Report for the Association of the British Pharmaceutical Industry

How Markets Work℠

PROJECT TEAM

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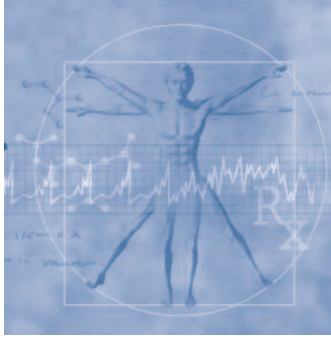
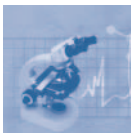




Summary and Conclusions

Innovation and the health care system

Innovation is vital in the health care system. Innovation can be about improving compliance with existing treatment regimes, bringing new ways of treating patients, providing their treatment more cost effectively, or expanding the boundaries of what can be treated. Innovation can come in many forms—new medicines, different devices, improved medical techniques and new processes.

Innovation and medicines

In this study we have focused on the value of innovation in medicines in the current and future treatment of two major disease areas for the UK, coronary heart disease (CHD) and Type 2 diabetes. Innovative medicines for CHD have included statins (to lower cholesterol) and, for diabetes, tight management of the levels of blood glucose (sugar) through the use of new medicines. The objective of this study is to bring together the information on the cost of CHD and diabetes, and to understand the value of new medicines in managing these diseases. In both cases, however, medicines are just one part of managing these diseases. It is acknowledged that other factors are important; the use of medicines generally needs to be complemented by changes in lifestyle including reducing smoking, increasing physical activity and adopting a healthy diet.

Innovative medicines and diabetes

Diabetes is a chronic disease characterised by raised blood glucose (sugar). The complications of diabetes include kidney failure, diabetic coma, eye disease and CHD. Some people with diabetes may need to inject insulin,for those who are needle phobic, this can cause anxiety and distress. There are also a variety of more routine day-to-day impacts, such as restrictions on driving (when diabetes is not well controlled) and higher premiums for life insurance, particularly because of the risk of complications. It is clear, therefore, that diabetes can have a significant impact upon the patient, both on their health and on more general activities.

Diabetes is a major concern, with around 1.4 million people in the UK diagnosed with diabetes. Over 80 per cent have Type 2 diabetes. However, it is thought that there are 1 million who suffer from Type 2 diabetes who are undiagnosed. Box 1 sets out key forecasts for the future.

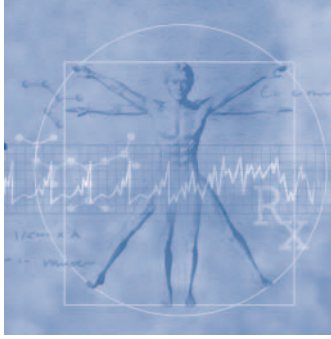
Box 1: Projections of the Number of People with Diabetes in the UK

1.4 million currently have diabetes in the UK.

- a simple forecast accounting for ageing leads to 1.8 million in 2027.
- adjusting for lifestyle changes (for example, over a quarter of all adults are likely to be obese in 2010) this could be 2 million in 2027.
- adjusting for an undiagnosed population could result in 3.9 million in 2027.

Source: NERA and NAO (2001)

Diabetes results in a significant cost to the UK, stemming from the reduced quality of life for those with diabetes, worry and concern for carers, a cost to the NHS, and a cost to the economy. Box 2 sets out the current cost from Type 2 diabetes in the UK.



Box 2: Current Costs of Type 2 Diabetes

Cost to Patients
Reduced quality of life for sufferers – complications can be serious and limit every-day activity. These can include eye disease, amputations, kidney disease and CHD.

Where patients with Type 2 diabetes report lost earnings as a result of their condition, the average loss is £14,000 per person per year.

Cost to Friends and Family
Concern and worry for friends and family.

Where carers of patients with Type 2 diabetes report losing earnings, the average loss is £11,000 per person per year.

Cost to the NHS
T²ARDIS CODE-2 UK

£1,738 to £1,505 per person with diabetes per year, of which:

£35 to £41 on oral medicines.
£273 to £298 on insulin.
£273 to £298 on primary care.
£721 to £545 on hospital admission.

Total: £2bn a year = 5 per cent of NHS resources.

Cost to Social Services
£2,450 per person a year for those using social services. Only 1 in 20 of those with diabetes use social services.

Cost to Economy
Sickness absence rate 2 to 3 times the rate of the general population. Higher absence is likely to be due to both a larger number of instances of absence as well as longer durations.

Source: GSK (2002), American Diabetes Association (2003), Olsson et al (1994), Škerjanc (2001)

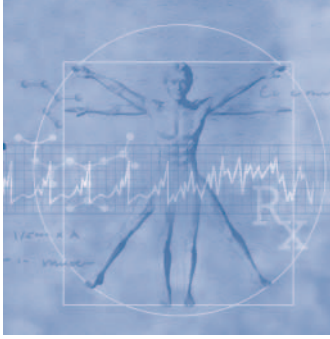
The rising number of people with diabetes is a major area of concern. Type 2 diabetes is generally a disease present in adults, but in 2002 the first cases of white adolescent Type 2 diabetes were discovered. As diet and lifestyles deteriorate this is likely to become more common. The long-term implications of this are not yet clear. It is a concern to patients who face reduced quality of life, and their carers who face considerable worry and concern about their loved ones.

Estimates suggest that diabetes costs the NHS some £2bn a year split across primary care and secondary care. This is around 5 per cent of total NHS resources, reflecting the relatively high cost of complications (such as kidney failure which may include dialysis). **The Department of Health (DH), the Scottish Executive and the National Assembly of Wales (NAW) have gone some way in addressing the management of people with diabetes** and the indirect costs imposed on society through a National Service Framework (NSF), produced in two parts (2000 and 2003) and respective regional strategies.

Two key themes included in the NSF are changing lifestyles and appropriate clinical management with medicines. Medicines are a crucial part of managing the current population with diabetes and unless there are marked improvements in current lifestyle trends (such as the rise in obesity and falling physical activity), medicines will continue to play a key role in the future. Whilst policies like the NSF are going some way to improving care for those with diabetes, recognised in the recent progress report (8th April 2004), there is still some way to go. There are further concerns about an **undiagnosed population**. The undiagnosed population could be as much as 1 million across the whole of the UK. **The NHS, therefore, still has some way to go in continuing to tackle this disease in the UK.**

The benefits of medicines for type 2 diabetes

Medicines can help to reduce the cost to patients, carers, the NHS and the economy, in conjunction with changing lifestyles. Proper management of diabetes with medicines can help to reduce or delay the onset of complica-



tions. Since the 1970s innovation in treating diabetes has included the move from single therapy to combination therapy with a combined oral pill likely to improve compliance and outcomes for patients. The benefits include reductions in the risk of heart attacks (individuals with diabetes are 2 to 4 times more likely to suffer from CHD), and avoidance of complications. **These are likely to be significantly valued by patients and carers alike.**

For the NHS, medicines can be used to **reduce the use of hospital resources**. The UK Prospective Diabetes Study (UKPDS) found that tight management of blood glucose levels (keeping fasting plasma glucose concentrations below 6 mmol/l) with medicines helps to reduce or delay the onset of diabetic complications. Tight management generates savings to the NHS acute care budget and is beneficial to patients and their carers. The cost of medicines to achieve the reduction in the onset of complications is largely offset by savings in other parts of the health system.

For the economy, medicines can **reduce sickness and absence**. Given the need for women to work longer (pensionable age is being increased on a phased basis from 60 to 65) and concerns about income in old age, enabling the population to continue working productively is a major benefit.

Box 3 sets out some of the key benefits of medicines for diabetes.

Existing medicines, as seen from Box 3, offer significant benefits in the treatment of diabetes. The pharmaceutical industry is also continuing to research and develop innovative medicines for diabetes. For instance, these include inhaled types of insulin that would not require injections and that are likely to be highly valued by patients (although rare, some people are needle-phobic). Inhaled insulin could also increase compliance, allowing the medicines to be used in a way that maximises their benefits.

Box 3: Benefits of Medicines for Diabetes

Benefits to Patients

Reduction and avoidance of complications, which are likely to be of high value to patients.

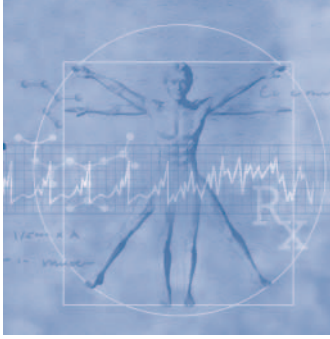
Benefits to the NHS

Diabetes currently costs the NHS some £2bn a year. Medicines can free up NHS resources from fewer complications. Relatively few people with diabetes are currently under tight management (keeping fasting plasma glucose concentrations below 6 mmol/1) using medicines. However, this tight management of blood glucose for the current population with diabetes could save some 380,000 bed days with the potential to treat some 78,000 patients per year by 2007. Going forward the potential for treating the current population with diabetes and new cases arising from ageing, lifestyle trends and better diagnosis could save some 600,000 bed days and treat an extra 130,000 patients per year by 2027.

Benefits to the Economy

Avoidance of sickness days for the benefit of the wider economy. Without tight management of diabetes the potential number of lost workdays is estimated to be around 6 million working days a year in 2002. This amounts to around £418m a year in direct financial terms to employers (which includes estimates of lost salary costs and replacement costs, and lost service or production time). Going forward, the potential cost could be some 9 million workdays or £650m in the year 2027. These costs almost double if the indirect costs to employers are included (such as the impact on quality of service and lower customer satisfaction).

Source: NERA and CBI



Innovative medicines and CHD

Coronary Heart Disease (CHD) is a chronic disease mainly characterised by angina (chest pain and shortness of breath) or heart attack. Despite falling mortality rates from CHD, it is still a major concern in the UK, with over 2 million people currently diagnosed. Box 4 sets out key forecasts for the future.

Box 4: Projections of the Number of People with CHD in the UK

2 million currently have CHD in the UK.

- a simple forecast accounting for ageing leads to 3.7 million in 2027.
- using a conservative adjustment of increasing prevalence of CHD by 5 per cent to account for lifestyle changes this could be 3.9 million in 2027.
- adjusting for an undiagnosed population could result in 4.7 million in 2027.

Source: NERA

The population with CHD results in a significant cost to the UK. This cost stems from the reduced quality of life for those with CHD (pain and discomfort which can limit everyday activities), the upset and anxiousness of family and friends, a cost to the NHS, and a cost to the economy. Box 5 sets out the current cost of CHD.

CHD mortality has been falling since the 1970s, thanks in large part to advances in science. Progress in surgery and new medicines have both played an important role. However the ageing of the population and lifestyle trends, including obesity, mean that CHD continues to be a major concern. A heart attack can lead to death or permanent damage to the heart.

CHD presents a major challenge to the NHS. CHD has been a major policy area for the Department of Health, the Scottish Executive and National Assembly for Wales, for example in England the National Service Framework to tackle CHD was created in 2000. The same themes underpinning the NSF for diabetes also apply to CHD, acknowledging the importance

Box 5: Current Cost of CHD

Cost to Patients

CHD is the one of the leading causes of mortality. More die from CHD in the UK than in several European countries.

Reduced quality of life for sufferers – angina includes pain and discomfort for sufferers which can limit everyday activity. Heart attack sufferers experience acute pain.

No estimate is currently available on the cost of lost earnings to sufferers.

Cost to the NHS

- £58m on primary care per year.
- £983m on A&E and hospital care per year.
- £559m on medicines per year.
- £138m on prevention, rehabilitation, community health and community social services per year.

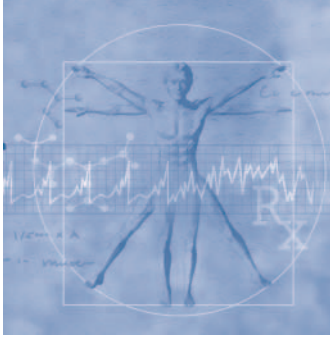
Total: £1.7bn a year = 4 per cent of NHS resources.

Cost to Economy

- Early death costs the economy the equivalent of 19 working days per man and 2 working days per woman with CHD a year.
- 25 sickness absence days per person with CHD a year.

Total: 330,000 working years per annum at a financial cost of £2.9bn.

Source: BHF Coronary heart disease statistics at www.heartstats.org and Liu et al (2002) and data correction, personal communication to NERA



of lifestyle changes and appropriate clinical management with medicines and surgery. CHD medicines are likely to play a key role in treating current patients whilst lifestyle changes are made.

Policies are already beginning to show strong benefits. For example, the National Primary Care Collaborative of 80 Primary Care Trusts has saved some 800 lives so far, using a chronic disease management approach of monitoring blood pressure, changing lifestyles and the appropriate use of medicines such as aspirin and statins. The Department of Health suggest that across the whole of England **some 6,000 lives have been saved by the use of statins**. This will rise as the number of people taking statins increases in the future.

However, there are concerns about an **undiagnosed population**. There could be a minimum of 1 undiagnosed case of CHD for every 4 diagnosed cases. **The NHS, therefore, still has some way to go in continuing to tackle CHD in the UK.** This is recognised by the most recent (24th March 2004) progress report on the NSF for CHD.

The benefits of medicines for CHD

Medicines can help to reduce the cost of CHD alongside changing lifestyles. Innovations for CHD include the development of better thrombolytics (clot busting medicines to restore blood flow to the heart following a heart attack) that can now be given to patients more than once. More recent thrombolytics increase the chance of survival and reduce permanent damage to the heart. Management of one of the risk factors for CHD, cholesterol, can be tackled with statins (licensed in the UK in 1989).

For the NHS, medicines can be used to **reduce the use of hospital resources**. Statins reduce the risk of heart attacks and strokes, which require hospitalisation. **For the economy** medicines can **reduce sickness and absence**. Women working longer and concerns about income in old age increase the importance of avoiding the costs to the economy from CHD. Box 6 sets out some of the key benefits from medicines for CHD.

Box 6: Benefits of Medicines for CHD

Benefits to Patients

Use of medicines such as aspirin, thrombolytics and statins, lengthens the life of CHD patients. It is estimated that a maximum of 12,500 deaths were avoided or postponed in England and Wales in the year 2000 alone.

Benefits to the NHS

Statins: Based on the UK based Heart Protection Study (HPS) only 58 people need to take statins to save 1 life. Statins help to prevent CHD and heart attacks by lowering cholesterol. The HPS study also found that those taking statins also have fewer heart attacks and strokes. Extrapolating from this study, the 1.5 million currently taking statins could avoid 30,000 heart attacks and 20,000 strokes over 5 years. This would avoid potentially serious consequences for patients including lasting impacts affecting every day activities. For the NHS this would avoid a minimum cost of £218m for hospitalisations over 5 years. This could free up 120,000 bed days a year which could treat some 24,000 extra patients a year. These savings do not offset the cost of statins (at around £3bn over 5 years, using current prices), but could save some 17,000 lives over 5 years.

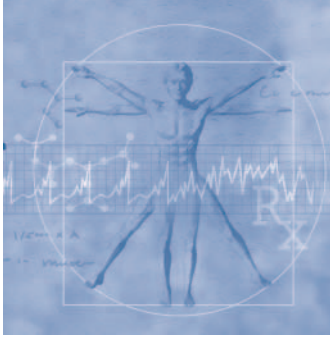
An estimated 1.2 million people* who could benefit from statins are not receiving them (reflecting a mix of people with CHD and those at risk of CHD who could benefit from lower cholesterol), wider use of statins for the 1.2 million people at risk and those with CHD, could save a further 14,000 lives.

Thrombolytics: Thrombolytics are clot-busting medicines which increase survival from a heart attack. Every minute of delay in receiving a thrombolytic leads to a loss, on average, of 11 days of life. Newer thrombolytics can be used repeatedly offering survival benefits to those who suffer from more than one heart attack. Thrombolytics, alongside changes in the way health services are organised, have contributed to falling heart attack mortality.

Benefits to the Economy

Medicines can also contribute to the avoidance of the cost to the economy. Using the costs per person of CHD from both premature mortality and sickness absence, projections suggest that the cost of CHD to the economy could be some £7.7bn in 2027.

Source: NERA, NAW (2001) and Unal et al (2004)
* NERA estimate based on MRC Press Release (2002)



In addition to the benefits from statins for those currently taking them, based on the HPS there are also thought to be around 1.2 million people who could benefit from statins who are not currently taking them. However, expenditure on statins is rising at 30 per cent a year suggesting that many more patients are now benefiting from statins in England. Nevertheless, a recent comparison of the use of statins in Europe found the UK behind some of its European neighbours. The UK had a rate of 23.86 daily doses per 1,000 covered population from 1997 to 2002, compared to the top rate of 59.28 daily doses per 1,000 covered population in Norway in 1997 to 2001. Treating the 1.2 million who could still benefit from statins, could save the lives of a further 14,000 people in the future.

