9 CHANGING HEALTH CARE NEEDS

Health care needs vary according to the age structure and health profile in a population. The likelihood of people seeking care is determined by a range of social and cultural factors and will impact upon demand for care. The likelihood of people receiving care is determined by policy decisions and will impact upon the volume of activity in the health system. This chapter reviews the evidence of how these factors might change over the next 20 years, and outlines the approach the Review is taking in further work.

Demography

- Over the next 20 years, the UK population is expected to grow by between 2 million and 8 million and the proportion of people aged over 85 will rise by between 37 per cent and 94 per cent.
- Age and people's proximity to death are the most significant determinants of health status and health needs, but the impact of ageing on future expenditure is likely to be relatively small when compared to other cost drivers.

Morbidity

- The major causes of disease and death in the UK are likely to remain similar over the next 20 years – mental ill health, cancer and cardiovascular diseases. However, population based health promotion initiatives (e.g. smoking cessation) and a reduction in health inequalities could have significant impacts on the future disease burden and need for care.
- As life expectancy rises, it is unclear whether or not this additional life will be healthy. Severe morbidity is declining, but more moderate ill health shows signs of increasing.

The likelihood of seeking health care and expectations

- Changing public and patient expectations, tackling inequalities in health, and tackling ageism in the health care system are likely to increase people's propensity to seek health care and widen access to treatment leading to significant impacts on future levels of demand and expenditure.

Introduction

9.1 Changes in the health needs of the population will affect the amount and nature of health care that will be required to provide a high quality, comprehensive service in 20 years' time. This Review has concentrated on three main areas that may lead to important changes in the health needs of the population:

- demography, including changes in both the overall size and the age structure of the population;
- the level of morbidity and pattern of disease and disability; and
- the extent to which people seek health care to manage their health needs.

9 CHANGING HEALTH CARE NEEDS

9.2 The health needs of the population are not fixed. Although the size and structure of the population over the next 20 years is largely predetermined, many of the trends that will affect health needs could be significantly affected by policy changes or changes in public expectations. Some changes in health needs will flow directly from explicit policy decisions. For example, disease prevention and health promotion programmes can impact directly on health needs. In other cases, changes in the amount of care needed will arise from a complex interaction between health policy, other public policies and wider cultural and societal changes. For example, changes in the level of service older people expect and receive will result in changes in the amount of activity in the NHS.

The impact of demographic change on health needs

9.3 Over the next 20 years, both the size and the age structure of the population will alter, changing the health needs of the population. The population of the UK is forecast to increase by around 5 million people from just under 60 million in 1998 to almost 64 million by 2023. Population projections are based on assumptions about:

- the number of births, estimated from fertility rates;
- deaths, estimated from projected mortality rates; and
- the net migration of people into the UK.

9.4 There is uncertainty about future changes in all three elements. Fertility rates can change as a result of cultural changes and the economic climate. Net migration is affected by the international economic and political climate and national immigration policy. The average age at death changes as a result of medical advance and living conditions. The UK Government Actuary's Department's (GAD) main population projection is based on extrapolating forward past trends in fertility, migration and mortality. For mortality GAD use a "targeting" approach:

- a target is set for the annual improvement in mortality rates at each age for some future year;
- for the 1998–based principal projection, it was assumed that changes in mortality rates at each age would converge to reductions of $^1/_2$ per cent a year by 2032. This equates to life expectancy at birth in 2032 of 79.2 for males and 83.4 for females;
- current improvements in mortality rates differ by age and sex; and
- convergence to $^1/_2$ per cent does not occur evenly across time, but more rapidly at first.

9.5 Over recent decades there have been significant errors in population projections. Projections have overestimated future numbers of very young people and underestimated future numbers of the very old[1]. For example ten–year projections made in 1981 overestimated the number of people aged 0–4 by 5 per cent and underestimated the number of people aged over 85 by 4 per cent. This was a considerable improvement on the ten–year projections made in 1971 in which the percentage errors were +34 per cent and –14 per cent respectively. So, there are signs that projections are more accurate, but uncertainty remains. The population projections used in this Review are based on estimates of baseline populations in 1998 and 2000 – there is no guarantee that these baselines are an accurate reflection of reality as they incorporate imperfections in past data on births, deaths and especially migration that have accumulated since the 1991 census. A view on this will only be possible once the results of the 2001 census are published (in the second half of 2002).

9.6 To illustrate the uncertainty surrounding population projections GAD produce a range of alternative population projections based on varying assumptions about fertility, net migration and life expectancy. For this Review two of these variant projections will be used in addition to GAD's principal projection: a "young" population variant and an "old" population variant. Table 9.1 shows the assumptions that underlie the different projections and their implications for the size and age profile of the UK's population in 20 years' time.

9.7 In addition to the GAD projections the table also shows how an even more optimistic assumption about future life expectancy would impact on the UK's population. This is the "longevity" projection shown in Table 9.1. This projection is based on optimistic Eurostat life expectancy assumptions combined with GAD principal projection assumptions about fertility and migration. This "longevity" projection assumes life expectancy at birth in 20 years' time will be 3 years higher for men and 2.6 years higher for women than the GAD principal projection.

9.8 Both the size and the age structure of the population in 20 years time are clearly very sensitive to the assumptions that are made about life expectancy, fertility and net migration. The range of GAD's projections shows that the UK's population could increase by between under 2 million people to nearly 8 million people during the next two decades. And the number of people aged over 85 could increase by between 37 and 94 per cent. Between 1980 and 1998 the population in this age group increased by 64 per cent.

[1] Shaw C (1994), Accuracy and uncertainty of the national population projections for the United Kingdom, *Population Trends* 77:24-33.

Table 9.1: Variant population projections for the UK

Projection (1998–based unless stated otherwise)	Fertility assumption*	Migration assumption**	Life expectancy at birth in 2023	Population in 2023 (000s)	Growth between 1998 and 2023 (000s)	Average growth per annum (per cent)	Percentage change in age group 1998–2023 2023 population in 000s					
							0-14	15-44	45-64	65-74	75-84	85+
Principal (2000–based)	1.75	135,000	Male: 78.8 Female: 83.1	64,491	5,254	0.36	–8% 10,471	–3% 24,071	27% 17,291	32% 6,567	39% 4,438	47% 1,654
Principal	1.80	95,000	Male: 78.7 Female: 82.9	63,959	4,722	0.32	–7% 10,634	–5% 23,651	25% 17,063	32% 6,560	37% 4,406	46% 1,645
Young	2.00	145,000	Male: 77.8 Female: 82.2	66,968	7,731	0.52	8% 12,277	0% 24,949	27% 17,350	32% 6,539	35% 4,315	37% 1,537
Old	1.60	45,000	Male: 79.7 Female: 83.5	60,933	1,696	0.11	–20% 9,087	–11% 22,256	23% 16,767	32% 6,575	40% 4,490	57% 1,758
Longevity	1.80	95,000	Male: 81.7 Female: 85.5	65,139	5,902	0.40	–7% 10,635	–5% 23,709	26% 17,234	36% 6,726	46% 4,662	94% 2,173

*Assumes the average number of children per woman will converge towards this number over time

**Assumes the annual net migration will converge towards this number over time

Note: 2000-based principal projections were released by GAD on 15 November 2001, 2000-based variant projections were not available.

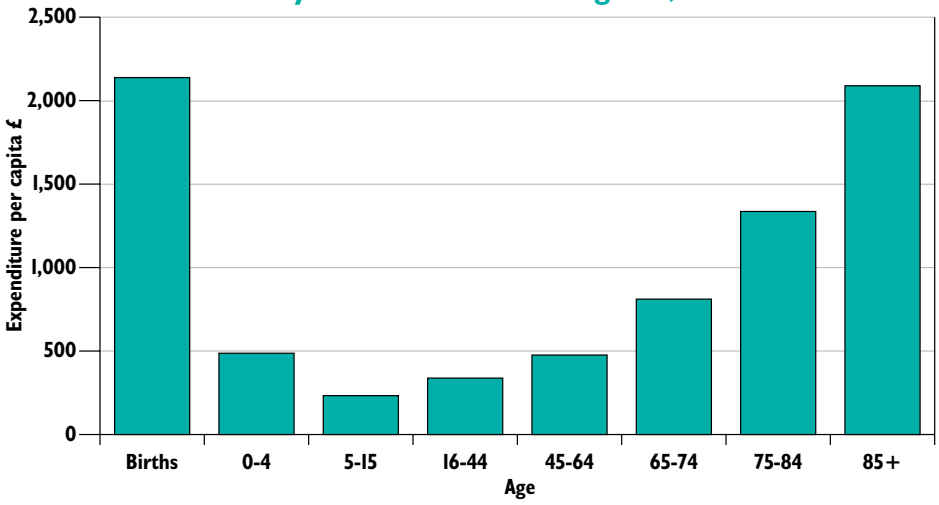
Source: Government Actuary's Department and Eurostat projections.