The pharmaceutical industry is continuing to develop medicines to treat CHD. Around 120 new medicines are currently in development to tackle heart disease and stroke. One approach is to promote "good" cholesterol (of which the body needs a certain amount to function properly) by preventing "good" cholesterol turning into "bad" cholesterol.

Using innovations as important as developing them

Most stakeholders in health care view innovation as favourable but there are potential conflicts, most commonly with cost containment. Many innovations are cost saving and efficiency improving, delivering financial benefits to the NHS overall. Sometimes there are tensions where costs increase in one part of the health system to use the innovation (e.g. primary care), but savings are either realised elsewhere more immediately (e.g. secondary care which is the case with tight management of diabetes with medicines) or some time in the future. Other innovations may be cost increasing, yet still deliver benefits to patients and the health system that represent good value for money (e.g. statins). This is where organisations such as the National Institute for Clinical Excellence (NICE) have a role to play in helping to understand how the costs and benefits impact across the health service and patients.

What is clear, however, is that innovation has delivered significant value to the health system, and it is important to recognise that whilst encouraging innovation is fundamental, making sure health systems make best use of such innovations is an integral part of the process.

Introduction

Innovation in health care is important. It can take a variety of forms (innovation in medicines, medical devices, processes (such as where patients are seen in specialist outpatient clinics or in primary care)) and can generate many benefits. These can be benefits to patients (saving lives and avoiding the pain and anxiety from an illness and complications), to their carers (avoiding anxiety and worry), to the health system (savings in hospitalisations) and more broadly to employers and the economy (avoiding employee sick days). In this report, prepared by NERA for the Association of the British Pharmaceutical Industry, we look at the value of innovation in medicines and its relevance to patients and other stakeholders in health care. The objective of the study is to bring together the information on the cost of CHD and diabetes and to understand the value of current and future treatment in managing these diseases.

There have been countless new innovations in medicines over the past half-century, delivering many benefits to patients. To illustrate the value of innovation in medicines, we have focused on two case studies—Type 2 diabetes and Coronary Heart Disease (CHD) in the UK. Both diseases are a significant cost to the health care system and the economy, with substantial impacts on quality of life for patients and their carers. For example, those with diabetes can suffer from eye disease and those with angina (one type of CHD) can suffer uncomfortable chest pains. There are likely to be a growing a number of people with both diseases.

Medicines are one strand of a number of approaches to managing CHD and Type 2 diabetes. There are a range of lifestyle factors that can also help. Nevertheless, medicines have been shown to be effective in helping to manage the cost of both diseases. This comes through a variety of routes. **For patients**, the benefits of medicines includes saving lives by preventing

heart attacks caused by CHD and avoiding complications of diabetes. **For the NHS**, the benefits of medicines mean better management of conditions and preventing more costly complications and **for the wider economy**, it avoids days lost to sickness.

Section 2 focuses on Type 2 diabetes and Section 3 looks at CHD. In both, we look at the epidemiology of the disease and its prevalence, which for both is skewed towards the older population and certain ethnic groups, and geographically towards areas of high deprivation. Good management has a lot to contribute to tackling health inequalities. Early intervention is also beneficial to health systems and to patients. The National Service Frameworks (NSFs) for both diseases recognise these links. After assessing the cost of each disease looking forward, we then assess the role of medicines in management and treatment and demonstrate the impact on patients, the health system and the economy.

The Value of Innovation in Managing Type 2 Diabetes

The Epidemiology and Cost of Type 2 Diabetes

What is diabetes?

Diabetes is a chronic disease (a long standing illness). The disease is characterised by raised blood glucose (sugar) levels, which occur either because the body is unable to create cells that manufacture insulin (Type 1 diabetes) or because these cells do not respond to the insulin that is produced by the body, known as insulin resistance (Type 2 diabetes). The body needs the hormone insulin so that it can use glucose from food. Without this, glucose builds up in the body's bloodstream, leading to a variety of potential consequences. These are outlined in Figure 2.1 and can be either microvascular (diseases of the small blood vessels, eye disease such as retinopathy, glaucoma and cataracts, kidney disease, or macrovascular (CHD, cerebrovascular disease such as stroke, and peripheral vascular disease where blood vessels become restricted or blocked). Those with diabetes are at a significant risk of dying from cardiovascular disease including CHD. Diabetes can affect the patient in other ways, for example those with diabetes must inform the DVLA, although as long as their diabetes is under control they can continue to drive.[1] Those with diabetes may also face higher premiums for life insurance.[2]

Diabetes affects all population groups. Type 1 diabetes tends to become evident rapidly and it develops most frequently prior to adulthood. Type 2 diabetes is most commonly diagnosed in adults over the age of 40 and

[1] Diabetes UK (2003a)

[2] Diabetes UK (2003b)

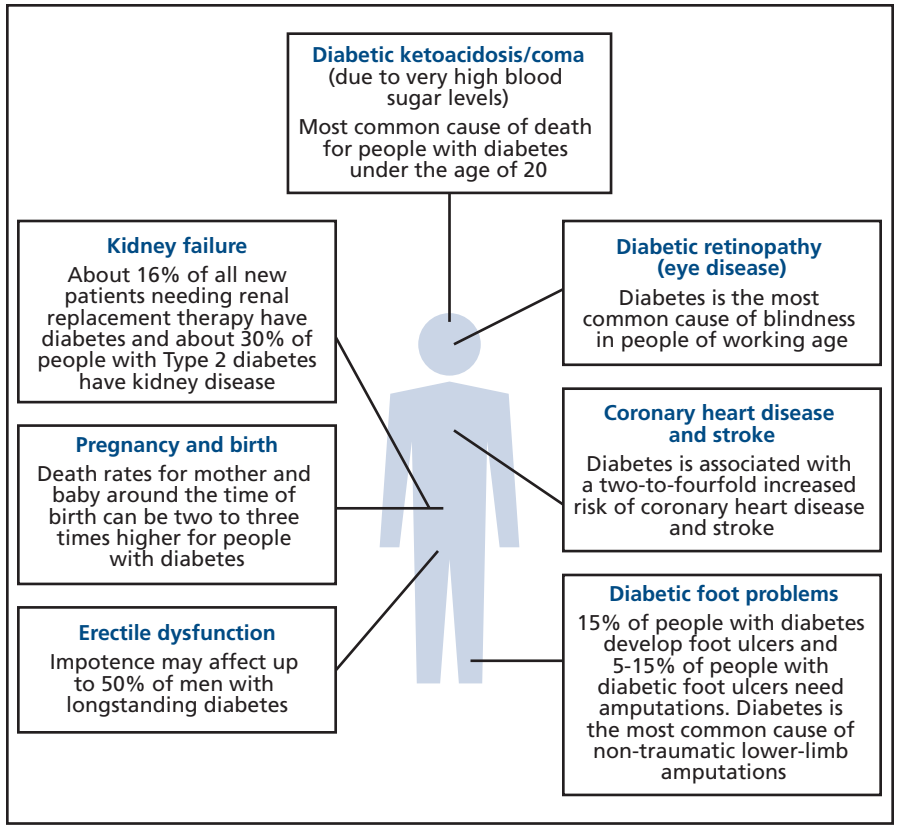


FIGURE 2.1 The Complications of Diabetes

Source: Audit Commission (2000) Testing times: a review of diabetes services in England and Wales

symptoms can often appear gradually. It is often diagnosed as part of a routine examination. It is thought that there is a significant pool of individuals with Type 2 diabetes who go undiagnosed.[3] The development of Type 2 diabetes is associated with unhealthy lifestyles and obesity and it is now starting to be seen in children and young adults.[4]

[3] Department of Health (2001)

[4] Department of Health (2001)

How many people suffer from diabetes?

The Audit Commission[5] suggests that around 1.4 million people in the UK are diagnosed with diabetes. Of this, over 80 per cent have Type 2 diabetes.[6] However, it is thought that there are many more people who suffer from Type 2 diabetes but who go undiagnosed. Estimates vary, but the Audit Commission suggest that up to half of all cases of diabetes go undiagnosed, so the true number of people with diabetes will be much higher than this. Many cases that are newly diagnosed have had Type 2 diabetes for a number of years and have already developed diabetic complications.[7] This implies considerable benefits from early intervention in preventing complications.

What is the cost of diabetes?

The cost of an illness can be measured in a number of ways. There are costs to the health service that, as suggested by the complications in Figure 2.1, are likely to be large in the case of Type 2 diabetes, there are costs to the individual and families, other calls on public expenditure (e.g. social services, support from state benefits) and costs to the broader economy (e.g. higher employee absence). Costs can be both financial and based around reductions in quality of life.

Figure 2.2 summarises the main costs of diabetes (including the costs of complications including heart attacks), based on recent cost of illness studies in the UK (T[2]ARDIS and CODE-2 UK).[8]

The cost of Type 2 diabetes to the NHS is estimated to be about £2bn per year (1999 estimate)—around 5 per cent of total NHS resources (including primary care by GPs and practice nurses and hospital care). Approximately 10 per cent of hospital resources are used treating patients with diabetes.[9] This reflects the cost of operations like amputations and complications including kidney failure, which may include dialysis. In per capita terms, this is equivalent to twice the average annual per capita health expenditure in the UK. For social services, it is estimated that in 1999 around £128m of social services expenditure was related to individuals with Type 2 diabetes (but only one in twenty patients are reported to use social services).[10]

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5 Audit Commission (2000)

6 Some estimates suggest that 90 per cent of patients with diabetes have Type 2 diabetes.

7 Department of Health (2001)

8 GlaxoSmithKline (2002)

9 Department of Health (2001)

10 GlaxoSmithKline (2002)

Quality of Life	• Those with Type 2 diabetes report significantly poorer quality of life then the general population, except in the 75+ age bracket • Common problems related to mobility and pain • Diabetic complications reduce quality of life further
Personal Costs	• These include e.g. over-the-counter medicines, residential care/nursing costs, transport • £230 per annum to the individual • £160 per annum to their carers • Diabetic complications increase personal cost 3-fold and double likelihood of needing carer
Lost Earnings	• £14,000 per year to the individual (figure relates only to those who have lost earnings) • £11,000 per year to their carers (figure relates only to those who have lost earnings) • 70% of individuals who lose earnings receive state benefits (incapacity benefit approx. £3,500 per annum)
NHS Costs	• £1,738 - £1,505 per annum of which: - £35 - £41 Oral anti diabetic drugs - £273 - £53 Insulin - £273 - £298 Other drugs - £434 - £567 Ambulatory care - £721 - £545 Hospital admissions
Social Services Costs	• £2,450 per annum (only 1 in 20 use social services) of which: - £475 care in home - £76 day centres - £1,899 residential or nursing home

FIGURE 2.2 The Cost of Type 2 Diabetes – Average Annual Costs (1998/99 prices)

Source: GlaxoSmithKline (2002) The True Cost of Type 2 Diabetes in the UK: Findings from T²ARDIS and CODE-2 UK
Note: NHS Costs on the left are from T²ARDIS and on the right are from CODE-2 UK

Diabetes also reduces life expectancy. On average, life expectancy in individuals with Type 2 diabetes is reduced by up to 10 years. It also increases substantially the risk of mortality from CHD and raises the risk of a range of other conditions, described in Figure 2.1.

The link between Type 2 diabetes and work place absence is not well documented in the UK. In the T²ARDIS and CODE-2 UK studies, it is noted that a small but significant (6%) portion of working age patients with Type 2 diabetes are unable to work because of their condition. The impact of this is higher when the costs of carers, who are also unable to work because they care for someone with diabetes, are taken into account.

Other studies indicate that patients with Type 2 diabetes have higher employee sickness absence rates than the general population. The literature indicates rates around two to three times the average rate (which is 6.8 days in the UK).[11]

Who is at risk from Type 2 diabetes?

The prevalence of Type 2 diabetes is influenced by a variety of factors. There are significant differences across age bands in the population (Type 2 diabetes is less common in children and young adults) and there are important differences across different ethnic groups (see Figure 2.3).

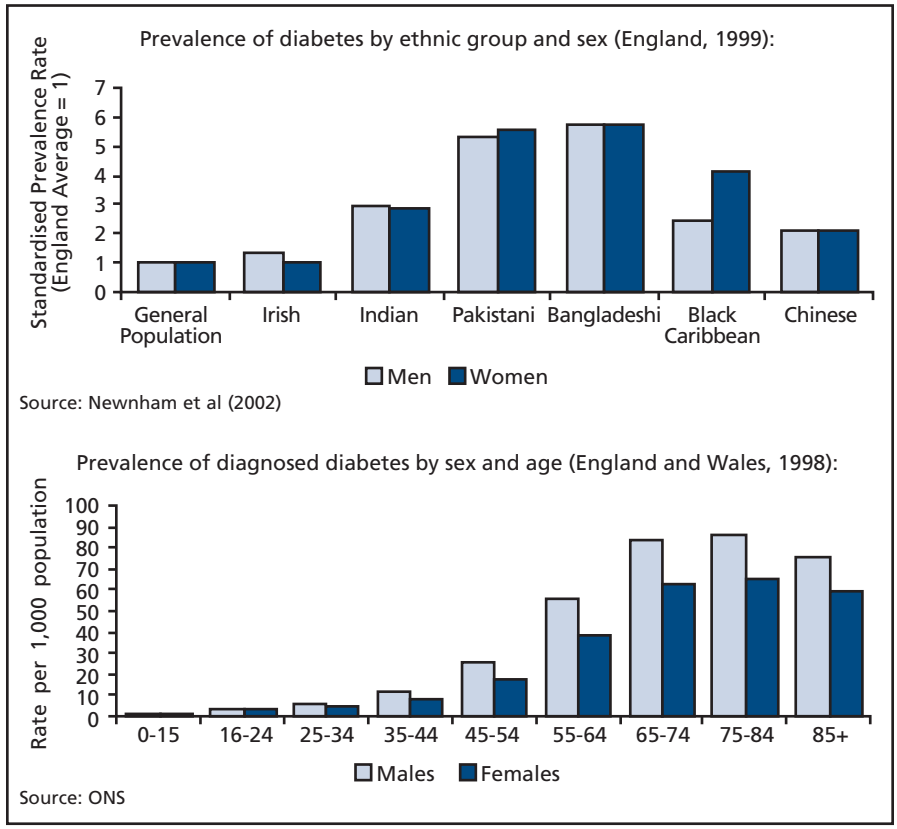

FIGURE 2.3 Prevalence of Diabetes by Age, Gender and Ethnic Group (1998/99)

[11] Sources: American Diabetes Association (2003), Olsson et al (1994), Škerjanc (2001), CBI (2002)

In addition to ethnicity, studies have shown a number of other factors that influence the risk of diabetes. In particular there is a strong association between body mass index (BMI) and the risk of Type 2 diabetes in middle-aged men. Distribution of fat is also important (an excess around the waist is a risk factor regardless of an individual's body mass index). Physical activity is also thought to influence the risk of diabetes—the risk of diabetes drops by 50 per cent in men who take moderately vigorous exercise compared to inactive males.[12]

The prevalence of diabetes is also linked to social deprivation. Prevalence tends to be higher in lower socio-economic groups. Figure 2.4 shows the age-standardised prevalence of diabetes for men and women by deprivation quintile.

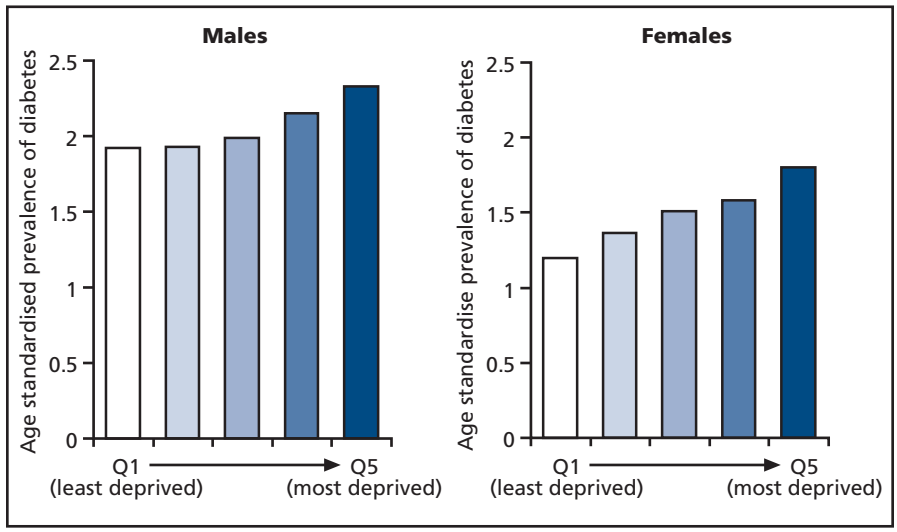

FIGURE 2.4 Age-Standardised Prevalence of Diabetes by Deprivation Quintile (1994-98)

Source: Bassed on Newnham et al (2002)

Taking these risk factors together, Type 2 diabetes is an important area for policymakers. It links closely to the current debate around health prevention and promotion activities. The dispersion of risk across ethnic groups and lower socio-economic groups also makes it relevant to the government's health inequality agenda.