Health care needs and age

9.9 As explained in Chapter 6, health care needs are very closely linked to age. This is why a life course approach is being used. At the beginning and end of people's lives they need a lot of health care. This and the following four sections explore issues related to people aged over 65, while the remainder of the chapter considers issues relevant to younger age groups.

9.10 The average annual cost to the NHS of a person aged over 85 is approximately six times the cost for a 16–44 year old and four times the cost for a 45–64 year old (see Chart 9.1). The higher cost is the result of higher levels of utilisation of the NHS by elderly people[2].

Chart 9.1: Average annual per capita expenditure on hospital and community health services in England, 1996-99



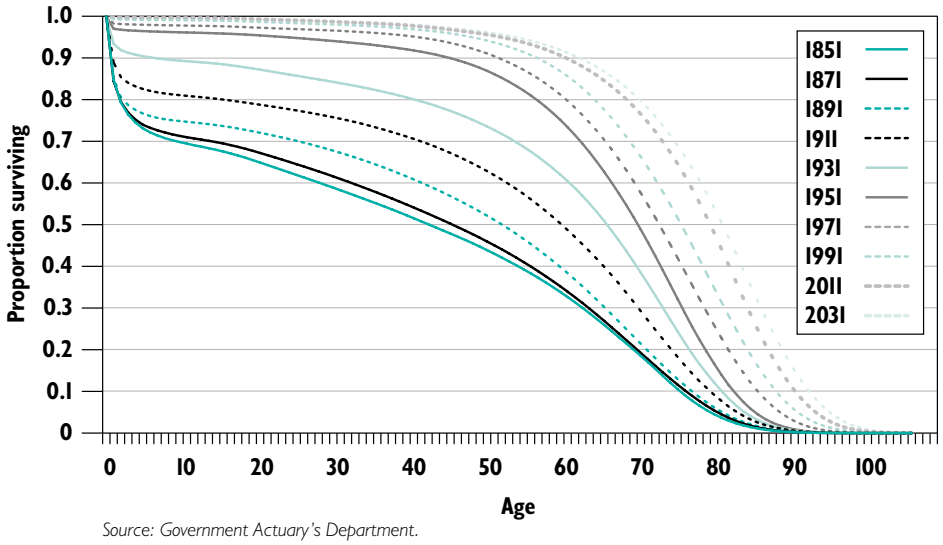
Source: Department of Health.

9.11 As elderly people are relatively heavy users of both health and social care, estimating the number of older people in the population is important in assessing future expenditure. The UK population has been ageing. Over the last 30 years the number of people aged over 80 has doubled. Over the next 20 years the number of elderly people will continue to rise and will account for an increasing share of the overall population. However the biggest increase in the proportion of the elderly will be felt in 30 years time as the 1960s baby boom reaches old age. The exact size of the future population aged over 85 is uncertain as it too depends on changes in life expectancy.

[2] Office for National Statistics (2000), *Living in Britain: results from the 1998 General Household Survey*, ONS/HMSO.

9.12 Over the last century, the number of people surviving into old age has increased dramatically. This was one of the great triumphs of the period. But, as Chart 9.2 shows, the maximum age that people reached has not changed very much. A much larger proportion of the population is surviving until relatively old ages. This phenomenon is known as the rectangularisation of the life curve.

Chart 9.2: The rectangularisation of the life curve in England and Wales



Source: Government Actuary's Department.

9.13 Between 1990–92 and 1997–99 life expectancy at birth for females increased by approximately 1 year and for males 1.5 years. Over the next 20 years the growth in the number of very old people will depend on the degree to which life expectancy continues to increase. As Chapter 5 highlights, while life expectancy for men in the UK was in line with some of our key comparator countries, life expectancy for women was the lowest recorded. In 1998 life expectancy at birth for women in the UK was 79.7 years, 1.5 years lower than the (unweighted) average for the seven comparator countries considered in Chapter 5 and 4.3 years lower than in Japan, which has the highest life expectancy in the world. The discrepancy may be related to the high smoking rates among UK women that began in the 1940s but which are a more recent phenomenon in the comparator countries.

9.14 There is clearly scope for further improvements in life expectancy in the UK. GAD projections assume that deaths will be increasingly concentrated at old ages and that the numbers of the "old old", especially centenarians, will increase substantially. The degree of improvement in life expectancy will, in part, depend on the extent to which it is constrained by a maximum age. This issue has given rise to a great deal of debate and a large literature exists[3].

[3] Thatcher AR (1999), The long-term pattern of adult mortality and the highest attained age, *Journal of the Royal Statistical Society Part A* 162 (Part 1): 5-43.

For example Professor Tom Kirkwood in the Reith Lectures argued that there is no biological basis for a maximum age. He and others suggest that over this century the human lifespan will extend. "We now understand that our bodies are not programmed with some unavoidable sell–by date; we are not programmed to die ... ageing is neither inevitable nor necessary".[4] However, this issue is unlikely to be important in the period of this Review.

The impact of proximity to death on health needs

9.15 It is possible to assess the impact of a growing and ageing population on the resources required for the health service, by estimating the change in health care utilisation that would be required if the future population used health services at the same rate as the current population in each age group. But this method assumes a relatively simple relationship between ageing and health and social care expenditure, i.e. the older one becomes, the higher the health and social care costs as illustrated by the conventional age–cost curve shown in Chart 9.1. However, there are two related effects that need to be taken into account: the health care needs of people as they age; and the health care needs of people as they approach death.

9.16 From around the age of 30 the probability of dying increases with each successive year. People's health care needs are higher as they approach death. Part of older age groups' higher cost will reflect the greater number of people close to death as well as age related health care needs. There is a considerable body of evidence from the UK and other countries that demonstrates that acute health care costs are strongly associated with proximity to death.[5,6,7,8,9] More than a quarter of all acute health care costs are incurred in the last year of life.[10]

[4] Kirkwood T (2001), *The end of an age: why everything about ageing is changing*, The Reith Lectures, Profile Books.

[5] McGrail K, Green B, Barer ML, et al (2000), Age, costs of acute and long-term care and proximity to death: evidence for 1987/88 and 1994/95 in British Columbia, *Age and Ageing* 29: 249-253.

[6] Hanlon P, Walsh D, Whyte B et al (1998), Hospital use by an ageing cohort: an investigation into the association between biological, behavioural and social risk markers and subsequent hospital utilisation, *Journal of Public Health Medicine* 20: 467-76.

[7] Lagergren M and Batljan I (2000), Will there be a helping hand: macroeconomic scenarios of future needs and costs of health and social care for the elderly in Sweden, 2000-30, Annex 8 in *The Long-Term Survey 1999/2000*, Stockholm.

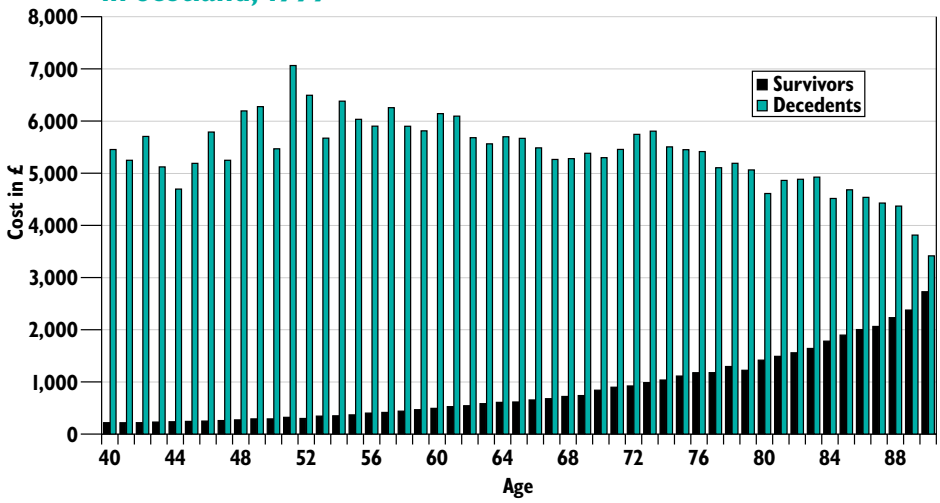
[8] Zweifel Felder S and Meiers M (1999), Ageing of population and health care expenditure: a red herring? *Health Economics* 8: 485-496.

[9] Lubitz JD and Riley GF (1993), Trends in Medicare payments in the last year of life, *New England Journal of Medicine* 328: 1092-6.

[10] This figure is based on preliminary analysis of English Hospital Episodes statistics, weighted for decedents and survivors using the results from Scottish Record Linkage data.

9.17 The costs of acute health care incurred in the last year of life do not increase sharply with age. As Chart 9.3 shows, it appears that the older a patient is, the lower their acute health costs in the period immediately before death (classified as decedents in Chart 9.3).[11]

Chart 9.3: Average hospital costs for decedents and survivors in Scotland, 1999



Note: decedents are people who died in 1999, survivors are people who were not in their last year of life in 1999.

Source: Graham B, Normand C and Goodall Y (forthcoming) Proximity to death and acute health care utilisation in, to be published on the Information and Statistics Division (ISD), NHS Scotland website in January 2002. www.show.scot.nhs.uk/isd/NHSiS_resource/costs/costs.htm

9.18 The cost of acute health care for survivors (people of the same age who were not in their last year of life in 1999) was on average around £4,500 a year less than for decedents. But the costs for survivors increase very steeply with very old age. The average cost of acute care for an 88 year old survivor was twice that of a 75 year old survivor.

9.19 A different pattern exists for social care in which costs rise with age, but the additional costs for those close to death also increase with age[12]. Long–term care is more heavily concentrated on the very elderly than acute care – the average age of older residents of care homes is 85. This suggests that the ageing population will result in a relative shift towards social care from acute hospital care leading to greater increases in long–term care costs than in acute care costs.

[11] Graham B, Normand C and Goodall Y (forthcoming), *Proximity to death and acute health care utilisation in Scotland*, to be published on the Information and Statistics Division (ISD), NHS Scotland website in January 2002. *www.show.scot.nhs.uk/isd/NHSiS_resource/costs/costs.htm*

[12] See footnote 5.

9.20 One study examined the implication of ignoring the importance of proximity to death in assessing the impact of ageing on health care costs. This research found that taking account of proximity to death (albeit using a crude and extreme method) could reduce projections of the acute care costs of an ageing population by up to a half[13].

9.21 For this review work has been commissioned using the Scottish Record Linkage database to compare current use of acute care services for different age groups separately for:

- decedents (people who died in 1999); and
- survivors (people who survived the year).

9.22 The different patterns of primary care use of decedents and survivors are also being explored using data from England and Wales from the General Practice Research Database combined with the results of previous Canadian research[14]. The impact of an ageing population is being assessed, taking account of both the resources required to meet people's needs as they approach death and the resources required to meet the increased health care needs of people as they age. The results will be incorporated into the final Health Trends Review report in 2002.

Changing health needs of an ageing population – compression of morbidity?

9.23 Projections of health care needs based just on demographic change assume that the health care needs of people at different ages will not change over the next two decades. This is clearly not realistic. Changes in the health care needs of older people are likely to have a significant effect on the health service in the UK.

9.24 There is a great deal of uncertainty and debate about what will happen to levels of morbidity among older people as life expectancy continues to increase. The optimistic view is that increases in life expectancy will be accompanied by similar or even greater increases in healthy life expectancy so that people will spend a smaller proportion of their lives in ill health. This is known as the compression of morbidity. The pessimistic view is that as people live longer they will spend more of their life in ill health and there will be an expansion of morbidity. Clearly these two scenarios would have very different implications for the health service over the next 20 years.

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[13] Emmerson C, Frayne C and Goodmand A (2000), *Pressures in UK healthcare: challenges for the NHS*, Institute for Fiscal Studies, London.

[14] Roos NP, Montgomery P and Roos LL (1987), Health care utilization in the year prior to death, *The Milbank Quarterly* 65(2): 231-254.

9.25 The evidence on the compression or expansion of morbidity has been mixed. In Great Britain, between 1981 and 1995 both life expectancy and healthy life expectancy at age 65 increased as Table 9.2 shows. But improvements in healthy life expectancy did not keep pace with improvements in life expectancy resulting in people living more years in self–reported poor health, which includes relatively minor conditions.[15]

Table 9.2: Changes in life expectancy and healthy life expectancy between 1981 and 1995

	Life expectancy		Healthy life expectancy at 65*		Life expectancy free from limiting long standing illness at 65	
	Males	Females	Males	Females	Males	Females
1981	13.0	16.9	9.9	11.9	7.6	8.5
1995	14.7	18.3	11.3	13.0	8.3	9.5
Difference	1.7	1.4	1.4	1.1	0.7	1.0

**expected years of life in good or fairly good general health*
Source: Kelly S and Baker A (2000) Healthy life expectancy in Great Britain, 1980–96, and its uses as an indicator in United Kingdom Government Strategies. Health Statistics Quarterly 7: 32–37.

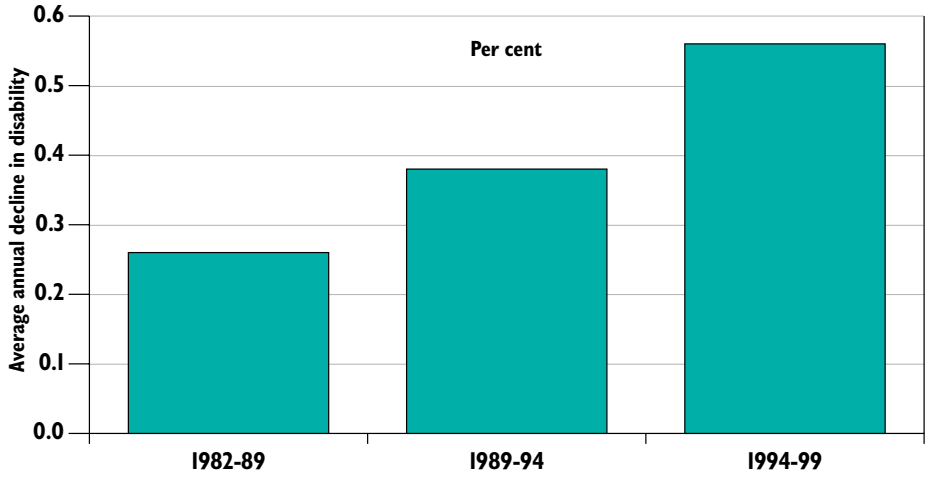
9.26 Comparing different generations of people at the same age provides an alternative way of exploring this issue. A recent study found that although life expectancy had increased, the majority of measures of health provided no indication that health among those aged 55–64 had improved[16]. "The prevalence of self perceived poor health, chronic and acute illnesses, cancer, and cardiovascular and respiratory conditions, and rates of GP referrals, hospital admissions, and numbers unable to work, have all either remained fairly constant or have increased".

9.27 However, there are some signs that the health of older people is improving between generations. The prevalence of smoking has been falling. But the overall prevalence of long–standing illness has not declined and trends in other health–related behaviours such as drinking alcohol and not exercising are worsening.

9.28 However, data from the US is generally considered to provide robust evidence of a significant compression of severe morbidity over the last two decades. Disability amongst the over 65s has declined throughout the period and at a greater rate in the 1990s than in the 1980s[17] (see Chart 9.4).

[15] Kelly S and Baker A (2000), Healthy life expectancy in Great Britain, 1980-96, and its use as an indicator in United Kingdom Government strategies, *Health Statistics Quarterly* 7: 32-37.
[16] Dunnell K and Dix D (2000), Are we looking forward to a longer and healthier retirement?, *Health Statistics* Quarterly 6: 18-24.
[17] Manton KG and Gu X (2001), Changes in the prevalence of chronic disability in the United States black and nonblack population above age 65 from 1982 to 1999, *PNAS* 98(11): 6354-6359.

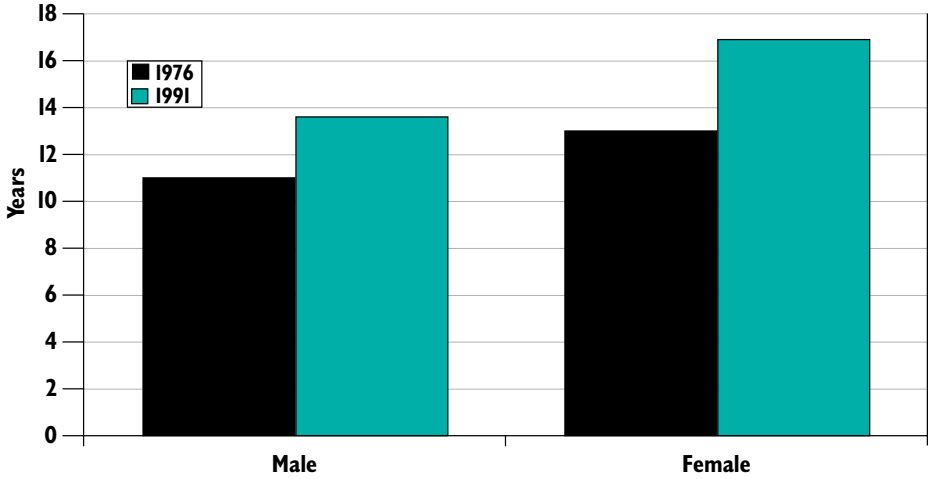
Chart 9.4: Disability among the over 65s in the US, 1982-99



Source: Manton KG and Gu X (2001), Changes in the prevalence of chronic disability in the United States black and nonblack population above age 65 from 1982 to 1999. PNAS, 98(11): 6354-6359.