[12] Perry et al (1995)

The Role of Medicines in the Treatment of Type 2 Diabetes

The National Service Framework for Diabetes

In December 2001, the Department of Health published a National Service Framework (NSF) on standards of care for diabetes. This was followed by a NSF on service delivery in January 2003.[13] Similar frameworks have been established for Scotland and Wales. There are at least four themes underlying the NSFs:

- The onset of Type 2 diabetes can be delayed or prevented.
- There is significant under-diagnosis of diabetes, implying that there are many people with diabetes that are not being properly managed.
- When diabetes is effectively managed, life expectancy can be increased, and the onset of complications can be reduced.
- Self-management is a critical part of good management of diabetes.

Health services have set themselves the goal of improving the diagnosis of diabetes. It is thought that many individuals are unaware that they have diabetes, but ensuring the early diagnosis of diabetes is important to slowing disease progression and improving quality of life. Some individuals are not diagnosed until they have already developed complications.

The NSF places much emphasis on the management of people with Type 2 diabetes. There is good evidence that management of diabetes, and in particular "meticulous blood glucose control" can prevent, or at least delay, the onset of complications.[14] This can be achieved through weight loss, increased physical activity and diet, but many individuals rely on medicines to improve management of their blood glucose levels. Medicines are also used to manage or reduce other risk factors associated with diabetes. For instance, raised blood pressure and raised cholesterol levels are common in adults with Type 2 diabetes. This places individuals with diabetes at an increased risk of cardiovascular disease.

Evidence on the Benefits of Medicines with Diabetes Patients

Figure 2.5 summarises some of the main relevant developments in medicines over the past 30 years in the treatment of individuals with diabetes.

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[13] http://www.dh.gov.uk/PolicyAndGuidance/HealthAndSocialCareTopics/Diabetes/fs/en

[14] Department of Health (2001), page 24

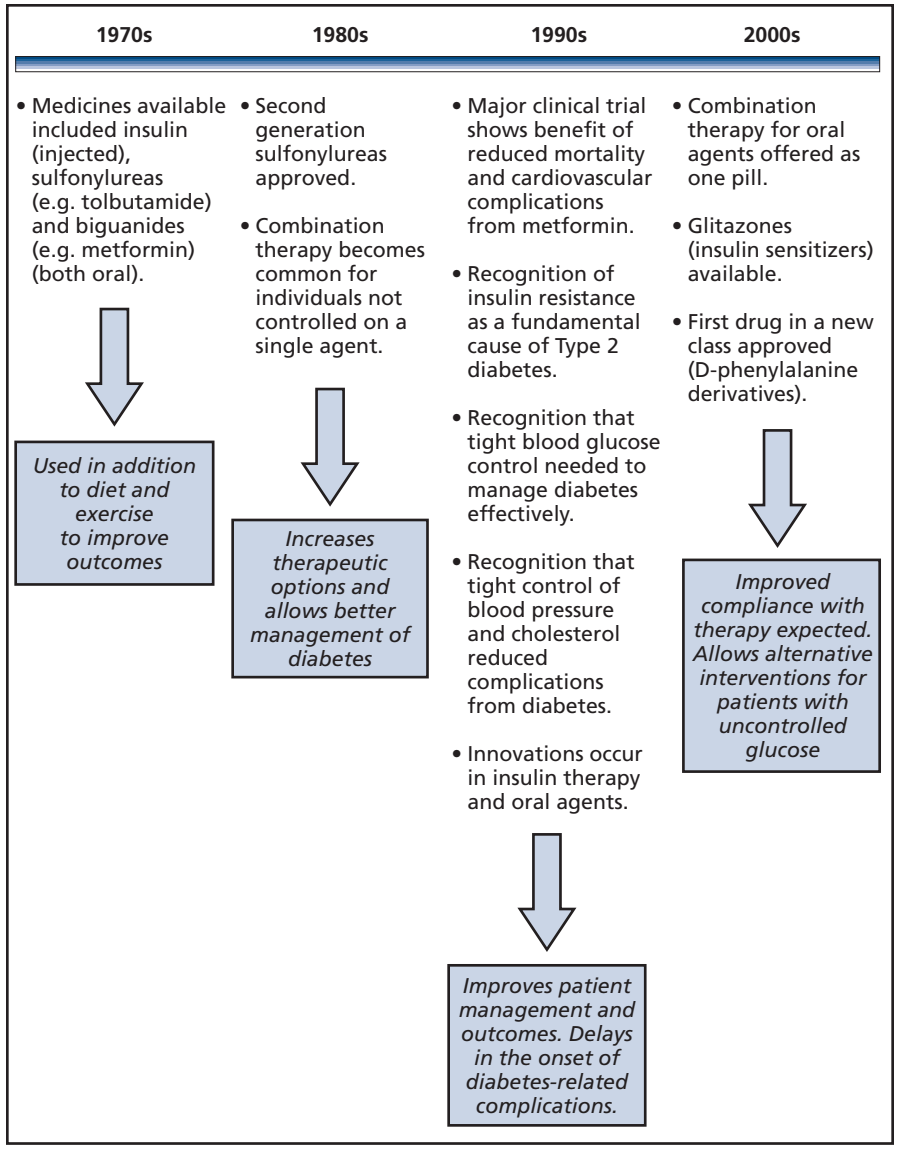

FIGURE 2.5 Developments in Medicines to Treat Type 2 Diabetes

Sources: MEDTAP International (2003), UKPDS (1998c) and ABPI (personal communication to NERA)

Modern medicines offer significant clinical benefits including reducing mortality and complications from cardiovascular disease. The pharmaceutical industry is continuing to develop new medicines to treat diabetes. The Pharmaceutical Research Manufacturers of America (PhRMA)[15] note that some of the new medicines in development include:

- Inhaled types of insulin which would not require injections;
- A compound that mimics the effects of a natural co-hormone that works with insulin to control blood glucose levels; and
- A compound that may modify the metabolism of fat cells and help treat diabetes-related obesity.

These new developments are likely to feed into the substantial benefits of existing medicine in the future.

In addition to the innovations in Figure 2.5, medicines typically associated with other disease areas (especially CHD) have been shown to be effective in reducing complications in those with diabetes. Figure 2.6 summarises some of the evidence, focused on four types of management with medicines, as follows:

- Intensive use of medicines to tightly manage blood glucose levels compared to conventional therapy (mainly diet). (Tight control of blood glucose is aimed at keeping fasting plasma glucose concentrations below 6mmol/l.)
- Tight control of blood pressure using medicines to keep blood pressure at or below 150/85mm Hg. (Either the angiotensin converting inhibitor enzyme inhibitor captropril or a beta-blocker atenolol was used, with other medicines as required.)
- Use of statins (in this example, pravastatin) to reduce cholesterol levels to 170mg/dL to reduce the risk of coronary events.
- Diabetes is "well managed" with medicines (use of glipizide gastrointestinal therapeutic system).

Whilst there are many factors that contribute to good clinical management of diabetes (diet and physical activity being two important ones), it is clear that medicines have a role to play both directly and in regulating blood glucose levels in those with diabetes. The benefits of these medicines include reductions in complications, and in managing risk

[15] PhRMA (2003)

factors such as high blood pressure and cholesterol levels. We look at the potential benefits from some of these in relation to managing the future cost of Type 2 diabetes in the next section.

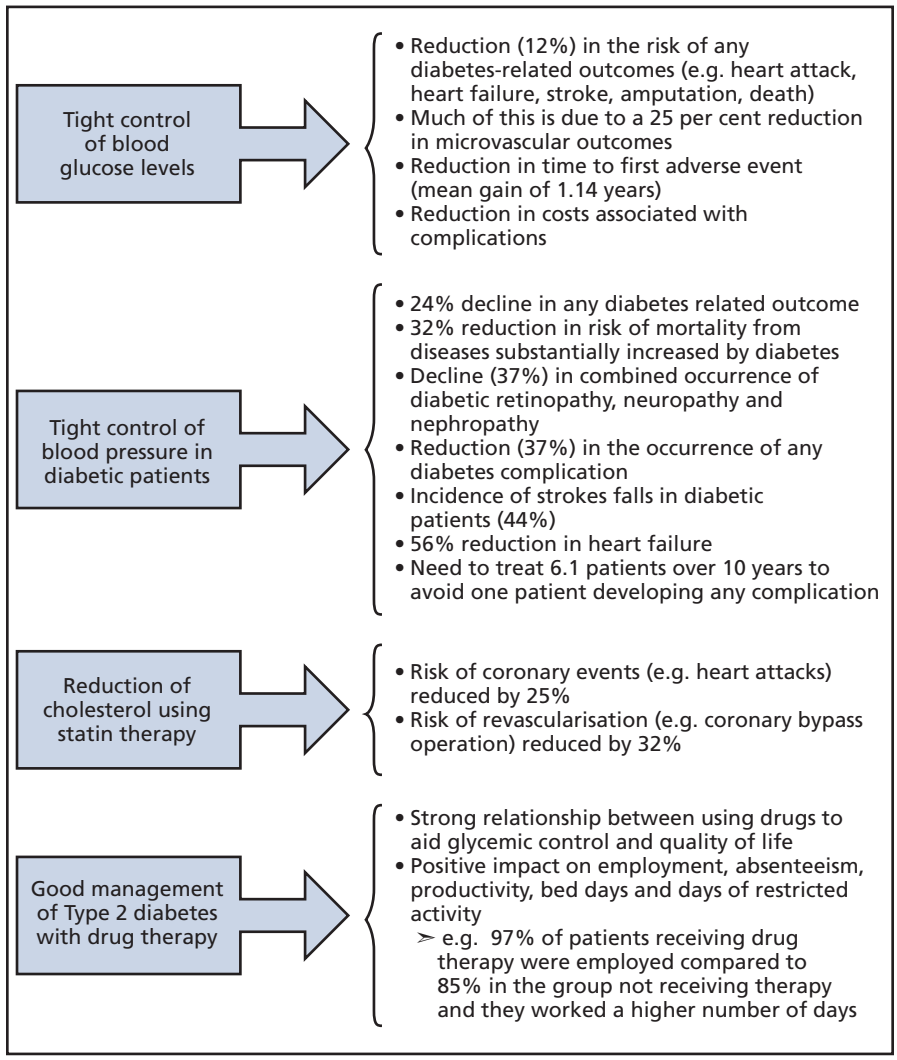

FIGURE 2.6 Benefits of Medicines in the Treatment of Type 2 Diabetes

Sources: Testa et al (1998), UKPDS (1998a), UKPDS (1998b), Goldberg et al (1998)

Future Trends in Diabetes

The Future Cost of Diabetes

There is little doubt that the cost of diabetes is set to grow. This growth is being driven by at least three sets of factors:

i. The UK population is ageing, which will increase the number of people with diabetes given the higher prevalence of Type 2 diabetes in older age groups (Figure 2.3).

ii. Risk factors such as obesity, poor diet and lack of exercise are likely to contribute to growth in Type 2 diabetes in the future.[16]

iii. It is thought that up to half of all diabetes cases are not diagnosed.[17] The current emphasis on better screening and diagnosis of diabetes will increase reported prevalence rates. Part of the emphasis in the National Service Frameworks is the potential for better screening to improve detection of Type 2 diabetes.

Figure 2.7 illustrates how the number of people in the UK diagnosed with diabetes will increase between 2002 and 2027, split by age band. The graph takes prevalence rates reported by the Office for National Statistics (shown in Figure 2.3) and applies them to UK population projections by age band for the UK. (This is a simple way to estimate the number with a disease in the future. The estimates obtained fall between those derived by Bagust *et al* (2002), who estimate the number of people with diabetes using incidence rates and make assumptions about mortality, and those provided by the International Diabetes Federation.[18] It is also consistent with an approach taken by the American Diabetes Association (2002)).

On this basis, by 2027 there will be 1.8 million individuals diagnosed with diabetes (Type 1 and Type 2) in the UK. However, this only accounts for the first of the factors identified above (changing demographics). The true number could be much higher, depending on what is assumed about under diagnosis and higher incidence of diabetes because of the growth in sedentary and unhealthy lifestyles. In Figure 2.8, we present two alternative scenarios: one takes the projections shown in Figure 2.7 and assumes that prevalence will grow by 10 per cent over the next 20 years;[19] the other assumes that currently half of all diabetes cases are undiagnosed and so shows the potential stock of cases.

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[16] Audit Commission (2000), Department of Health (2001), Newnham et al (2002)

[17] Audit Commission (2000)

[18] International Diabetes Federation (5.3.04) Personal communication to NERA

[19] Newnham *et al* (2002)

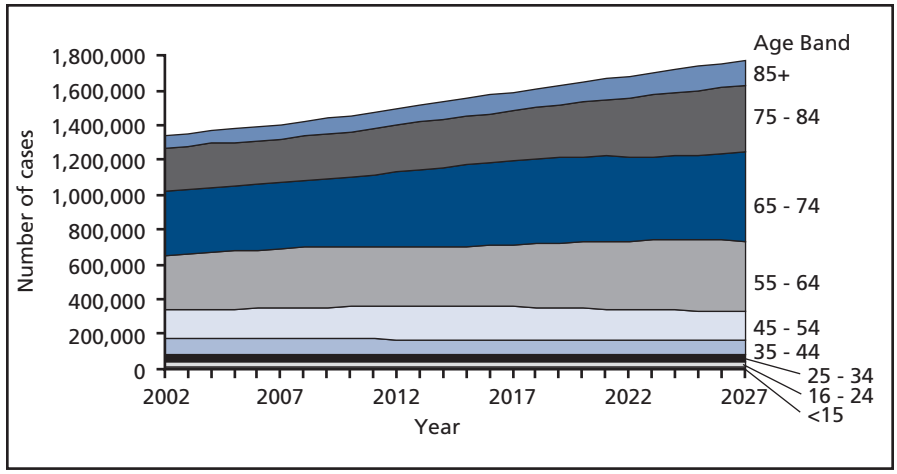

FIGURE 2.7 Number of People With Diabetes, 2002-2027, UK, by Age

Source: NERA calculation using ONS and Government Actuary Department data

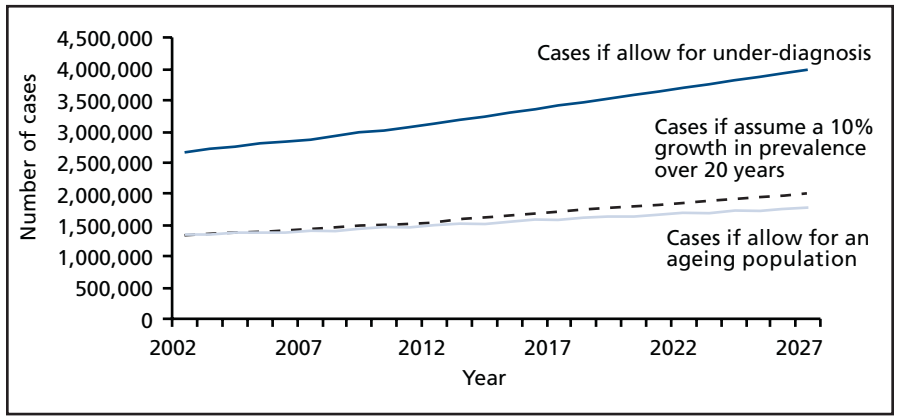

FIGURE 2.8 Scenarios Around Future Prevalence of Diabetes

Source: NERA calculation

As a base scenario for considering the number of people with diabetes moving forward, we have assumed that the increase in the number of people diagnosed with diabetes will increase 25 per cent over 20 years, over and above what is expected because of ageing alone. This could come about through improvements in detection of diabetes and changes in growth because of lifestyle factors. On this basis, Table 2.1 shows the total number

of the UK population diagnosed with diabetes between 2002 and 2027, with separate projections for the number with Type 2 diabetes.[20]

Table 2.1
Projections of UK Population with Diabetes[20]

Number (000s)	2002	2007	2012	2017	2022	2027
Number diagnosed with diabetes	1,341	1,491	1,675	1,887	2,110	2,346
Number diagnosed with Type 2 diabetes	1,216	1,366	1,550	1,762	1,986	2,222

Source: NERA calculation

The Benefits of Management of Blood Glucose Levels with Medicines

The projections in Table 2.1 suggest that the number of cases of diabetes could rise by over 80 per cent between 2002 and 2027. This reflects assumptions on ageing, increasing prevalence from obesity and improved detection and is likely to be a high-end estimate. This raises important questions about how to manage the rising population with diabetes. The UK Prospective Diabetes Study has shown that tight management of blood glucose, using insulin or sulphonylureas, can help to reduce/delay the onset of diabetic complications.[21] This has two consequences: it can increase the up-front costs of managing diabetes in a primary care setting, because of greater use of medicines; it can reduce longer-term costs of treating diabetic complications (which often involves costly inpatient care). Work by Gray *et al* (2000) suggests that these two costs essentially balance each other out. For the patient, this implies that diabetic complications have been delayed or reduced. For the health system, the impact is close to cost neutral—the cost of the additional expenditure is largely offset by reduced inpatient expenditure. A challenge for the health system is to take a long-term view and be willing to invest in primary care now and to reduce secondary care expenditure in the future.