9.29 Evidence for Great Britain also indicates that rates of severe disability may be declining. Between 1976 and 1991 disability free life expectancy at age 65 increased from 11.0 years to 13.6 years for men and from 13.0 years to 16.9 years for women[18] (see Chart 9.5). Severe disability in both the US and UK was defined in relation to an inability to perform activities of daily living, such as bathing.

Chart 9.5: Disability free life expectancy at age 65 in Great Britain, 1976-91



Source: Based on data from Bone M et al (1995) Health expectancy and its uses – The Stationery Office, London.

[18] Bone A, Bebbington A et al (1995), *Health expectancy and its uses*, The Stationery Office, London.

9.30 The apparently conflicting findings between the UK work on self–reported ill health and US and UK work on severe morbidity may be the result of different trends affecting severe and more moderate ill health. The data suggests that while levels of very serious ill health are falling, older people are experiencing more minor health problems. This suggests that: costs associated with long–term chronic conditions might rise while costs associated with severe disabilities might fall, although past trends may not prove a good guide to the future. Box 9.1 provides an insight into the future elderly and their health status.

9.31 For this Review, the impact of different future levels of physical dependency on use of long–term care for people aged over 65 is being examined. The Review is examining how a 1 per cent annual increase and a 1 per cent annual decline in age–specific levels of physical dependency (measured in relation to the ability to perform activities of daily living) will affect elderly people's need for care. These target rates have been selected as they allow comparison with previous work.[19] These projections will also incorporate future changes in marital status and housing tenure. This will enable the likely balance between informal and formal care to be assessed, the importance of which is outlined in Box 9.1.

Tackling age discrimination in the treatment of elderly people

9.32 Even if health status remains constant, current levels of service use by elderly people are likely to increase over the next 20 years. This is because of presently widespread concerns about the existence of age discrimination in the treatment of older people in the health service. Evidence suggests:

- the elderly receive a poor deal from public health services when compared with younger counterparts with similar clinical need[20];
- analysis of treatment rates by age for certain cardiac and orthopaedic procedures suggests that expenditure on these procedures would need to rise by 11 per cent to give the oldest elderly the same treatment rates as the younger elderly. The fact that prevalence rises with age suggests treatment rates should rise, not fall, with increasing age, although rises in co–morbidity and other contra–indications may limit appropriate treatment rates in late old age;

[19] Wittenberg R, Pickard L, Comas-Herrera A et al (2001), Demand for long-term care for older people in England to 2031, *Health Statistics Quarterly* 12.

[20] Bowling A, Bond M, McKee D et al (2001), Equity in access to exercise tolerance testing, coronary angiography, and coronary artery bypass grafting by age, sex and clinical indications, *HEART* 85(6): 680-686.

Box 9.1: The future elderly

The experiences of people born at different times during the last century have been very different. The elderly today were born during and immediately after the First World War. They lived through the stock market crash, great depression, fought in World War Two and started their families as the NHS was being established. Key differences between this group and the future elderly, who were the first baby boomers born immediately after World War Two, are:

- those born in 1946-50 experienced unusually high rates of marriage and child-bearing suggesting that the levels of solo living in this group may prove lower than indicated by the overall trend[1];
- informal care provided by spouses is likely to be increasingly important in the coming decades. In 20 years' time more dependent older people are likely to be in a stable married or cohabiting union than is true of dependent older people at present[2]. This reflects the unusually high rates of marriage of the 1946-50 birth cohort;
- the future elderly are likely to be healthier than their predecessors thanks to reductions in the prevalence of smoking[1];
- but they may report higher rates of limiting long-standing illness. This relates to a broadening of public definitions of health and higher expectations about quality of life combined with reduced tolerance of minor disorders. It might also be related to evidence of higher levels of stress in the workplace (e.g. longer working hours) combined with higher levels of participation in the labour force among women[1];
- the future elderly, as a whole, will probably be better off in retirement than current elderly people. This is a result of higher levels of owner occupation and rising membership of pension schemes. This trend will reinforce the likely rise in expectations of quality of life[1];
- but there may be increasing inequalities in wealth in later life for those entering retirement in the next decades[1].

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[1] Evandrou M and Falkingham J (2000), Looking back to look forward: lessons from four birth cohorts for ageing in the 21st century, *Population Trends* 99: 27-36, and Evandrou M (2001), *Socio-economic characteristics of future elders and their impact on the demand for health and social care over the next 20 years*, & Health Trends Review: Proceedings of a conference held at the Barbican Centre, London on 18 and 19 October 2001, HM Treasure, November 2001.

[2] Pickard L, Wittenberg R, Comas-Herrera A et al (2000), Relying on informal care in the new century? Informal care for elderly people in England to 2031, *Ageing and Society*, 20: 745-772, and Pickard L, Wittenberg R, Comas-Herrera A et al (2001), *The interface between informal and formal care of older people now and over the next 20 years*, paper in Health Trends Review: Proceedings of a conference held at the Barbican Centre, London on 18 and 19 October 2001, HM Treasury, November 2001.

- international comparisons of treatment rates for cardiac procedures show that the UK is among the countries that relied the least on technologically intensive treatments[21];
- on average, elderly people in the UK use three and a half times the amount of hospital care used by those aged under 65. In Canada older people get more than eight times as much care as those aged under 65. In the UK the ratio has been declining while elsewhere it has increased[22] (see Table 9.3). The difference could be explained by different incentives to treat in Canada, differences in the relative costs of interventions customary at different age bands, and differences in the average length of stay in hospital. However, age discrimination could also play a part.

9.33 Unequal access related to age is something that is increasingly unacceptable, as the English National Service Framework for Older People makes clear. Standard One of the National Service Framework for Older People is "Rooting out age discrimination" – "NHS services will be provided, regardless of age, on the basis of clinical need alone". This policy direction is likely to lead to higher levels of utilisation among elderly people in the UK in future.

Table 9.3: Ratios of per capita expenditures of those aged over 65 to those aged 15–64

		Early to mid 1980s	Mid to late 1990s
Japan	Overall expenditure	4.34	4.49
	Inpatient expenditure	5.34	5.44
	Other expenditure	3.46	3.79
Canada	Overall expenditure	4.46	4.32
	Hospital expenditure	7.72	8.57
	Physician expenditure	2.04	2.22
	Drug expenditure	20.85	17.89
Australia	Overall expenditure	1.77	2.16
UK	Overall expenditure	3.63	2.87
	Hospital and community health services expenditure	4.74	3.63
	Family health services expenditure	1.45	1.37

Source: Seshamani M (forthcoming), Health care expenditures and ageing: an international comparison, Chapter in PhD thesis, The impact of ageing on health care expenditures, Oxford University.

[21] Jacobzone S (2001), Can we open the black box of health systems? Paper presented at the OECD Health Conference *Measuring up: improving health system performance in OECD countries*, November 2001, Ottawa, Canada. www.oecd.org/els/health/canconf/jacobzone.pdf

[22] Seshamani M (forthcoming), Health care expenditures and ageing: an international comparison, Chapter in PhD thesis *The impact of ageing on health care expenditures,* Oxford University.

Expectations of the future elderly

9.34 Expectations about quality of life at particular ages are likely to be different in 20 years time. Many more of the very elderly are likely to expect to be fully mobile, have good eyesight, etc. It seems probable that there will be increases in the number of operations, such as hip and knee replacements and cataract removals, being undertaken for older age groups, particularly if technology reduces the risks of intervention. Future elderly people are therefore likely to be more demanding of the health service because of their expectations about health and treatment; their improved education and economic circumstances suggest they will be less deferential towards medical professionals than the current elderly. These trends combined suggest future elderly people will receive higher levels of care for a given health need (see Box 9.1 for an analysis of the future elderly).

9.35 To assess the impact of tackling age discrimination and rising expectations, this Review will investigate the sensitivity of expenditure projections to increases in the levels of care received in hospital by future elderly people. The analysis will be limited to hospital care as this is the area in which there is evidence to support the development of specific scenarios.

Changes in the disease burden

9.36 Chapter 6 explained that the Review is using a life course approach. The main focus has been on the later stages of life – old age and death – described above. This is because the conditions that account for the majority of the burden of disease in the UK are primarily related to old age. But a life course approach highlights the importance that health in early life can have on later adult health[23] and the benefits of investing in child health[24]. However, during the 20 year time frame of this Review, the major impact that any changes in child health should eventually have on future adult health will not be felt.

9.37 Most diseases are caused by the interaction of biological and environmental factors. The ageing process results in biological degeneration that in turn increases vulnerability to disease. Most chronic conditions have a very strong environmental or lifestyle link. For example around a third of all cancers are related to smoking and a further third to diet[25]. As a person ages, their cumulative exposure to these environmental and life style risks increases, resulting in a higher probability of succumbing to chronic diseases such as cancer and heart disease.

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[23] Barker DJP (1998), *Mothers and babies and health in later life* (2nd edition), Churchill Livingstone, Edinburgh.

[24] Wadsworth M (1999), Early life, chapter in Marmot M and Wilkinson RG (Eds) *Social determinants of health*, Oxford University Press, Oxford.

[25] Anonymous (1997), *Food, nutrition and the prevention of cancer: a global perspective*, American Institute for Cancer Research, Washington.

9.38 As the population ages, so these chronic diseases account for an increasing share of the burden of disease. This is increasingly the case since one of the great successes of modern medicine has been to convert previously life–threatening conditions into chronic conditions. And there is concern that extending life expectancy could result in higher numbers of older people with chronic age–related conditions such as arthritis and dementia.

9.39 But age alone does not account for the health profile. The nature of the prevailing risk factors, medical advance and the quality of the health care system also have an impact on the level and type of disease that will occur. For example, as Chapter 5 discussed, there is evidence that the number of medical staff per head in a country is strongly associated with health outcomes.

9.40 However, the impact of risk factors and the health care system on the current disease profile (i.e. those diseases that constitute the major burden to society) is thought to be considerably less than the impact of demography[26]. Over the next 20 years there is unlikely to be a significant change in the *major* burdens of disease in the UK. Chronic conditions and accidents will remain the most important burdens as in recent decades[27]. Chart 9.6 shows how the ranking of the burden of disease in developed countries in 2000 is projected to change by 2020[28]. The analysis presented in Chart 9.6 incorporates population projections. The conditions represented in the chart account for 80 per cent of the total burden of disease.

9.41 Based on the information in Chart 9.6 it can be concluded that over the next 20 years:

- there will be no changes in the conditions that account for the five main burdens of disease in each age group. There will be minor changes in the relative positions in the list;
- mental ill health will remain the key burden among young adults;
- the absolute burden of disease will fall across all the main conditions for 0–44 year olds; and
- the absolute burden of disease will rise across all the main conditions for those aged over 45.

[26] World Bank (1993), *World Development Report: investing in health*, Oxford University Press.
[27] Black DA and Pole JD (1975), Priorities in biomedical research: indices of burden, *British Journal of Preventive and Social Medicine* 29: 222-7.
[28] Murray CJL and Lopez AD (Eds) (1996), *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020*, Harvard School of Public Health, on behalf of the World Health Organisation and World Bank, distributed by Harvard University Press.

Chart 9.6: Ranking of the main burdens of disease in established market economies (DALYs in brackets)

Age	Five main burdens of disease 2000	Five main burdens of disease 2020
0–4	1 Congenital anomalies (1,566)	1 Congenital anomalies (791)
	2 Perinatal conditions (1,411)	2 Perinatal conditions (666)
	3 Unintentional injuries (429)	3 Unintentional injuries (253)
	4 Infectious and parasitic diseases (276)	4 Infectious and parasitic diseases (152)
	5 Neuro-psychiatric conditions (226)	5 Neuro-psychiatric conditions (142)
5–14	1 Unintentional injuries (597)	1 Neuro-psychiatric conditions (518)
	2 Neuro-psychiatric conditions (562)	2 Unintentional injuries (427)
	3 Respiratory diseases (213)	3 Respiratory diseases (191)
	4 Cancer (142)	4 Oral conditions (147)
	5 Oral conditions (139)	5 Cancer (117)
15–44	1 Neuro-psychiatric conditions (16,381)	1 Neuro-psychiatric conditions (14,755)
	2 Unintentional injuries (4,939)	2 Unintentional injuries (4,150)
	3 Infectious and parasitic diseases (2,637)	3 Intentional injuries (2,083)
	4 Intentional injuries (2,240)	4 Infectious and parasitic diseases (1,995)
	5 Cancer (2,156)	5 Cancer (1,649)
45–59	1 Cancer (5,434)	1 Cancer (5,538)
	2 Cardiovascular diseases (4,301)	2 Cardiovascular diseases (4,057)
	3 Neuro-psychiatric conditions (3,502)	3 Neuro-psychiatric conditions (3,601)
	4 Musculo-skeletal diseases (2,133)	4 Musculo-skeletal diseases (2,251)
	5 Digestive diseases (1,741)	5 Digestive diseases (1,915)
60+	1 Cardiovascular diseases (12,769)	1 Cardiovascular diseases (13,449)
	2 Cancer (8,171)	2 Cancer (9,426)
	3 Neuro-psychiatric conditions (4,011)	3 Neuro-psychiatric conditions (5,585)
	4 Respiratory diseases (2,498)	4 Respiratory diseases (3,020)
	5 Digestive diseases (1,791)	5 Digestive diseases (2,285)

Notes: DALYs are disability adjusted life years which measure both mortality and morbidity.

Source: based on an analysis of data in Murray CJL and Lopez AD (Eds) (1996) The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020. Harvard School of Public Health, on behalf of the World Health Organisation and World Bank, distributed by Harvard University Press.

9.42 So the *ranking* of the major causes of the disease burden is expected to remain relatively stable over the next 20 years. This stability was also reflected in Chapter 8 in relation to the evolution of the incidence of cancer. Much of the change in the absolute burden in Chart 9.6 relates to the changing age profile. The growing burden of disease among the elderly groups is linked to the increased population in this age group in 2020. However, it is likely there will be changes in the prevalence of specific sub–categories of disease among particular age groups. Chapter 8 documented recent increases in the prevalence of diabetes, other recent past trends in the UK demonstrate[29]:

- a decline in death from lung cancer among middle aged men in recent years, but increasing rates among women;
- a slight decline in death from breast cancer across all age groups since the early 1990s;

[29] National Statistics (2001), *Social Trends No 31*, The Stationery Office, London.

- a decline in the mortality rates from coronary heart disease in all age groups for both men and women;
- an increase in the incidence of asthma among children between the 1970s and early 1990s but a subsequent decline;
- an increase in the prevalence of common mental disorders among children[30] and young adults;
- an increase in accidents among young men; and
- an increase in the prevalence of insulin treated diabetes among people aged over 55.

These trends have resulted from changes in risk exposure such as the decline in smoking, improvements in our ability to recognise, prevent, diagnose and treat specific conditions and secular changes. Some may continue into the future while other new trends may emerge and certain trends may be reversed.

9.43 An overall improvement in mortality is reflected in the population projections that make assumptions about the extent to which mortality rates (and thus associated morbidity) will continue to improve in the future. However, the population projections do not incorporate any trends that are likely to operate over and above any changes seen in the past, nor do they capture changes in chronic morbidity. In addition to considering morbidity among the elderly as outlined earlier in this chapter, the Review is also looking at the potential impact of disease prevention and health promotion and that of reducing health inequalities among the non–elderly – both of which operate largely over and above the trends inherent in population projections.

The impact of health promotion on future health care needs

9.44 As environmental risk factors are important to the burden of disease, health promotion and disease prevention have the potential to impact significantly upon future health and health care needs. By reducing economic inactivity in the working age population and improving the productivity of individual workers, good public health can also contribute to economic prosperity. Increased life expectancy among the retired population will raise the dependency ratio so some of the economic benefits of a healthy workforce may be offset; it may, of course, be that the social implications of these effects will trigger fundamental changes in retirement.

[30] Rutter M and Smith D (Eds) (1995), *Psychosocial disorders in young people: time trends and their causes*, Wiley.

9.45 Evaluating the impact of health promotion on health outcomes is notoriously difficult. Improvements in health outcomes arise because of a wide range of impacts such as reductions in pollution, changes in the nature of employment and cultural change. Improvements in the major diseases such as heart disease and cancer can take years to materialise – hence the importance of taking a life course approach. In this respect, the 20 year time frame of this Review is too short to show the full potential beneficial impact of health promotion and disease prevention initiatives on the population's quality of life, health and use of services. However, over a 20 year period some changes can be expected and the Review is estimating what these might be.

9.46 The Government has set targets to reduce smoking rates from 28 per cent in 1996 to 26 per cent by 2005 and 24 per cent by 2010. Meeting these targets could reduce average annual admissions for heart attacks and strokes by almost 10 per cent over this decade[31]. In California, smoking levels have fallen to 17 per cent. Matching this success in the UK would double the reduction in admissions. The Review is incorporating these potential reductions in hospital admissions and will present the results in the final report in 2002.

9.47 Focusing only on smoking prevention and cessation will underestimate the full impact of health promotion and disease prevention initiatives but it is the one area in which existing evidence provides a clear quantitative method for assessing the likely impact on future utilisation of health care. In addition, Chapter 8 outlined the potential benefits in terms of reduced admissions for heart attacks as a result of widespread use of statins and the incorporation of this into the Review.

9.48 Attributing improvements to other specific interventions is problematic. However, the body of evidence in support of health promotion and disease prevention is growing and there is reasonable consensus about other key areas for intervention such as improving levels of exercise and encouraging healthy diets. Success with these two interventions and smoking cessation could reduce by around 8 per cent the number of life years lost due to known, quantifiable risk factors that are amenable to NHS intervention[32] (see Chart 9.7).