[20] There is considerable uncertainty in making projections of this sort into the future, so the numbers should be taken as illustrating the potentially large burden, accepting that there are margins of error. In particular, estimates of the number of individuals with Type 1 diabetes is unclear so we have taken an estimate based on data from Amos *et al* (1997) and assumed that the number of patients with Type 1 diabetes remains flat constant over time. This implies that the share of Type 1 cases in the overall burden declines over time, which is reasonable given that prevalence of Type 2 diabetes is expected to grow because of the factors described above.

[21] UKPDS (1998a)

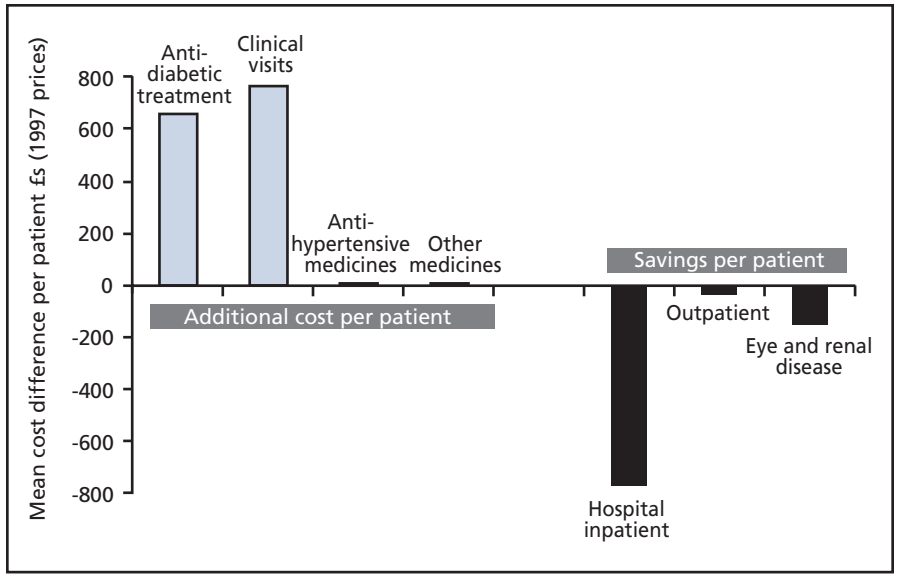

FIGURE 2.9 Offsetting the Cost of Intensive Medicine Blood Glucose Control (1997 Prices)[22]

Source: Gray et al (2000)

Figure 2.9 illustrates this offsetting of costs. The graph shows the incremental cost, over a 10-year period, of treating an individual intensively with medicines to control blood glucose levels compared to conventional treatment (typically diet) and the savings in costs of complications. This does not account for the value that the patient might place on avoiding complications.

In Table 2.2 we translate these numbers into expenditure impacts for the UK health system as a whole, based on the projections of the number of people with Type 2 diabetes outlined above.[23] We show the anticipated costs depending on whether all of this population is treated with conventional treatment or with tight management of blood glucose using medicines. Using primary care estimates to reflect costs in practice rather than in a clinical trial setting shows a small net cost to the NHS, but reducing complications delivers significant quality of life benefits.

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[22] Costs and savings are shown in 1997 prices. The costs have not been discounted to account for the time horizon over which costs and benefits are incurred.

[23] In doing so, we have assumed that the costs outlined in Figure 2.9 can be applied across the entire population of those with Type 2 diabetes (the study only included individuals aged 25-65 years), and have assumed that they are representative of costs across the UK (the study was based on data from 23 centres across the UK). We have uprated costs from 1997 to 2001/2 levels using the Hospital and Community Health Services Pay and Prices Index, supplied by the Department of Health.

How many individuals are currently receiving tight management of blood glucose levels is unknown, but Diabetes UK has suggested that the number is small (between 100,000-150,000).[24] However, the relatively few who are currently tightly managed suggests that there is significant scope to increase the number of individuals receiving tight management of blood glucose levels and realise many of the benefits. Gray *et al* (2000) concluded that the average cost of an event free year of intensive blood glucose control is about £1,166 (1997 prices).[25]

Table 2.2
Costs of Managing Future Population with Diabetes with Conventional or Intensive Medicine Treatment (2001/2 Prices)

	2002	2007	2012	2017	2022	2027
Costs (inpatient)						
Intensive medicine treatment (£m)	761	855	970	1,103	1,243	1,391
Conventional treatment (£m)	900	1,011	1,147	1,304	1,469	1,644
Costs to primary care (drugs and visits)						
Intensive medicine treatment (£m)	447	503	570	648	731	817
Conventional treatment (£m)	240	270	306	348	392	438
Of which: cost of antidiabetic drugs						
Intensive medicine treatment (£m)	181	203	231	262	295	331
Conventional treatment (£m)	86	96	109	124	140	156

Source: NERA calculation using Gray et al (2000)

One of the drivers of savings from intensive blood glucose management is that fewer inpatient hospital bed days are used to manage the complications of diabetes. This can free scarce bed and doctor capacity to treat others requiring inpatient treatment. Figure 2.10 suggests that if all patients with Type 2 diabetes in 2002 were treated with intensive blood glucose control rather than conventional treatment, a maximum of 339,325 hospital bed days would be saved.[26] This equates to over 70,000[27] hospital admissions—a

[24] Diabetes UK, Personal communication to NERA

[25] Although the confidence intervals around this number mean it is not significantly different from zero cost.

[26] This figure needs to be interpreted with care, because it assumes that savings in bed days accrue immediately. In practice, they will accrue over time, so tight management of blood glucose may not generate significant bedday savings immediately. However, over time the benefits will accrue.

[27] This assumes an average length of inpatient stay of just less than 5 days (source: Department of Health HES statistics for 2001/2). In practice, this may under-state the number of waiting list admissions possible because acute elective admissions tend to have shorter lengths of stay than the average across all admissions.

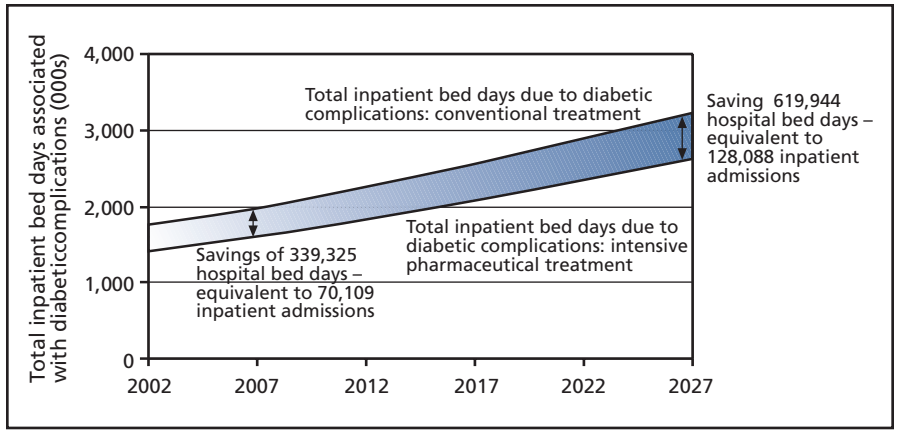

FIGURE 2.10 Estimated Inpatient Days Saved from Diabetic Complications (UK, Based on Projected Cost of Type 2 Diabetes)

Source: NERA calculation using Gray et al (2002).
Note: Estimate of inpatient admissions assumes an average length of stay of 4.8 days (held constant over time). Source: Dept of Health HES statistics (2001-2)

significant proportion of current patients on waiting lists for elective admissions, which currently number a little over 1 million patients. By 2027, this saving could be as much as 619,944 bed days (128,088 admissions).

Management of Other Complications with Medicines

In addition to tight management of blood glucose, medicines can deliver a range of other benefits to patients with diabetes. Two examples are management of blood pressure and management of lipid levels.

According to the UK Prospective Diabetes Study,[28] at the age of 45, around 40 per cent of patients with diabetes have high blood pressure (also known as hypertension). This figure rises to 60 per cent by the age of 75. High blood pressure increases the risk of CHD including heart attack. The study examined the impact of controlling blood pressure in patients aged 25-65 using medicines (captopril or atenolol). Around 38 per cent of patients recruited for the study had hypertension. The study found that tight management of hypertension significantly reduced the risk of adverse events, notably the risk of death and stroke.

Figure 2.11 shows the risk of adverse events in hypertensive diabetic patients, showing how the risk changes depending on whether patients

[28] UKPDS (1998b)

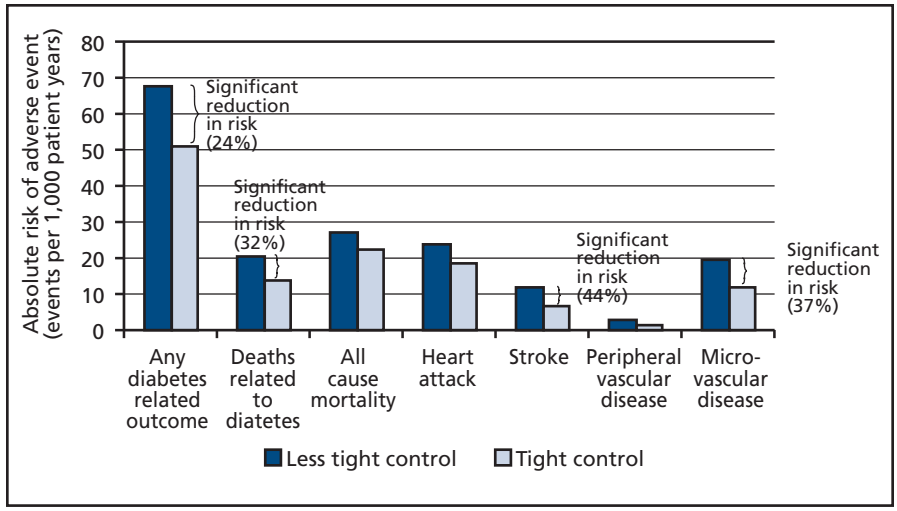

FIGURE 2.11 Risk of Adverse Events (Tight Control of Blood Pressure vs. Less Tight Control)

Source: UKPDS (1998b)
Note: Significant reductions in risk refer to those that are statistically significant at the 5% level

have their blood pressure tightly controlled with medicines. For all the complications listed, the risk falls with tight control, with statistically significant reductions in mortality, stroke and microvascular disease. (Note that these reductions refer only to the period during which patients were monitored (around 8.5 years on average)).

As with tight control of blood glucose levels the reduction, or delay, of complications will generate savings to inpatient expenditure, as well as benefits to patients from a reduction in adverse events.

As described in Figure 2.6, Goldberg *et al* (1998) found similar benefits from the management of cholesterol in diabetic patients, using pravastatin to lower lipid levels. The study concluded that pravastatin treatment reduced the risk of coronary events[29] in those with diabetes by 25 per cent. The relative risk of revascularisation procedures was reduced by 32 per cent. Again, these reductions will generate savings to the health system from inpatient care costs avoided and reductions in adverse events should improve quality of life for patients.

[29] These include death from coronary heart disease, non-fatal heart attack, heart bypass and percutaneous transluminal coronary angioplasty.

Employment Costs

It is difficult to quantify the precise impact of improved management of diabetes with medicines to employers. However, the impact is likely to be large and we know from T²ARDIS and CODE-2 UK that Type 2 diabetes results in significant employment costs. For instance:

- Of those covered in the T²ARDIS and CODE-2 studies, around 42 per cent were of working age (51% of their carers were also working age).
- 6 per cent of these patients were not working because of their diabetes, whilst 9 per cent of those caring for people with diabetes were not working because of diabetes (another 3% were working part time as a result).
- The majority of those not working as a result of their diabetes had microvascular or macrovascular complications, or both.
- The number of days of employee sickness absence are likely to be higher in diabetic patients than they are for the general population. We have not found good evidence related to the UK, but studies in the literature suggest that patients with diabetes can have two to three times the sickness absence rates of the general population.[30]

In Figure 2.12 we illustrate the potential number of workdays lost due to Type 2 diabetes for the UK between 2002-2027. The graph shows the number anticipated if those people with diabetes had absence rates seen in the general working age population[31] compared to the number if the rate were 2.5 times this.[32]

On this basis, the current cost to employers of absence, over and above what is expected in the general population, was £418m in 2002. This is the direct cost to employers, which includes salary and replacement cost. If the indirect costs are included, such as the value of poor quality of service and the knock-on impact on customer satisfaction, the cost to employers almost doubles. The literature does not add much on the scope for better management of diabetes with medicines, or other risk factors, to reduce employee-absence. It is therefore a matter of judgement as to how much better management of diabetes and other risk factors will reduce this absence, but we know from the UKPDS that complication rates, hospital bed days and

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[30] American Diabetes Association (2003), Olsson et al (1994), Škerjanc (2001), Wackawski (1990)

[31] 6.8 days in 2002. Source: CBI (2003)

[32] This is a pragmatic assumption intended to illustrate an order of magnitude of absence amongst those with Type 2 diabetes that is consistent with estimates from the literature. We have not identified evidence on absence rates in those with diabetes in the UK.

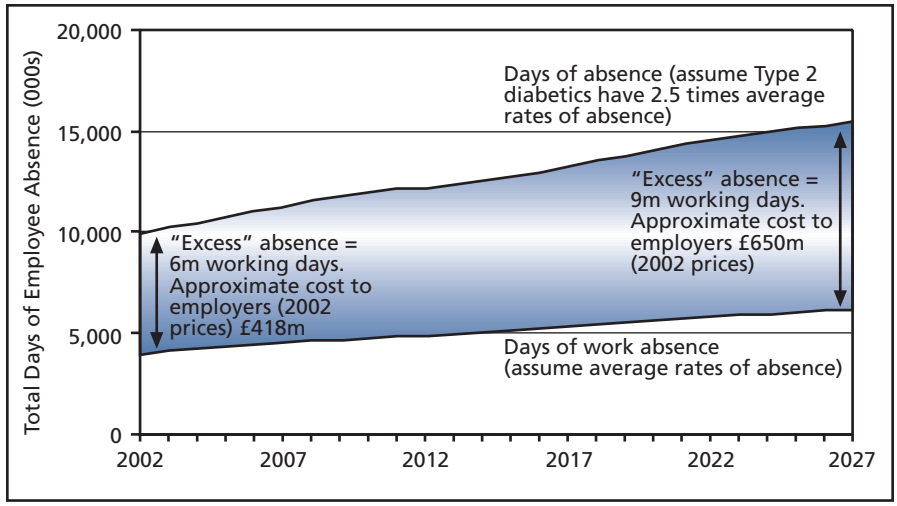


FIGURE 2.12 Work Days Lost Due to Type 2 Diabetes (Based on Projections of UK Population of Working Age with Type 2 Diabetes, 2002-2027)[33]

Source: NERA calculation
Note: Assumes absence on average in the workforce is 6.8 days and is 2.5 times higher in those with diabetics. The cost to employers is based on a CBI estimate of £476 per employee (average for all employees) per year in 2002.

mortality from diabetes is reduced through wider use of medicines to manage Type 2 diabetes. This will translate into employee absence benefits.

Benefits for Patients

We have not found any evidence that allows a direct link to be made between management of diabetes with medicines and other risk factors and benefits to patients. However, earlier sections have demonstrated that tight management of blood glucose and blood pressure using medicines has significant impacts on the risk of microvascular and macrovascular complications.

We know from the T²ARDIS and CODE-2 studies that patients with Type 2 diabetes have significantly lower quality of life than the general population, which supports other data on quality of life collected in the Health Survey for England in 1996. T²ARDIS and CODE-2 also tell us that quality of life is significantly further reduced by the existence of diabetic complications. It is therefore reasonable to assume that medicines that avoid and delay the

[33] The projections are based on those of working age, but does not control for age and absence rates beyond this.

onset of complications or reduces their severity, will translate into quality of life benefits for patients. It is a simple measure, but Gray *et al* (2000) estimated the cost of achieving a diabetic adverse event-free year through medicine management of blood glucose levels is £1,166.