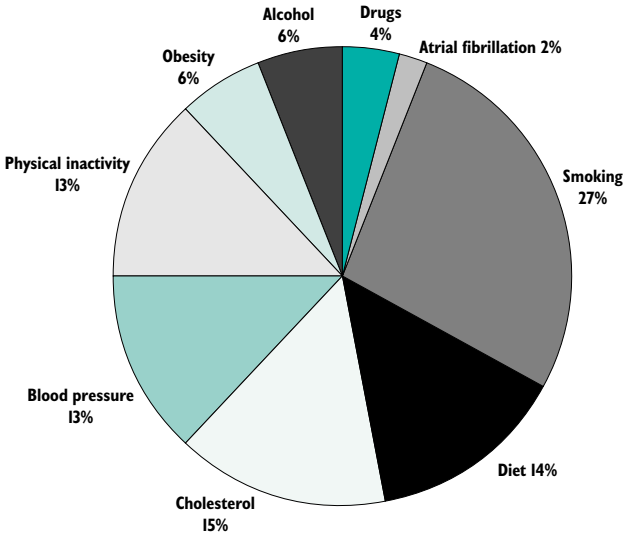
9.49 Increasingly sedentary lifestyles and low levels of physical activity are contributing to higher rates of obesity than in the past. Recent US research suggests that obesity is more detrimental to health than smoking, heavy drinking or poverty.[33] But ensuring long–term adherence to healthy lifestyle changes has yet to be demonstrated on a wide scale and the Review is not estimating any potential impacts on reduced hospital admissions beyond those associated with smoking cessation and the use of statins.

[31] Naidoo B, Stevens W and McPherson K (2000), Modelling the short term consequences of smoking cessation in England on the hospitalisation rates for acute myocardial infarction and stroke, *Tobacco Control* 9: 397-400.

[32] Department of Health (2001), Preliminary analysis. This assumes the success rate for interventions in these areas is about 15 per cent.

[33] Sturm R and Wells KB (2001), Does obesity contribute as much to morbidity as poverty or smoking?, *Public Health* 115:229-235.

Chart 9.7: The contribution of the main known, quantifiable risk factors to NHS preventable life years lost

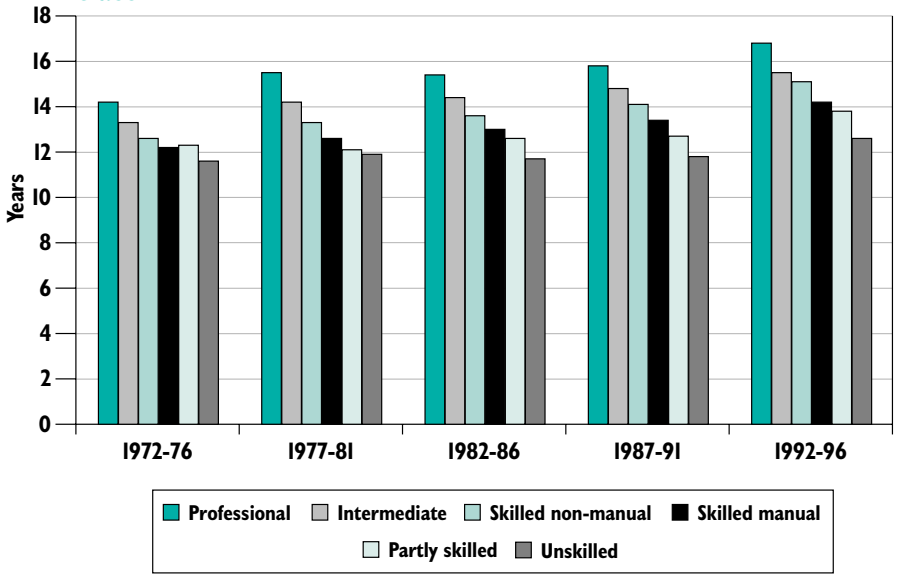


Note: there is some overlap between some of the factors.
Source: preliminary analysis by the Department of Health

Health inequalities

9.50 Although life expectancy has been improving across the entire UK population, improvements have not been spread evenly across population groups; the disparity in health status between rich and poor has been widening. The impact of socio–economic status on life expectancy is illustrated in Chart 9.8 where life expectancy at age 65 is shown to have increased by 2.6 years between 1972 and 1996 for professional men compared with an increase of only 1 year for unskilled men.

Chart 9.8: Expectations of life for men at age 65 by social class



Source: National Statistics (2000) Social Trends.

9.51 The Acheson report showed that health outcomes in the UK are not equal. For example in the late 1970s death rates were over 50 per cent higher among men in social classes IV and V compared with those in classes I and II. In the late 1980s they were two thirds higher. For women the differential rose from 50 per cent to 55 per cent.[34]

9.52 The Government has targets to reduce health inequalities. One relates to reducing by 2010 by at least 10 per cent the gap between the fifth of health authorities with the lowest life expectancy at birth and the population as a whole. This is a challenging target as life expectancy in the worst fifth of health authorities is currently 2.2 years lower for men and 1.6 years lower for women than the national average. Meeting the targets will require action to tackle the underlying causes of ill health and enhance access to health care by disadvantaged groups. As outlined in Chapter 7, the public values a health service that can help tackle inequality, but wider intervention is also required. A cross–cutting review of what more can be done to tackle health inequalities is underway. It will inform policy in health and other areas such as transport and education.

9.53 A significant proportion of avoidable ill health and death is related to socio–economic deprivation. The major killers such as cancer, coronary heart disease and stroke are linked to socio–economic deprivation partly because of the socio–economic gradient in smoking (which is steepening). In addition certain mental health problems are associated with deprivation.[35] Preliminary analysis suggests that around a third of life years lost from coronary heart disease, stroke and cancer that are amenable to NHS intervention are due to socio–economic inequalities in key risk factors such as smoking and obesity.

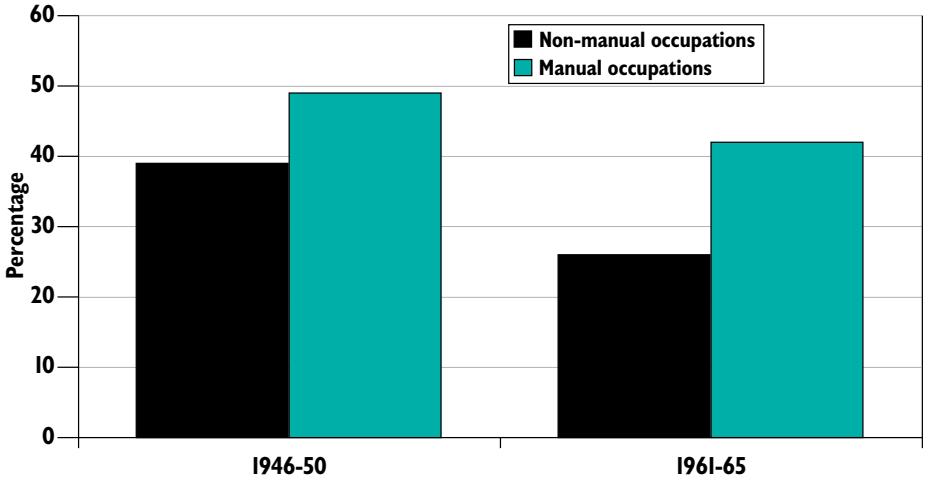
9.54 Socio–economic factors are not the only drivers of health inequalities. Evidence points to people from minority ethnic groups experiencing worse health status. In some instances these differences are driven by underlying socio–economic inequalities as many minority ethnic groups have above average levels of poverty and unemployment. The Acheson report concluded that "The diversity of experience of health between different ethnic groups may reflect different causes of poor health; differential susceptibility to these causes; differential access to factors which ameliorate cause or susceptibility, for example preventive health care services; or a combination of these".

[34] Acheson D (1998), *Independent inquiry into inequalities in health report*, The Stationery Office. London.
[35] See footnote 34.

9 CHANGING HEALTH CARE NEEDS

9.55 Looking to the future it is difficult to project what will happen to health inequalities over the next 20 years. Knowledge of how to tackle health inequalities has increased but there are still large gaps. If the Government's targets related to poverty reduction are met by 2010 it is likely that underlying health inequalities will, eventually, also be reduced. However, much evidence points to a recent widening in health inequalities.[36] For example, Chart 9.9 demonstrates the widening inequalities in smoking among successive cohorts of women. Research using the same data demonstrated the delay in uptake and reduced impact of public health messages among more deprived groups. Smoking cessation occurred first and most effectively in the middle social class.[37]

Chart 9.9: Percentage of female smokers at age 30 in two birth cohorts



Source: Evandrou M and Falkingham J (forthcoming), Smoking behaviour and social class 1974–1998: a cohort analysis, Health Statistics Quarterly, summer 2002.

9.56 The Review is exploring how changes in the socio–economic determinants of health will impact on the need for health care. To do this the Review is analysing the impact on the health service of changes in the pattern of mortality in the most deprived groups in the population. Specifically it is examining what would happen if people in the most deprived group had the same pattern of mortality as people in more affluent groups. This work is based on Scottish data on the use of acute hospital services in the last year of life by age and deprivation group.

Inequalities in access to health care

9.57 In addition to inequalities in exposure to risk and health outcomes, there is evidence of inequality in access to health care in the UK, despite care being provided free at the point of delivery. Inequality in access to care could partly explain the inequalities in outcome described above.

[36] Marmot M (2001), Future links between soioeconomic status and health, Health Trends Review: Proceedings of a conference held at the Barbican Centre, London on 18 and 19 October 2001, HM Treasury, November 2001.

[37] Evandrou M and Falkingham J (forthcoming), Smoking behaviour and social class 1974-1998: a cohort analysis, *Health Statistics Quarterly* Summer 2002.

9.58 Health service resources are distributed across the NHS according to health need.[38] A recent World Health Organisation study ranked the UK health system as one of the most equitable in the world in terms of the fairness of the financial contribution to the health system.[39] This reflects a combination of progressiveness in the tax system as a whole and the fact that it is the better off who buy private health insurance. However, an equitable distribution of payment for health care does not necessarily equate with an equitable distribution of resources between different parts of the country or between population groups. And, in turn, an equitable distribution of resources does not necessarily equate with equity in receipt of care for individuals, i.e. equal care for equal need. The NHS Plan highlighted concern that the inverse care law still applies across much of the UK. Evidence in this area presents conflicting results.

9.59 A range of studies have concluded that the distribution of NHS care is "weakly pro–poor" and appears to be in favour of the less well–off even after taking account of their higher needs. This conclusion was based on an assessment of individuals' access to resources, their use of health care services and their self–reported health status[40]. If there are systematic differences in the likelihood of an individual reporting poor health by socio–economic status these results would need to be questioned, but in the absence of any such evidence the work supports the conclusion that there is no inverse care law in the UK.

9.60 However, other work has found that the average cost per cancer death in Scotland varies systematically with socio–economic status. People living in more deprived areas who died of cancer used fewer health care resources than those in middle or affluent areas[41] (see Chart 9.10). After the age of 74 the pattern is less clear and in some age groups reversed. For example in the 90+ group those living in deprived areas had higher average costs per death compared to residents of middle and affluent areas, possibly due to bed–blocking.

9.61 The apparent inverse care law at younger ages is partly explained by the distribution of the incidence of different cancers by deprivation category. For example, there is a higher incidence of lung cancer, which has relatively low average costs per death, in more deprived categories while there is a higher incidence of breast cancer, which has relatively high average costs per death, in more affluent categories. But the different types of cancer underlying the pattern in Chart 9.10 only partly explain the results. The existence of an

[38] Propper C (2001), *Expenditure on health care in the UK: a review of the issues*, CMPO Working Paper Series No 01/030, University of Bristol. www.bris.ac.uk/Depts/CMPO/wp30.pdf

[39] WHO (World Health Organization) (2000), *The World Health Report 2000 Health systems: improving performance*, World Health Organization, Geneva.

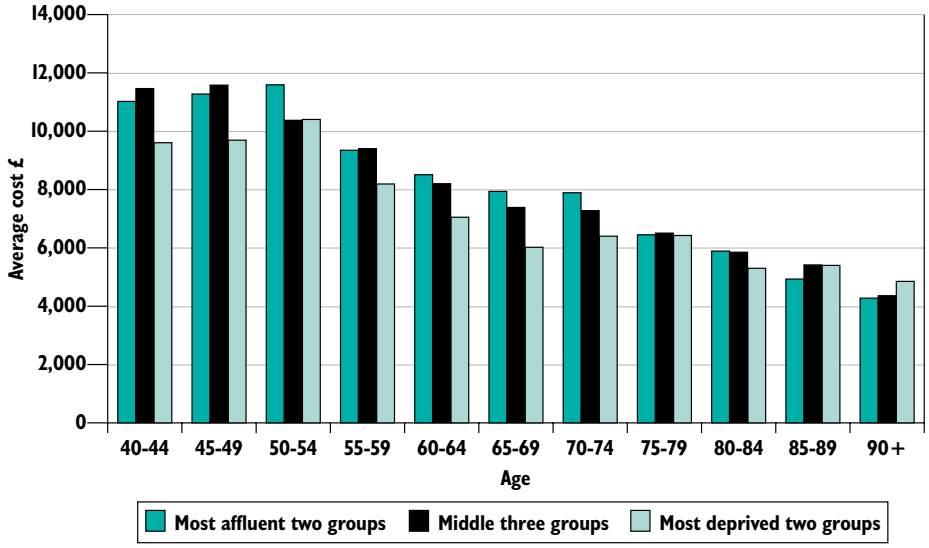
[40] See footnote 38.

[41] See footnote 11.

inverse care law is also likely to be important, with deprived groups having less access to care facilities, presenting at a later stage of disease development and being more deferential and/or less demanding towards medical professionals.

9.62 Over the next 20 years this pattern of health care use is likely to change. The Government has committed itself to tackling health inequalities and reducing poverty. If successful, levels of utilisation of care among deprived groups are likely to increase in the future relative to levels of care in more affluent groups. This is likely to happen before underlying health status improves, which was discussed in the previous section on inequalities in health. The Review is therefore exploring the likely impact on the use of hospital care of reducing the inverse care law among people in their last year of life, while holding underlying patterns of mortality constant. This involves increasing levels of utilisation in deprived groups to reflect the higher use by people living in affluent areas.

Chart 9.10: Average hospital cost per cancer death by Carstairs deprivation category, Scotland 1999



Source: Graham B, Normand C and Goodall Y (forthcoming) Proximity to death and acute health care utilisation in Scotland, to be published on the Information and Statistics Division (ISD), NHS Scotland website in January 2002. www.show.scot.nhs.uk/isd/NHSiS_resource/costs/costs.htm

Trends in health seeking behaviour

9.63 People will seek health care when they expect to gain some benefit from doing so. It is not clear whether in the future people will be more or less likely to seek care for a given health problem. Earlier in this chapter the likely increase in utilisation of health care by elderly people (even if their underlying health status remains unchanged) was described, but it is much less certain what will happen for those aged under 65. The previous section described a

potential increase in use of care as a result of reducing inequalities in access to health care. But there may be changes in the likelihood of people seeking care that go beyond those associated with the inverse care law.

9.64 Some commentators have described an increasing intolerance of minor health problems and rising expectations of quality of life and of what the health system can provide leading to greater use of care. Evidence in this area has been hard to come by; if anything, past trends point to a decreasing likelihood of consulting a GP but an increasing likelihood of attending hospital as an outpatient, when adjustment is made for self–reported health status. This conclusion is based on preliminary analysis of General Household Survey data from 1972 to 1998.

9.65 In order to deal with this uncertainty, the Review is analysing the impact on future expenditure of both increasing and decreasing the likelihood of seeking health care among those aged under 65.

9.66 Chapter 7 outlines the likely reductions in waiting times for health care. Reducing waiting times encourages people to use the NHS more. Research suggests that demand for inpatient care will be stimulated by falling waiting times[42], although the overall impact is relatively small (for every 1 per cent decline in waiting times demand for inpatient care will increase by 0.15 per cent). This Review is taking account of this effect when assessing the impact of lower waiting times on future activity in the NHS.

Conclusion

9.67 Elderly people consume a large proportion of publicly funded health and social care. The UK population has been ageing but projections have not been very accurate. The number and proportion of elderly people will rise because of the baby boom cohorts reaching older age as well as falling mortality rates (rising life expectancy). But there is uncertainty about future fertility, migration and the extent to which life expectancy will continue to increase. This means there is uncertainty about the extent to which the number and proportion of people who will be aged over 65 will rise in the future.

9.68 The projected growth in the proportion of people aged over 85 is lower between 2000 and 2020 than it was between 1980 and 2000 and is likely to be between 2020 and 2040. In the timescale this Review is considering, it is unlikely that the future age structure of the UK population alone will have as significant an impact on future expenditure on health and social care as technological change or workforce issues.

[42] Martin S and Smith P (1999), Rationing by waiting lists: an empirical investigation, *Journal of Public Economics* 71:141-164.

9 CHANGING HEALTH CARE NEEDS

9.69 An analysis of demographic pressures that does not separate the costs in the last year of life (i.e. the costs of dying) from other costs risks over–stating the size of demographic pressures on acute health care.

9.70 Other issues related to the demand for health care and levels of service use may produce substantial cost effects. There is uncertainty about the extent to which current levels of morbidity among older people will change: it seems likely that severe morbidity will decline; but evidence suggests that less severe morbidity will be extended so that people live in poorer health for a longer time than at present.