It is, of course, also important to consider the mortality impacts of medicines for diabetes and other risk factors. For instance:

- UKPDS (1998a) found that tight management of blood glucose levels using medicines reduced death rates within the ten-year period of the study by 10 per cent (although the drop was not statistically significant).
- UKPDS (1998b) found that tight management of blood pressure using medicines significantly reduced death from diseases that are substantially increased by diabetes (e.g. cardiovascular disease). All cause mortality also fell, but the drop was not statistically significant.

As well as improving quality of life, medicines that reduce or delay complications will generate other benefits. Both T²ARDIS and CODE-2 studies showed the patients with Type 2 diabetes (and their carers) incur significant personal costs (e.g. related to over-the-counter medicines, nursing and residential care, transport). These costs rise steeply in the presence of diabetic complications. It is therefore natural to conclude that interventions to reduce or delay the onset of diabetic complications will have a positive effect on the personal costs of patients and their carers.

The Value of Innovation in Managing Coronary Heart Disease

The Epidemiology of CHD

What is CHD?

CHD is a chronic disease of the heart that occurs when the walls of the coronary arteries (vessels which supply oxygen-rich blood to the heart) become narrowed by a gradual build up of fatty material (atheroma).[34] The heart needs a constant supply of oxygenated blood in order to work well, this fatty material reduces the amount of oxygen rich blood reaching the heart and so the heart cannot work very efficiently. Figure 3.1 outlines the two main forms of CHD, angina and heart attack, and the effect on the patient.

How many people suffer from CHD?

More than 1.4 million people have angina in England and around 275,000 people have a heart attack in England each year.[35] In Scotland around half a million have CHD.[36] In Wales the development of disease registers will provide a clearer picture of how many are currently suffering from CHD.[37] The British Heart Foundation suggests that some 2 million have angina across the UK as a whole, although there are concerns that some people are not currently diag-

[34] Wanless (2003)

[35] Department of Health (2003a)

[36] Scottish Executive (2001)

[37] National Assembly for Wales (2001)

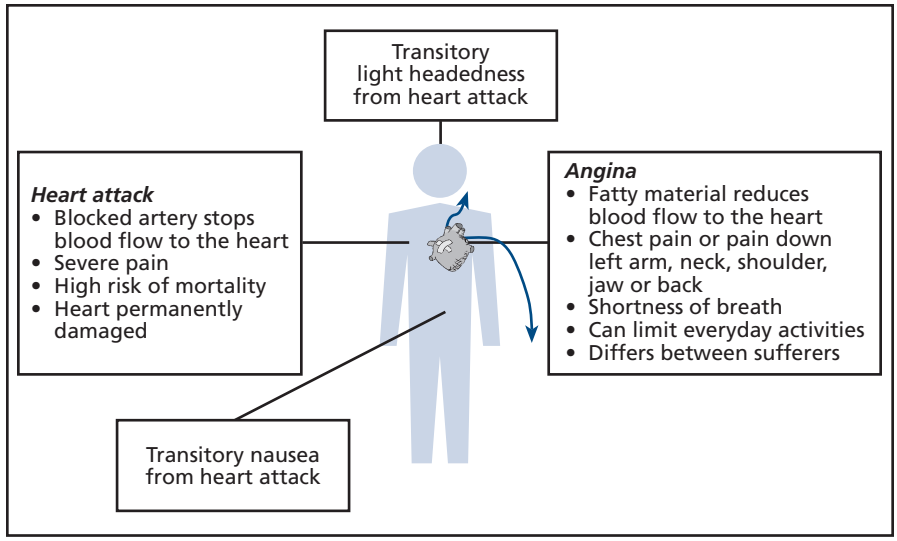


Figure 3.1 The Main Forms of CHD

Source: US Dept. of Health and Human Services, Facts about Coronary Heart Disease and BHF

nosed.[38] Drawing on a long-term study of civil servants in the UK this could be in the region of 1 undiagnosed person for every 4 diagnosed with CHD.[39]

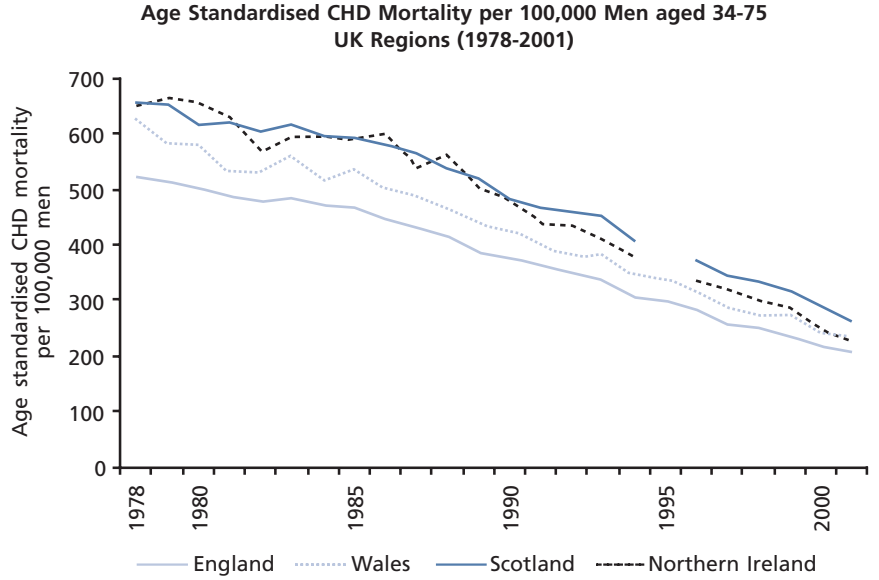
What is the cost of CHD?

The consequences of CHD are very broad. As with diabetes the costs relate to individuals and their carers, the health system, other public expenditure and costs to the economy through absence from work. CHD is a leading cause of death and has substantial ill health and quality of life implications.

Despite falling mortality since the 1970s, **CHD remains one of the leading causes of death in the UK**. CHD is the top cause of years of life lost up to the age of 75 in England. Figure 3.2 illustrates age standardized CHD mortality per 100,000 men aged 34 to 75 for the regions of the UK and the top causes of Years of Life Lost. Scotland has higher rates than all other regions of the UK, with a mortality rate of 261 per 100,000 men in 2001 compared to the lowest in England of 207 per 100,000 in England. Scotland also has the highest mortality rate for women with 98 per 100,000 women in 2001, compared to 70 per 100,000 women in England.

[38] http://www.bhf.org.uk/professionals/index.asp?SecID=15&secondlevel=519

[39] Hemmingway et al (2003)



Top Cause of Years of Life Lost Up to Age 75
England (1999)

Contributing factor	% total life yrs lost
CHD	18
Cancer	17
Injury/Poisoning	9
Suicide	6
Stroke	6
Respiratory disease	6
Liver disease (alcohol related)	2
Road Traffic Accidents	2
Diabetes	1
Others	33
Total	**100**

FIGURE 3.2 UK Mortality from CHD and Top Causes of Years of Life Lost

Source: BHF Coronary heart disease statistics at www.heartstats.org and Wanless (2003)

Although the reduction in mortality is clear, the UK compares less well with its European counterparts, with higher mortality rates (249 per 100,000 men in 1999) than some of it's closest neighbours including France and Germany (with 83 and 178 per 100,000 men in 1999 respectively). Trends in mortality for men are illustrated in Figure 3.3.

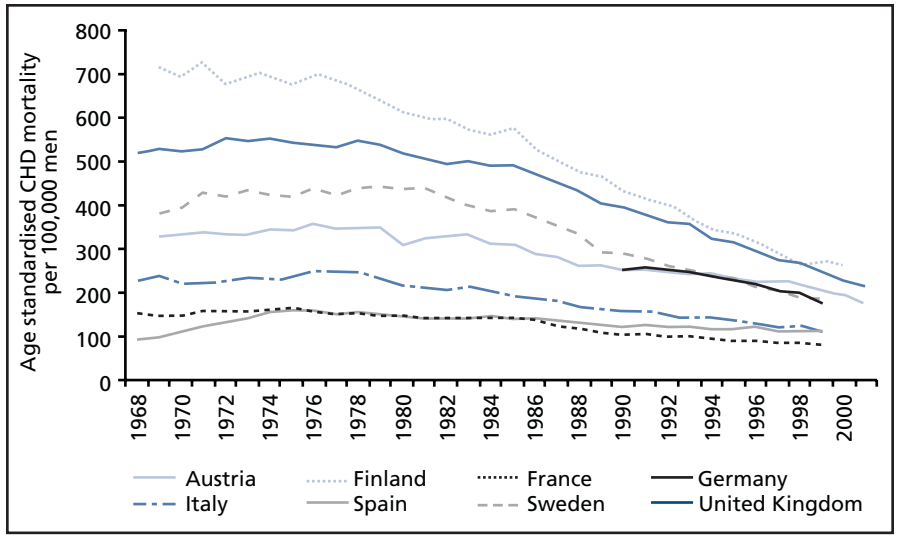


FIGURE 3.3 Age Standardised CHD Mortality per 100,000 Men Aged 34-75, Selected European Countries

Source: BHF Coronary heart disease statistics at www.heartstats.org

CHD reduces quality of life. For those with angina, this means a painful feeling in the chest, and for those who suffer a heart attack it includes acute pain. Figure 3.4 compares the impact on reduction in quality of life from a number of diseases including heart failure and angina (measured using the Short Form 36 quality of life survey). In this survey perfect health is a score of 1; death is zero. Some-one living with angina experiences significantly lower quality of life (around 60% less) than some-one without. In this figure, heart failure and angina generate the largest reductions in quality of life out of the disease shown.

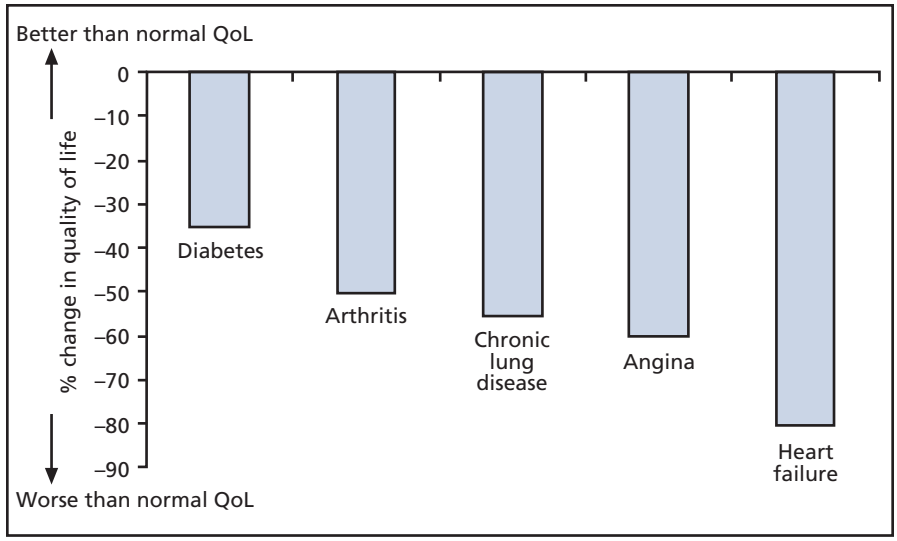


FIGURE 3.4 Impact on Quality of Life – Selected Diseases

Source: McMurray et al (1998)

CHD has a considerable **cost to the NHS**, both in primary care and in secondary care. For example, the rate of GP consultations for CHD outweigh those for diabetes and stroke (Figure 3.5).

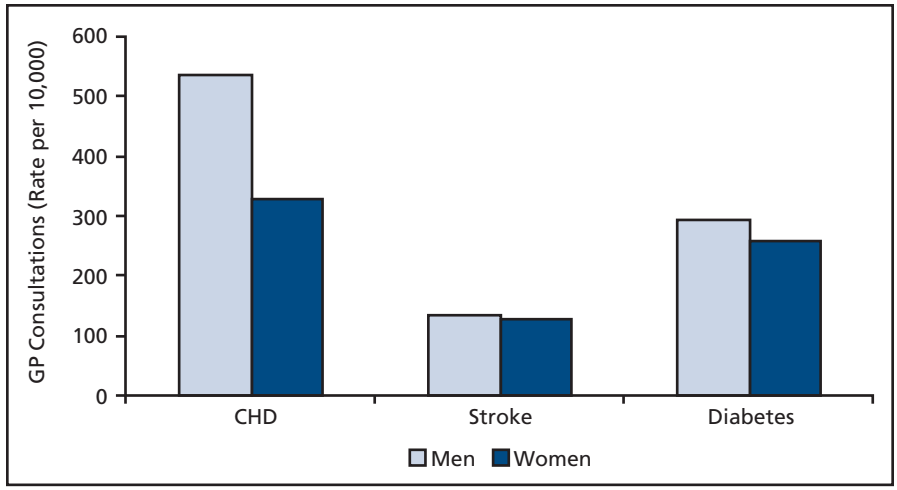


FIGURE 3.5 GP Consultations for CHD, Stroke and Diabetes

Source: BHF Coronary heart disease statistics at www.heartstats.org

In monetary terms, CHD has been estimated to cost the NHS in the region of £1,738 million a year (1999).[40] Figure 3.6 shows the cost of CHD across the NHS from prevention through to A&E and hospitals. It is clear that the majority of costs occur in the hospital sector, where CHD accounts for around 7 per cent of NHS acute care spend (including, for example, hospitalisations for heart attacks and unstable angina).[41] It also accounts for over 12 per cent of medicines expenditure in primary care.[42]

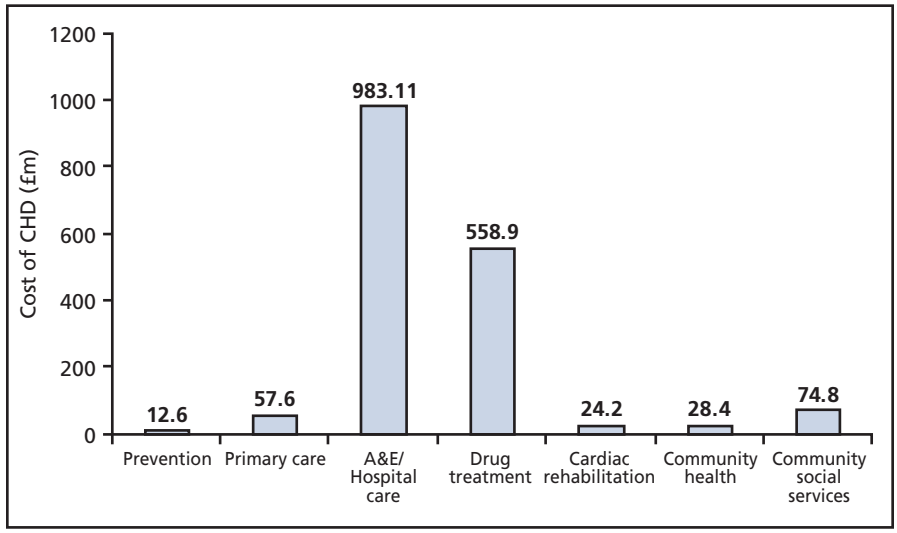


FIGURE 3.6 Monetary Cost of CHD to the NHS, UK (1999 values)

Source: Liu et al (2002) and corrected data personal communication to NERA (15.3.04)

CHD is also a **cost to the economy**, from working days lost due to premature death and illness. Although CHD is most common in older people, it still affects a significant proportion of the economically active population. Figure 3.7 illustrates the working years lost due to early death and sickness absence and the financial cost to the economy in one year. Some 19 working days per man and 2 working days per woman were lost from mortality in 1999 in the UK. A further 25 days per person were lost to certified incapacity in 1999 in the UK. Overall, CHD costs the UK economy almost £3bn per year through productivity losses. In the light of the need for women to work longer (pensionable age is being increased on a phased basis from 60

[40] Liu et al (2002) and corrected data personal communication to NERA (15.3.04)

[41] NERA calculation using Department of Health (2003d) data.

[42] NERA calculation using Department of Health (2003d) data.

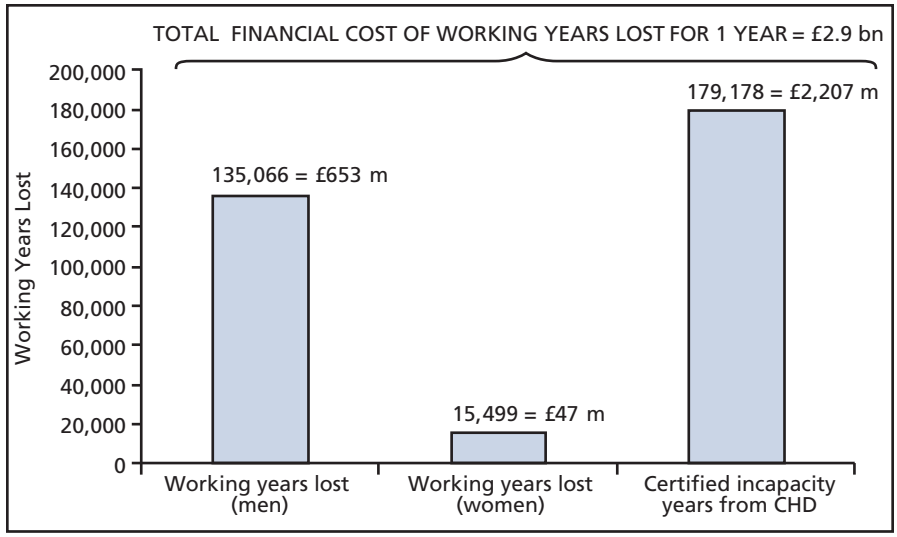


FIGURE 3.7 Productivity Losses from CHD, UK (1999 values)

Source: Liu et al (2002)

to 65[43]) and concerns about income in old age, enabling the population to continue working productively is a major concern.

Who is at risk from CHD?

CHD affects some groups of the population more than others. It is particularly prevalent in the elderly and is more common in men than in women. For example, 216 in 1,000 men and 161 in 1,000 women were treated for CHD in England and Wales (1994 to 1998) (Figure 3.8). It is thought that women have some protection from heart disease due to hormones (oestrogen) produced by their bodies up until the menopause.[44]

The number of people with CHD is disproportionately distributed across the UK (Figure 3.9). The age-standardised mortality rate from CHD for men under the age of 65 shows that mortality is higher in the northern areas including Scotland compared to significantly lower mortality in the south east. The main reasons for the higher mortality in Scotland are thought to be high rates of smoking, poor diet and poverty.[45]

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[43] http://www.over50.gov.uk/englandandwales/pensions/state.shtml

[44] This is a theory that has not yet been scientifically proven. BHF (24.3.04) personal communication to NERA

[45] http://www.show.scot.nhs.uk/isdonline/heart_disease/heart_disease.htm

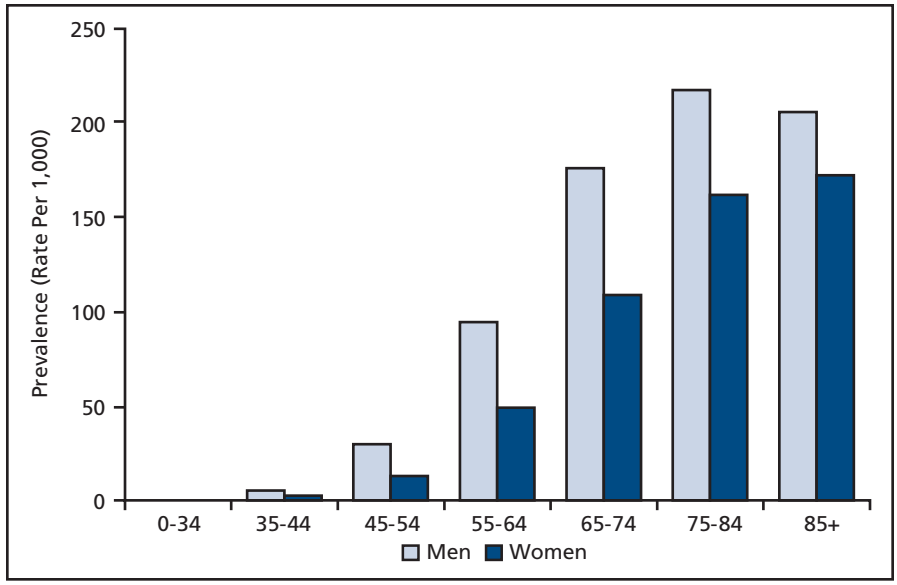

FIGURE 3.8 Prevalence of Treated CHD by Age Group, England and Wales (1994-1998), UK

Source: ONS

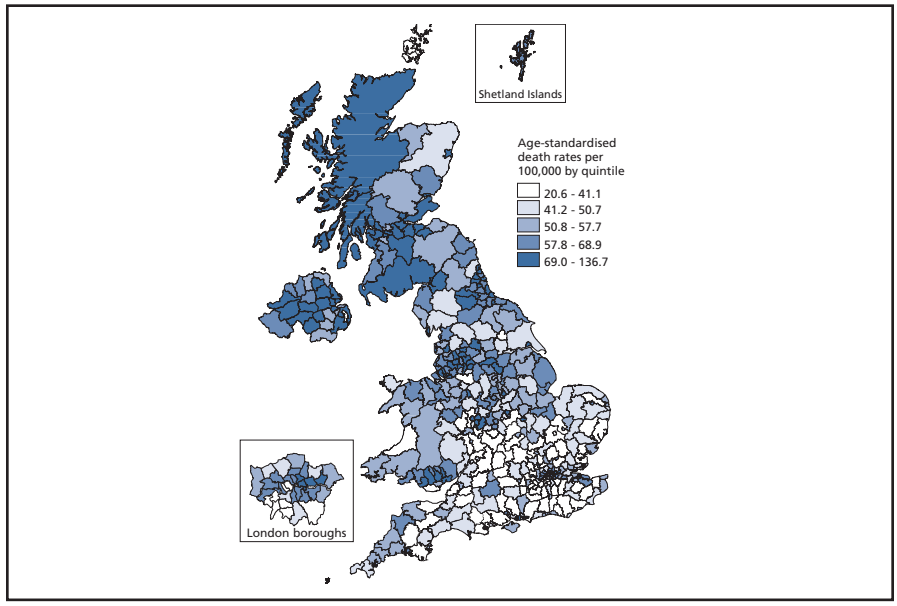

FIGURE 3.9 Age Standardised Mortality from CHD for Men Under 65 by Local Authority

Source: BHF Coronary heart disease statistics at www.heartstats.org

CHD also disproportionately affects ethnic groups. Seven per cent of Bangladeshi men and 10 per cent of Pakistani men suffer from angina compared to just 5 per cent of men in the general population. Higher rates of CHD are also found in those in greater deprivation, with 4 per cent of men in the highest deprivation category (Q5) suffering from angina, compared to 3 per cent in the lowest deprivation category (Q1) (Figure 3.10).

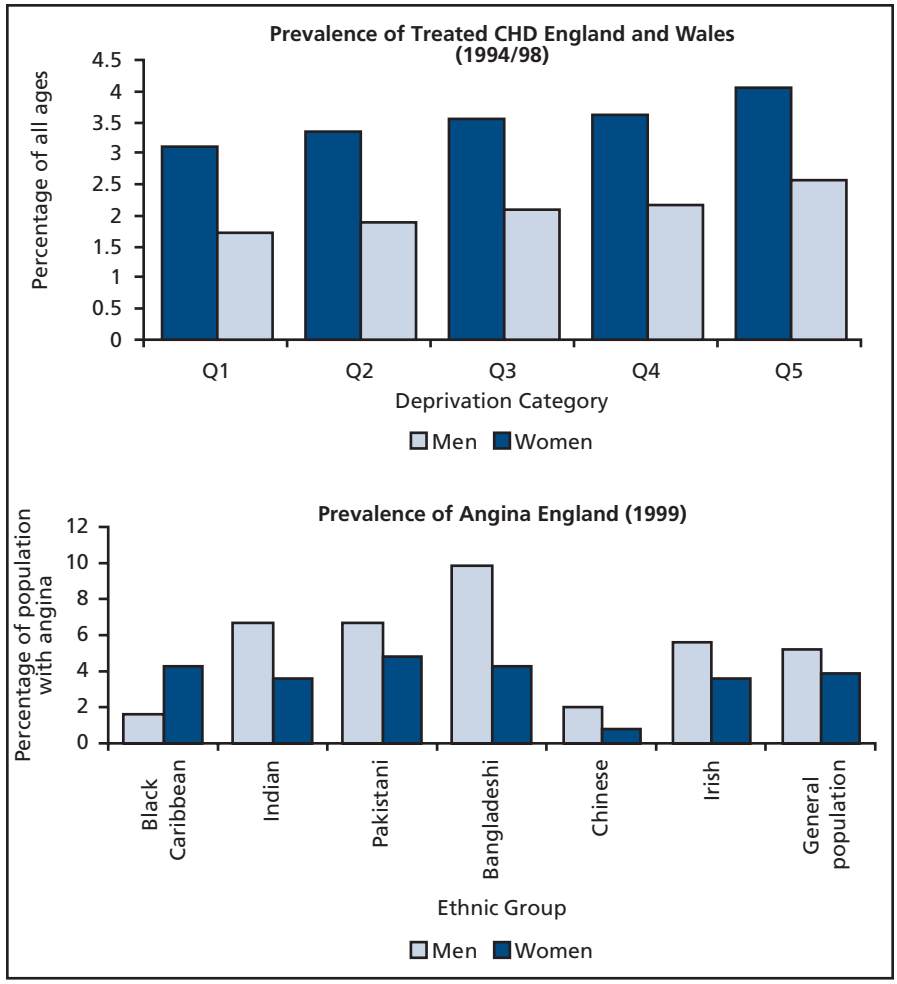

FIGURE 3.10 Prevalence of Angina by Ethnic Group and by Deprivation Category, England and Wales

Source: BHF Coronary heart disease statistics at www.heartstats.org

CHD is related to a number of key risk factors. Some of these can be changed, such as smoking and diet. Others, including age and family history cannot be altered. Figure 3.11 sets out both the risk factors that can't be changed and those that can. These risk factors interact in complex ways. Individually each risk factor alone doubles the chance of developing CHD. Jointly the risk changes, for example, someone who has high cholesterol, high blood pressure and smokes cigarettes is eight times more likely to develop CHD than someone who has no risk factors.[46]

Risk factors that can't be modified	**Age:** 45 or older for men, 55 or older for women **Family history of early CHD:** A father or brother diagnosed before aged 55, or a mother or sister diagnosed before age 65
Risk factors that can be modified	**Diabetes:** Forecasts suggest a significant increase in the number of people with diabetes. This is partly due to the changing demographic profile of the population and also because of growth in the risk factors associated with Type 2 diabetes (many of which are similar to CHD). **Obesity:** In the UK, prevalence of adult obesity is rising with 14 per cent of the UK population classified as obese (Body Mass Index over 30kg/m2) in 1991 rising to 22 per cent in 2001. **Smoking:** Although the prevalence of adult smoking has been falling it still remains at around 28 per cent of all adults aged 16 and over in England. **Alcohol:** There remains a significant proportion of the adult population who are drinking at higher levels than recommended. For example, in 2001 some 27 per cent of men and 15 per cent of women were drinking outside recommended limits (21 units per week for men and 14 for women). A sizeable proportion (in 2002 around 15 per cent) of those in the 11 to 15 age group also drink alcohol. **Blood pressure:** In 2002 26.3 per cent of English men and 20 per cent of women had hypertensive untreated blood pressure. **Diet:** The 2003 National Diet and Nutrition Survey conducted by the Department of Health and the Food Standards Agency found that fruit and vegetable consumption has increased since 15 years ago. It has increased most in the older population (3 portions per day in 1987 to 3.7 portions per day for women aged between 50 and 64) but younger people aged 19 to 24, are eating no more fruit and vegetable, or oily fish, than they were fifteen years ago. **Physical activity:** Current data suggests that only 37 per cent of men and 25 per cent of women take the recommended 30 minutes of exercise five times a week in the UK. **Cholesterol:** 66 per cent of men and 67 per cent of women in England have blood cholesterol levels greater than the recommended 5 mmol/1.

FIGURE 3.11 Risk Factors for CHD

Source: OECD Health Data (2003), Department of Health (2003b and 2003c), and BHF Coronary heart disease statistics at www.heartstats.org

[46] US Department of Health and Human Services, Facts About Coronary Heart Disease

Future Trends in CHD

The wide range of risk factors for CHD mean that is difficult to accurately predict the future trends for CHD in the UK.[47] A simple extrapolation of current prevalence of CHD in the UK illustrates a likely increase in the numbers suffering from CHD in the future (Figure 3.12).[48] On this basis, the number of people with CHD is likely to increase to some 3.7million by 2027. This extrapolation implicitly assumes no changes in the factors affecting the prevalence of CHD and is driven purely by the ageing of the population and a simple approach to estimating the likely future population with CHD. Given the growth in the risk factors for CHD, this is likely to be a conservative estimate moving forward.

This forecast is related only to ageing. The number of people with CHD is likely to rise from trends in lifestyle. For example, the National Audit Office (NAO) suggest that by 2010 over a quarter of all adults are going to be obese

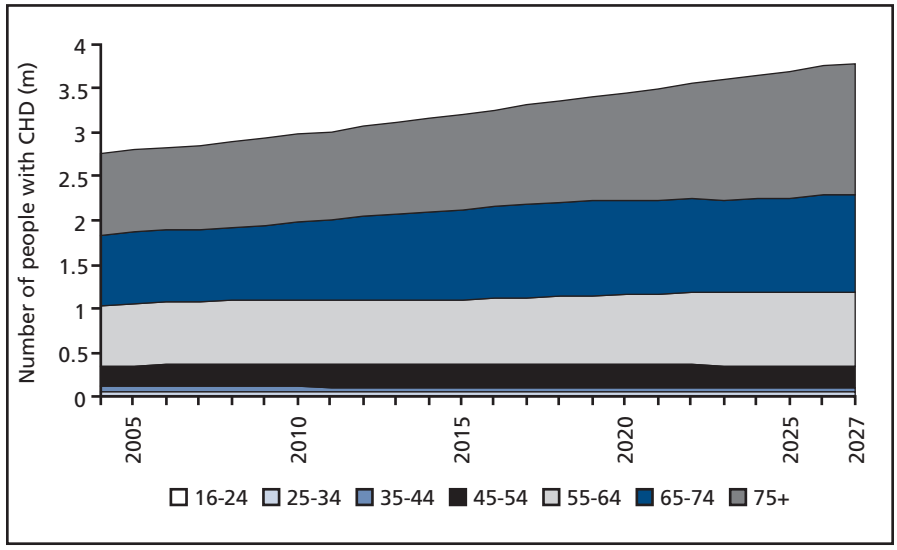

FIGURE 3.12 Number of People with CHD, 2002 – 2027, UK

Source: NERA calculations using Liu et al (2002) data and GAD population projections

[47] The British Heart Foundation is unaware of work to forecast the future burden of CHD. BHF (15.3.04) Personal communication to NERA

[48] This extrapolation implicitly assumes no changes in the factors affecting CHD and the increase in numbers with CHD is driven purely by the ageing of the population.

based on current trends.[49] The NAO also suggest that being obese increases the relative risk for heart attacks by 3.2 per cent and 1.5 per cent for women and men respectively. It increases the relative risk of angina by 1.8 per cent for both women and men. Although this is a simple approach, we have undertaken a scenario which looks at the possible size of the population with CHD if prevalence were to rise by 5 per cent over the next 20 years to proxy what might occur from this increase in obesity and other lifestyle factors (Figure 3.13). This is an illustration only, but clearly shows that the cost of CHD could be substantial in the future.

There is also evidence that a number of cases of angina are not being diagnosed in primary care. Extrapolating from a study of Whitehall civil servants undertaken over 11 years suggests that there could be a minimum of 1 undiagnosed case of angina for every 4 diagnosed cases.[50] Using this as an adjustment factor and assuming improvements in diagnosis, cases of CHD would rise in future from 3.7 million to 4.7 million in 2027.

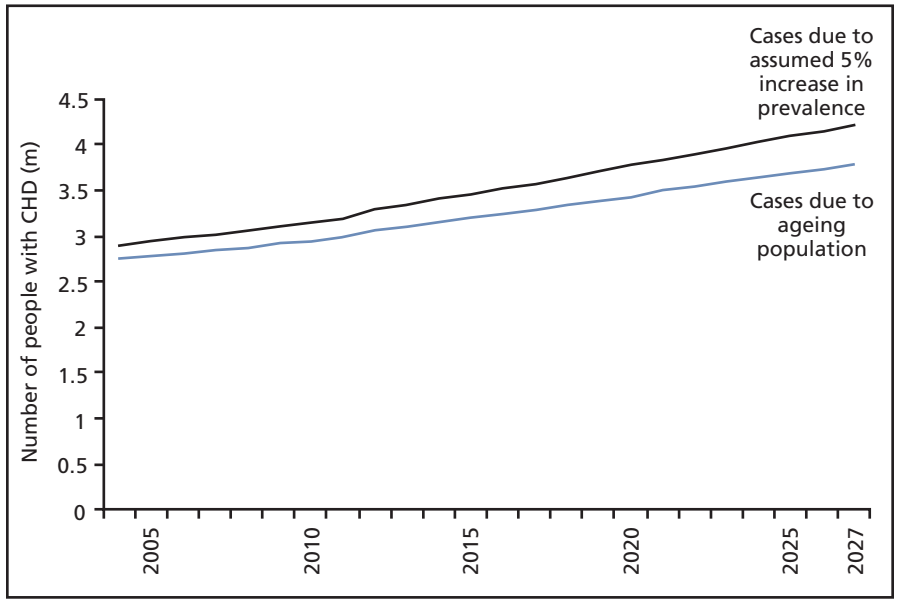

FIGURE 3.13 Scenarios Around Prevalence of CHD

Source: NERA calculations using Liu et al (2002) data, GAD population projections and assumptions for prevalence

[49] National Audit Office (2001)

[50] Hemingway et al (2003)

Coupling the simple forecasts due to ageing with estimates of the cost of CHD across the economy, it is possible to estimate what the potential cost could be to the NHS and the economy in the future. This provides a lower bound estimate that only accounts for the ageing of the population.

Table 3.1
Estimated Cost of CHD in the UK, £m (1999 values)

	1999	2010	2020	2027
Direct Health Care Cost	1,738	2,011	2,342	2,572
Productivity Cost:				
– Sickness absence	2,207	2,553	2,973	3,265
– Early death	701	811	944	1,037
Informal Carer Cost	2,416	2,795	3,255	3,575
Total	7,064	8,170	9,514	10,449

Source: NERA calculations based on Liu et al (2002) and GAD population projections.

The Role of Medicines in the Treatment of CHD

The National Service Framework for CHD

It is clear that CHD imposes a significant cost on the health service, the economy and individuals. This cost is likely to rise, both as the UK's population's age and lifestyles change. The National Service Framework for CHD in 2000 set out a national standard of care to help tackle CHD in England. Similar standards have been set out in Wales and Scotland. The main themes include putting the emphasis on individuals to manage their lifestyle and reduce the risks of CHD, and ensuring the health service provides proper support and access to services for those at high risk of CHD. There is also an emphasis on increasing capacity to deal with more serious cases of CHD.

Figure 3.14 sets out the standards of the English NSF for CHD.

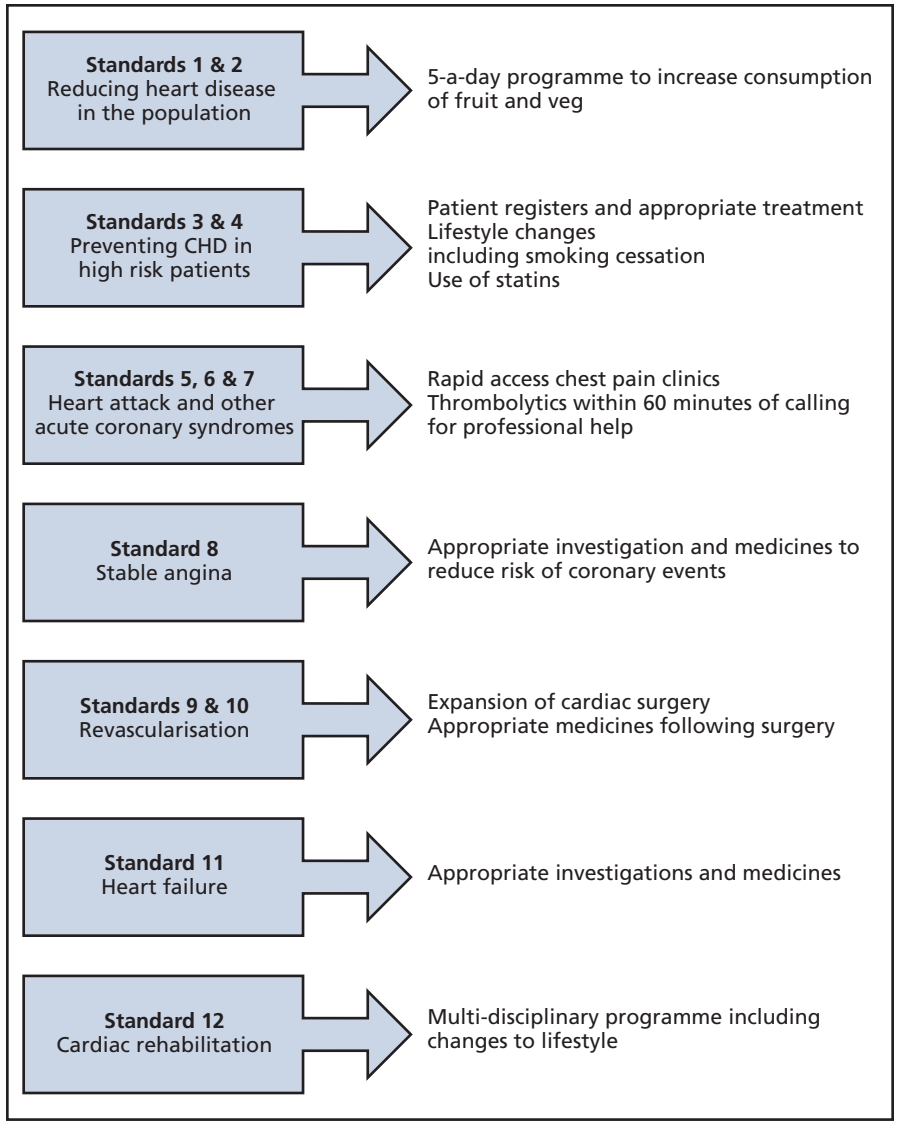

FIGURE 3.14 NSF Standards

Source: Department of Health (2003)

Using Medicines to Help Manage the Cost of CHD

Mortality from CHD has been falling in the UK since the 1970s. Throughout this time a number of medicines have been available as part of the package of care for CHD. Medicines are only one part of the equation for managing CHD—lifestyle and encouraging individuals to take responsibility for their health is important—but medicines have been shown to deliver significant benefits to patients with, or at risk from, CHD. Figure 3.15 provides some examples.

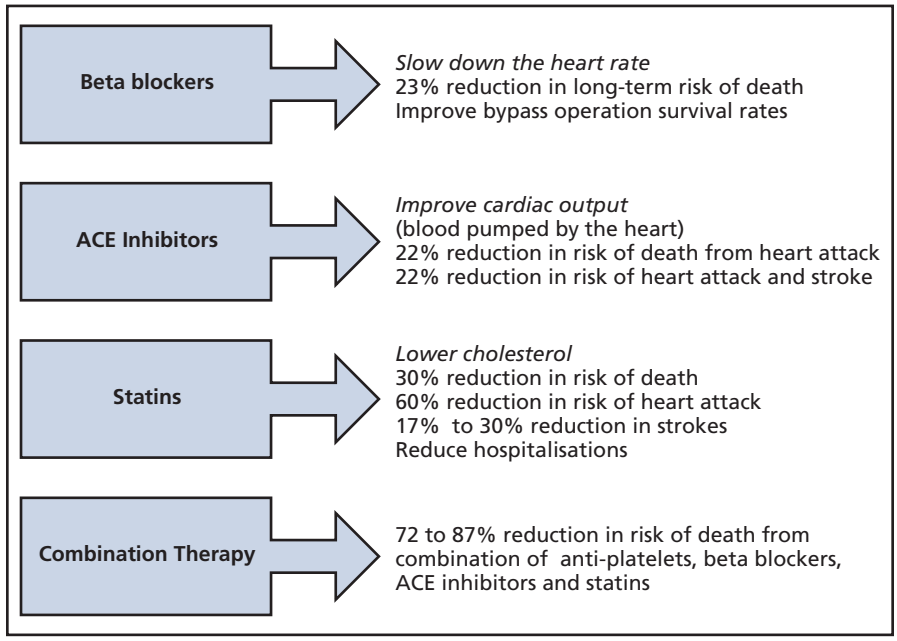

FIGURE 3.15 Benefits of Selected Medicines in the Treatment of CHD

Source: Law et al (2003), HPSGC (2002) Heart Protection Study, Freemantle et al (1999), Mayor (1999) and Mukherjee et al (2004)

The pharmaceutical industry is continuing to develop new medicines to treat CHD. The recent PhRMA 2003 survey of new medicines in development highlights the 123 medicines in the pipeline to tackle heart disease and stroke, see Figure 3.16. This includes some 7 for heart attack, 6 for angina and 10 for hypertension (high blood pressure is a risk factor for CHD and stroke).

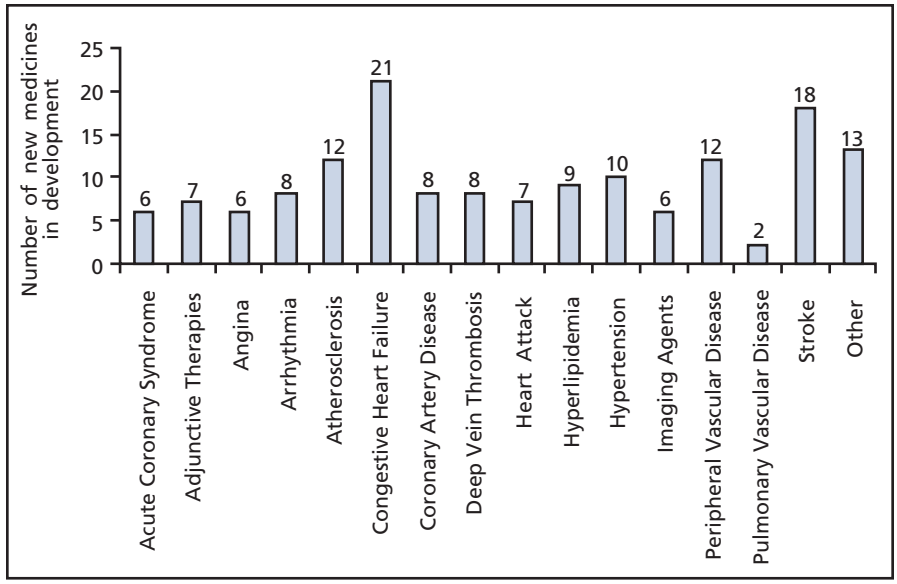

FIGURE 3.16 New Medicines in Development for Heart Disease and Stroke (2003)

Source: PhRMA (2003)
Note: Some medicines appear in more than one category

Some key innovations include:

- A medicine that changes the heart's metabolism (how quickly it uses energy) so that it requires less oxygen. For the patient this means less pain and a potentially more active life.
- A medicine that promotes vessel growth and may enable patients to 'grow' their own heart bypasses and blocked arteries.
- A vaccine that may be able to promote "good" cholesterol (the body needs a certain amount of cholesterol to function properly) by preventing "good" cholesterol turning into "bad" cholesterol.

These are still in development but offer potentially high benefits in the future.

Looking back over time at the reduction in mortality from CHD, recent work has been carried out that has attributed this reduction to available treatments.[51] This approach uses data on effectiveness and uptake and trends in

[51] Unal et al (2004)

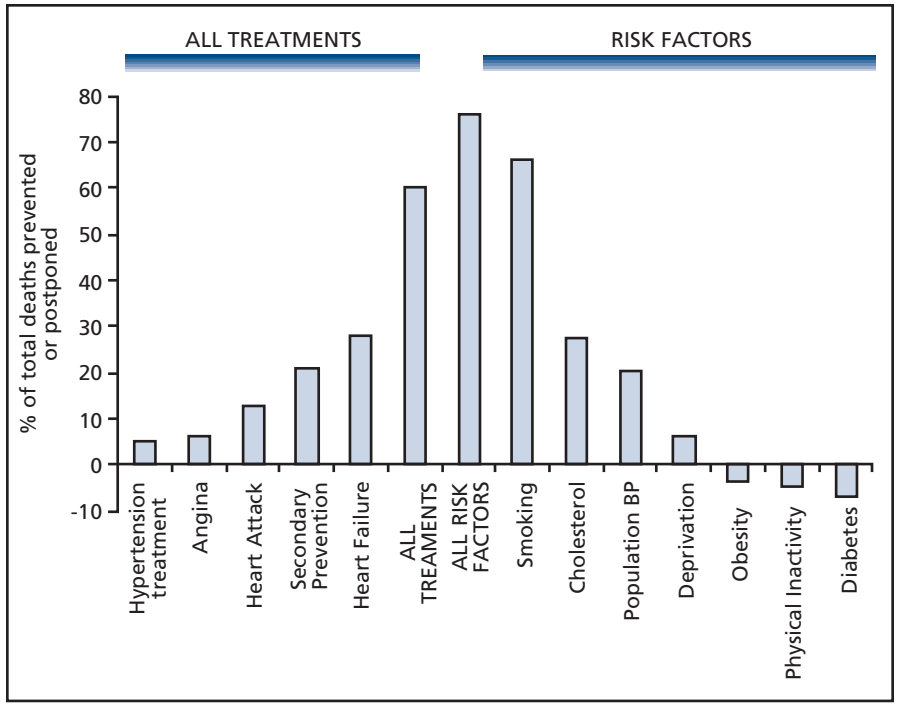

FIGURE 3.17 Contribution of Treatments and Risk Factors to the Reduction in CHD Mortality in England and Wales (2000)

Source: Unal et al 2004

risk factors in a cell based model to estimate the impact of medicines, surgery and changes in risk factors on mortality. Figure 3.17 illustrates how this varies across different types of treatments and the change in broader risk factors (such as smoking) in the population. The largest contribution to reductions in mortality from CHD comes from the reduction of risk factors such as smoking and cholesterol.

In this analysis, medicines accounted for thirteen per cent of deaths avoided or postponed. Figure 3.18 illustrates how this reduction is split across different types of medicines. Although not shown, aspirin alone is estimated to have prevented between 2,527 and 7,545 deaths in the year 2000.[52] Thrombolytics (medicines that break down blood clots), beta-blockers (slow down the heart rate) and statins (medicines that reduce cholesterol levels)

[52] A range is estimated to reflect uncertainty in modelling the impact of medicines and risk factors on mortality. It is uncertain how many people would have died if medicines and surgery and changes in risk factors had not happened.

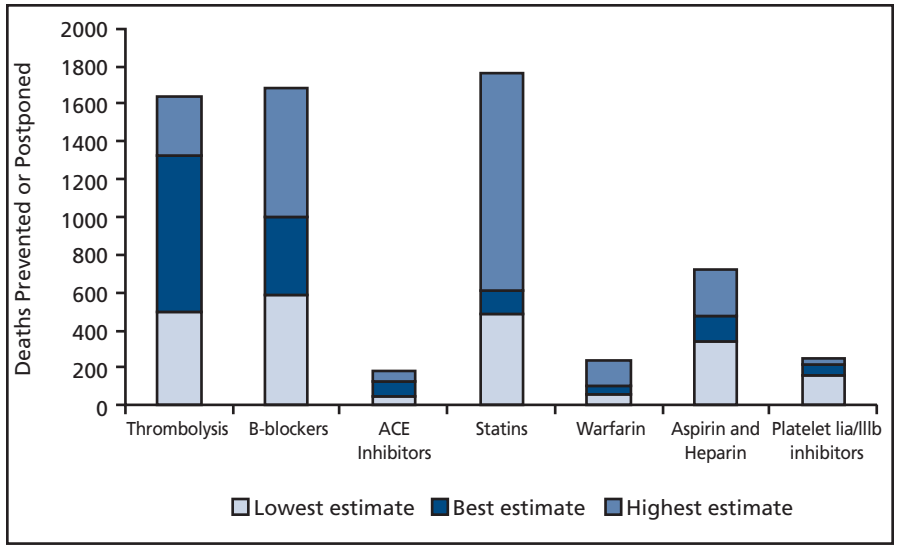

FIGURE 3.18 Estimates of Deaths Prevented or Postponed by Medicines, England and Wales (2000)

Source: Unal et al 2004

are the next most important, accounting for between 1,552 and 5,061 lives saved in the year 2000.

There are a number of different classes of medicines that can be used in the treatment of patients with CHD. Below, we describe two case studies (statins and thrombolytics) to illustrate how pharmaceutical innovation has helped in the treatment of CHD.

A case study of Statins

High cholesterol is an important risk factor for CHD. Statins (lipid lowering medicines) lower the amount of cholesterol in the blood. They have been one of the latest major innovations in tackling CHD (first licensed in the UK in 1989).

The NHS in England is expected to spend some £694.7 million on lipid lowering drugs treating some 1.8 million patients over the year 2004/5.[53] Expenditure has been rising over time following a sharp increase in the number of prescriptions for statins. For example, from 6.4 million prescriptions in 1998/9 to 18.8 million in 2002/3 (Figure 3.19) with an average growth

[53] Department of Health (2004)

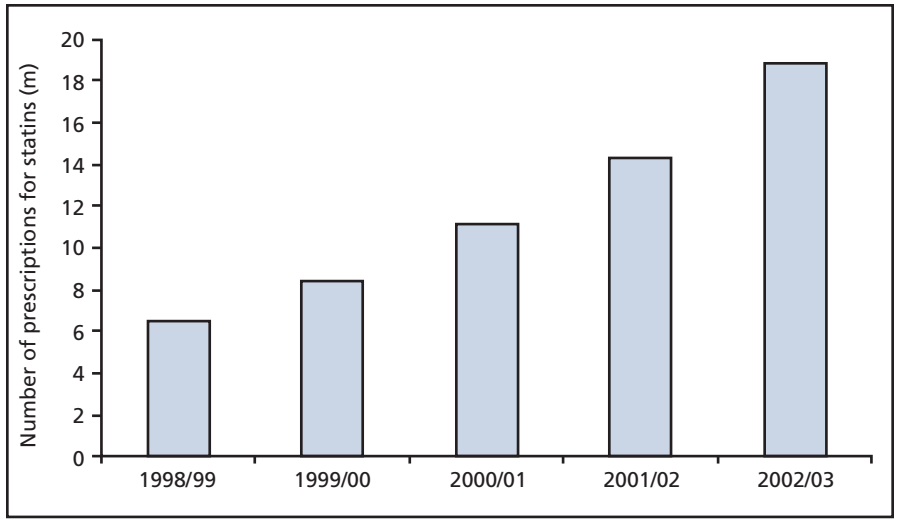

FIGURE 3.19 Prescribing of Statins, England (1998/99 to 2002/03)

Source: Department of Health (2003a)

in expenditure of 30 per cent per year. Much of this increase in spending is attributed to the increase in the use of medicines for CHD from introduction of the NSF for CHD in England in 2000.

This prescribing has the potential to deliver a range of benefits, and a number of studies have shown the benefit of statins. Table 3.2 draws on evidence from some of the main clinical trials of statins. It shows the reduction in cholesterol, relative risk reduction (reduction in the group receiving statins compared to those who weren't receiving statins) and the number of people needed to treat to avoid an adverse outcome associated with CHD (for example, death or heart attack).

Extrapolating findings from the UK-based Heart Protection Study and applying the benefits to the one and a half million people currently taking statins in England provides an estimate of the likely adverse events avoided from taking statins (Figure 3.20). (This may overstate the benefits due to the clinical trial setting but is a useful way of analysing the likely benefits to the NHS.) This approach draws on the number needed to treat from the clinical trial and applies this to the one and a half million taking statins. We can also estimate the likely costs avoided by the NHS, although the costs we present are minimums excluding the follow-on costs associated with support once a patient has left hospital. We have also included an estimate of the number of lives saved, and their value. The value of lives saved is

TABLE 3.2
BENEFITS OF STATINS REPORTED IN MAJOR CLINICAL TRIALS

	AFCAPS/Tex CAPS	WOSCOPS	CARE	LIPID	4S	Heart Protection Study
Average cholesterol reduction (mmol/l)	1.0	1.4	1.1	1.0	1.7	0.8
Relative Risk Reduction	37%	31%	24%	24%	34%	27%
Number Needed to Treat	50	42	33	28	11	33
Outcome	Fatal and non-fatal heart attack, unstable angina and sudden death	← CHD death or non-fatal heart attack →				

Source: SIGN (1999) and HPSCG (2002)

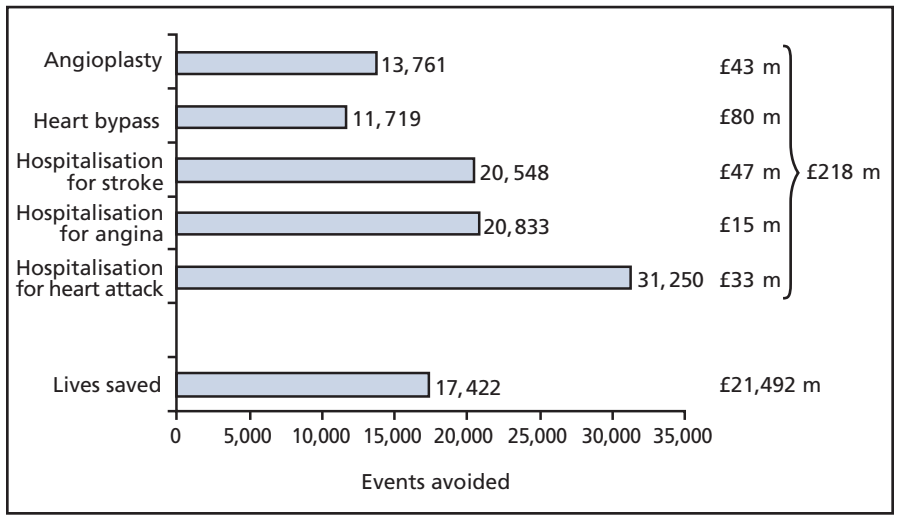

FIGURE 3.20 Events Avoided Through Treatment with Statins Over 5 Years

Source: NERA calculations using HPSCG (2002) data, NHS reference costs (2003), Highways Economic Note 1 (2000)

derived from Department for Transport estimates used to value lives saved from the avoidance of road traffic accidents.

In total, we estimate that the hospitalisations avoided equate to saving around 607,000 bed days over the 5 years. This is approximately 120,000 bed days each year. This equates to around 24,000 extra patients who could be treated.

The total costs avoided for the NHS over 5 years is some £218 million. This does not offset the estimated £3.2 billion spent on statins (at current prices) but leads to some 17,400 lives saved and the avoidance of the reduction in quality of life and productivity costs.

Wanless (2002) estimated that statins could cost the NHS some £2.1 billion by 2010 (this estimate includes cost offsets from reduced hospitalisations and assumptions related to off-patent savings). Whilst we cannot exactly match the benefits of this spending (as it is not reported how many people will receive statins in 2010) the benefits are likely to be substantial, including around 40,000 lives saved, reduced hospitalisations and the avoidance of productivity loss.

The value of medicines, particularly for CHD was clearly recognised by the then Secretary of State for Health, Alan Milburn, in his April 2003 speech to the Association of the British Pharmaceutical Industry:

> *"Already in the last few years the number of premature deaths from major killers such as cancer and coronary heart disease have begun to fall dramatically in our country. New drugs and more effective prescribing have played their part in that……prescribing of statins has risen by 30 per cent benefiting over one million people and helping to save an estimated 6,000 lives"*

The UK has increased uptake of statins, but in a European comparison of uptake rates it lies in 10th place (Figure 3.21). The UK had a rate of 23.86 daily doses per 1,000 covered population from 1997 to 2002, compared to the top rate of 59.28 daily doses per 1,000 covered population in Norway in 1997 to 2001. The reasons for differential performance are varied, for example, Norwegian doctors have been involved in key studies for the use of statins that may have encouraged their rapid uptake. The Heart Protection Study demonstrated that statins were effective for those at high risk of CHD and that some 2 million in addition to the 1 million who were taking statins could benefit. Since then, a further 800,000 are now taking statins, implying that there are around 1.2 million people who could still benefit from statins. If the remaining 1.2 million starting to take statins this could lead to a further saving of 14,000 lives.

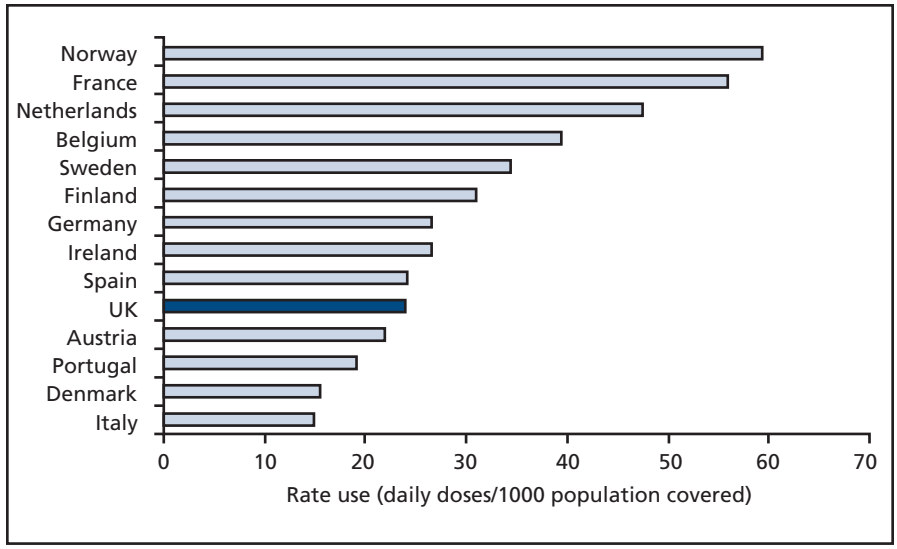

FIGURE 3.21 Uptake of Statins, Selected European Countries

Source: Walley et al (2004)

John Reid, the Health Secretary, announced in late 2003 that one statin could be made available over the counter following a consultation period.[54] Currently it is only available from a prescription written by a GP. Under the proposal, patients would be assessed by pharmacists and can exercise their own choice on whether to buy statins that will lower the chance of heart attacks. This could significantly increase access to these medicines. The Medicines and Healthcare products Regulatory Agency (MHRA) note that there is some evidence for other drugs that are switched to over the counter (OTC) that even though sales of the OTC medicine have increased the number of prescriptions filled has remained constant.[55] The consultation closed on the 16th January 2004. The MHRA is still considering its decision.[56]

Evidence on the use of statins as part of a broader chronic disease management approach, which includes advice for lifestyle changes, is promising. The National Primary Care Collaborative have set out a disease management programme in 2000 focused on CHD. The programme included a review of

[54] http://www.dh.gov.uk/PublicationsAndStatistics/PressReleases/PressReleasesNotices/fs/en?CONTENT_ID=4062710&chk=0akVDx

[55] http://www.mhra.gov.uk/news/2003.htm#arm18

[56] MHRA (23.3.04) Personal communication to NERA.

lifestyle changes, monitoring of blood pressure and cholesterol and the use of medicines like statins and aspirin. The benefits of the programme include an estimated 800 lives saved compared to practices who did not have the disease management programme. Anecdotal evidence suggests that the programme led to reductions in heart attacks as well. The programme led to significant uptake in medicines including increasing aspirin uptake from 20 to around 90 per cent and statins from 50 to 90 per cent.[57] This has the potential to save lives and improve the health of many in the future.

A case study of Thrombolytics

Thrombolytics are used following a heart attack to break down the clot that causes a heart attack and restore blood flow to the heart.[58] They are crucial following a heart attack to improve survival rates. The faster that thrombolytics can be administered the more likely a patient will survive. In the first three hours after a heart attack, every minute of delay in giving a thrombolytic leads to a loss on average of 11 days of life.[59] Some 240,000 people in England and Wales have a heart attack each year, only 50,000 of these receive thrombolysis and there are concerns that it is underused.[60]

Although the first major thrombolytic, streptokinase, has been available since before the 1970s, alternatives have now been developed which offer substantial benefits for patients. Streptokinase can only be given once because it leads to the development of antibodies that render it inactive if given again. The newer atlepase can be used repeatedly, offering benefits to those who have had more than one heart attack. In some areas it is estimated that 50 per cent of patients with a heart attack have already received streptonkinase once, suggesting that the scope for atlepase to deliver real benefits is significant. Figure 3.22 charts the progression of pharmaceutical innovation since the 1970s.

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[57] Health Service Journal 20th November 2003 p. 28/9

[58] NICE (2002)

[59] National Assembly for Wales (2001)

[60] NICE (2002)

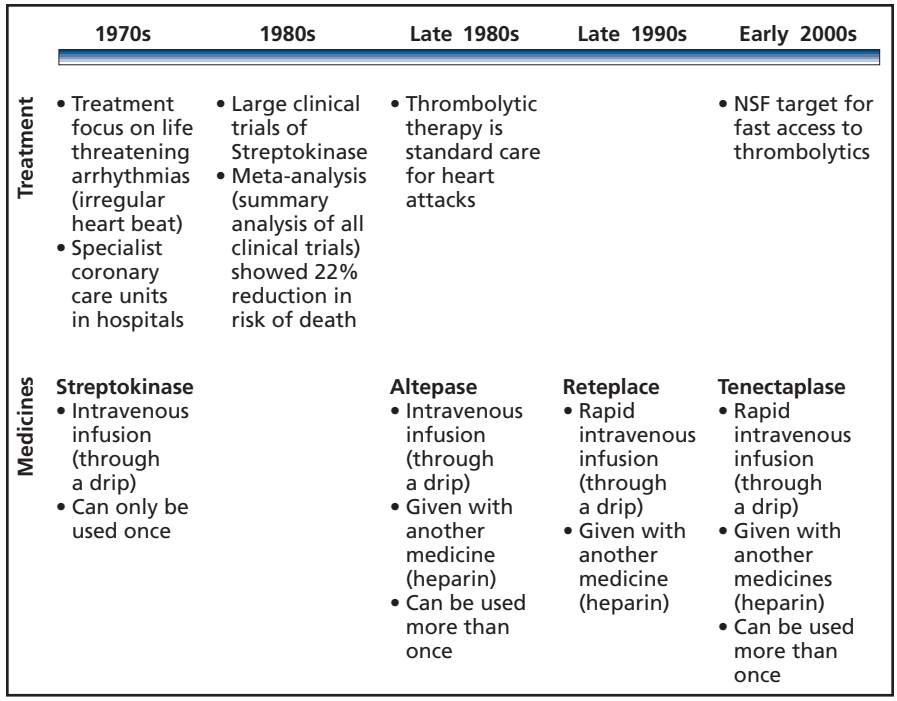

FIGURE 3.22 Thrombolytic Innovations

Source: NERA based on NICE (2002) and Liverpool Reviews and Implementation Group (2002)

Mortality from heart attacks has been falling in the UK, a reduction of 1 per cent per annum over the period 1966/7 to 1994/5 for men.[61] Thrombolytics have been shown to have prevented some 493 to 1,636 deaths in England and Wales in 2000 (Figure 3.18).

There has also been a marked improvement in the time for a patient to receive a thrombolytic following a heart attack (Figure 3.16) so that 81 per cent of eligible heart attack patients now received a thrombolytic within 30 minutes of hospital arrival compared to 38 per cent before the introduction of the NSF for CHD in 2000.[62]

[61] BHF Coronary heart disease statistics at www.heartstats.org

[62] Department of Health (2003a)

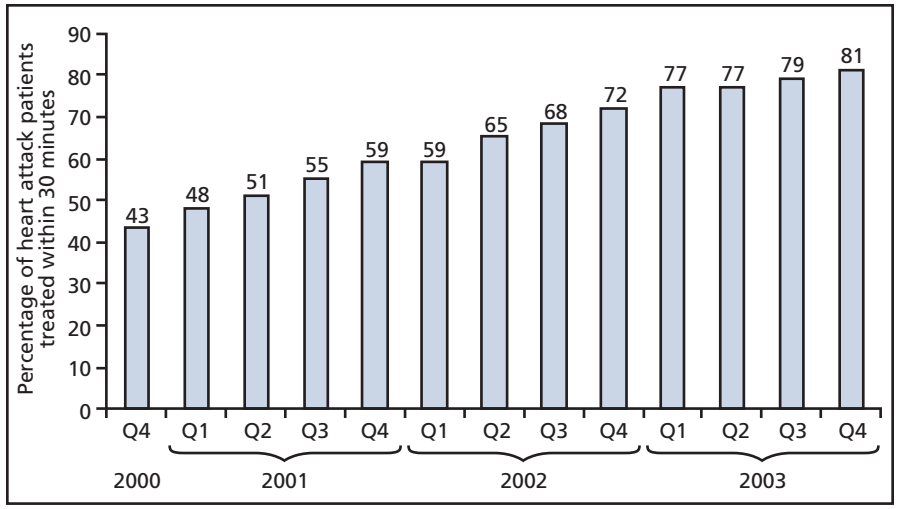

FIGURE 3.23 Time to Receiving Thrombolytics, England (2000 to 2003)

Source: Department of Health (2004)

The Department of Health suggest that unpublished data found improvements in survival following the publication of the CHD NSF which included recommendations on fast access to thrombolytics and use of statins following a heart attack.[63] This improvement has been attributed to a number of changes including better team working in emergency care, improvements in diagnosis and faster access to thrombolytics allowing these medicines to be used when they are most effective. This improvement is a result of changing ways of delivering care, emphasizing the importance of the interaction of medicines and the wider care setting.

[63] Department of Health (19.3.04) Personal communication to NERA.

Concluding Comments

Most stakeholders in health care view innovation as favourable but there are potential conflicts, most commonly with cost containment. Many innovations are cost saving and efficiency improving, delivering financial benefits to the NHS overall. Sometimes there are tensions where costs increase in one part of the health system to use the innovation (e.g. primary care), but savings are either realised elsewhere more immediately (e.g. secondary care which is the case with tight management of diabetes with medicines) or some time in the future. Other innovations may be cost increasing, yet still deliver benefits to patients and the health system that represent good value for money (e.g. statins). This is where organisations such as the National Institute for Clinical Excellence (NICE) have a role to play in helping to understand how the costs and benefits impact across the health service and patients.

Innovation has delivered significant value to the health system, and it is important to recognise that whilst encouraging innovation is fundamental, making sure health systems make best use of such innovations is an integral part of the process.

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