9.71 There is evidence that elderly people in the UK receive less care (for a given condition) than younger people in the UK or elderly people in other countries. Current policy suggests this imbalance will be addressed.

9.72 Differences in age– and condition–specific use of services and underlying health status are, to a certain extent, explained by differences in socio–economic status. Changes in the socio–economic distribution of the population could therefore have significant impacts on levels of morbidity and service use.

9.73 This Review is assessing the impact of the following factors on future health care expenditure:

Demography

Five variant population projections;

A separate assessment of the acute care costs for decedents and survivors;

Morbidity

Changing patterns of morbidity among elderly people;

The impact of successful smoking cessation interventions on future acute health care activity;

Reducing health inequalities;

Likelihood of seeking health care and expectations

Changing levels of utilisation of acute care among elderly people, independent of health status;

Reducing the inverse care law;

Changing health seeking behaviour among the non–elderly.

The results will be incorporated into the final report in 2002.

Questions for consultation

Q9.1 Are there any other key changes in the health needs of the UK population that are likely to have a significant impact on expenditure over the next 20 years? Are there data available so that their impact can be quantified?

Q9.2 How will the trends in the number of elderly people, their morbidity and expectations affect social care and its relationship with health care in the future? How will the impact on health and social care differ?

Demography:

Q9.3 How is life expectancy likely to change over the next 20 years? What do the changes mean for the assumptions the Review should make about the future size and structure of the population and the future patterns of disease?

Morbidity:

Q9.4 Will there be a compression or expansion of morbidity among future elderly people?

Q9.5 What health promotion and disease prevention interventions over and above smoking cessation are likely to have a significant, sustained impact on health service utilisation over the next 20 years? To what extent will health inequalities change? What impact will this have?

Likelihood of seeking health care and expectations:

Q9.6 How are future elderly people's demands for health care likely to differ from the current elderly? How will their changing expectations relate to health service use?

Q9.7 What evidence is available on trends in the likelihood of people seeking care for a given health problem?

10 TECHNOLOGY AND MEDICAL ADVANCE

Technology and medical advance are major drivers of health expenditure and have significant potential to improve the outcomes and the efficiency of the health service. Yet there are considerable uncertainties about the future direction, pace and impact of technology in health care.

This chapter considers the historical contribution of technology to spending growth, the current position in the UK, the main drivers of spending on technology and medical advance and what the next 20 years might hold in store. The main points are:

- while some technologies may reduce unit costs, overall new technology is likely to continue to put upward pressure on health care spending as it enables more people to be treated and for longer periods of time;
- the Review's preliminary estimate is that over the past 20 years technology and medical advance have contributed around 2 percentage points to the annual rate of growth in health spending;
- the UK has historically been slow to adopt and diffuse technology, leaving it lagging well behind many other major countries;
- the UK health service has a poor record on the use of information and communication technology (ICT). Putting in place the necessary infrastructure is a crucial step which must be taken before the health service is able to invest fully in applications with the potential to improve the quality, safety and efficiency of the service;
- over the next 20 years, spending on technology and medical advance will need to grow at a faster rate than in the past to catch up and keep up with other countries, including as envisaged in the National Service Frameworks (NSFs) and to meet increasing patient expectations; and
- advances in genetics and stem cell research offer the prospect of radical changes in the way medicine is practised and have the potential for significant impacts on health outcomes and costs, but there is uncertainty about the likely pace and extent of such developments over the Review period.

Introduction

10.1 Technology and medical advance are widely recognised as major drivers of health expenditure, through the delivery of more and better services to patients. A survey of 50 leading health economists in 1995[1] found that 81 per cent agreed with the statement: "The primary reason for the increase in the health sector's share of GDP over the past 30 years is technological change in medicine".

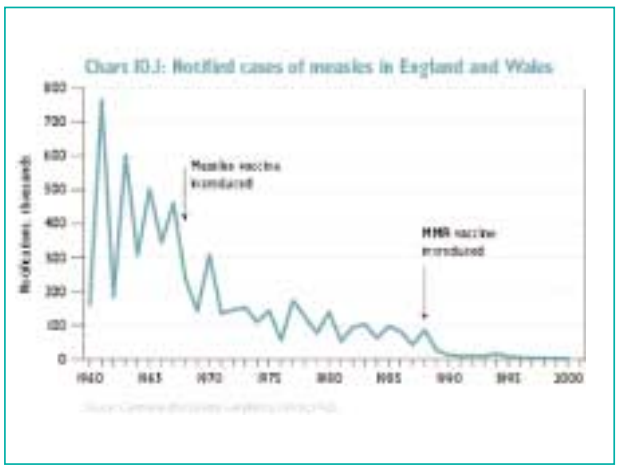
[1] Fuchs VR (1996), Economics, values and health care reform, *American Economic Review* 86:1-24.

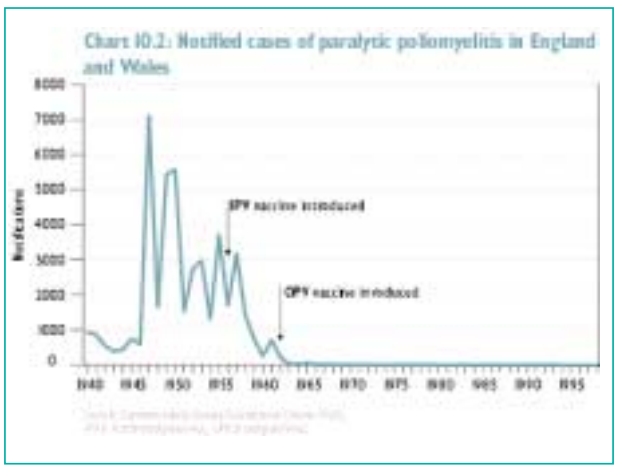
10 TECHNOLOGY AND MEDICAL ADVANCE

10.2 Technology and medical advance can be defined in a number of ways, from the very narrow to the very broad. Much consideration of technology tends to be from the physical perspective, such as the development of new pharmaceuticals and medical devices and equipment. However, the role of knowledge and information is also extremely important. For example, it was not for some 20 years after the endoscope became available that its full potential in minimally-invasive surgery began to be realised. And it seems likely that there is considerable scope for information and communication technology (ICT) to make a significant impact on the future operation of the health service.

10.3 This Review has therefore chosen to define technology and medical advance in broad terms, encompassing not just physical equipment, instruments and pharmaceuticals, but also clinical procedures and knowledge and the organisation and support systems within which health care is provided. This is consistent with the World Health Organisation (WHO) definition of technology[2].

10.4 During the last century, technology and medical advance had a major impact on the way in which medicine was practised and the health outcomes achieved. In some cases, such as the development of vaccines and antibiotics, the impact has been revolutionary. For example, as shown in Chart 10.1, the introduction of a vaccine for measles in 1968 reduced notifications in England and Wales from an average of around 400,000 a year during the 1960s to an average of around 150,000 a year in the 1970s and 75,000 a year in the 1980s. The introduction of the MMR vaccine in 1988 resulted in a further fall in the number of cases during the 1990s, with only around 2,500 notifications in both 1999 and 2000. As shown in Chart 10.2, after the introduction of a polio vaccine in 1956, polio cases fell rapidly from a peak of 7,095 notifications of paralytic polio in 1947 to just 9 cases in 1969. The last confirmed case of UK indigenous wild poliovirus was in 1982.





[2] Johansen KS (1998), WHO Concept of Health Technology Assessment, *Health Policy* 9:349-51.

10.5 There will undoubtedly be further revolutionary medical advances over the coming decades. The difficult questions to answer are what they will be, when they will occur and what impact they will have. Many people identify genomics and its related fields in this category, but there is differing opinion over the progress that will be made and the resulting impact over the 20 years covered by this Review.

The impact of technology on health spending

10.6 It is possible to distinguish two potential effects of technology on health care spending: a cost effect and a volume effect. Box 10.1 provides some examples distinguishing between the two.

Box 10.1: Examples of the impact of technology on health care spending

The differing impacts of technology on the cost and volume of health care delivered can be illustrated by considering some specific examples.

Diagnosis and treatment of peptic ulcers

It has been estimated[1] that the replacement of X-ray (barium meal) diagnosis for peptic ulcers by flexible endoscopy increased the cost of diagnosis from £120 to between £673 and £748. By contrast, the introduction of Heliobacter pylori eradication therapy for peptic ulcers significantly reduced both the initial and subsequent year treatment costs when compared to treatment through surgery. The treatment costs of this eradication therapy were put at £83 in the first year and £15 in subsequent years, compared with surgery costs of between £393 and £546 in the first year and £27 in subsequent years.

Cholecystectomy (removal of the gall bladder)

When laparoscopic cholecystectomy replaced cholecystectomy by abdominal incision (i.e. replacement of a major surgical procedure by a minimally-invasive surgical procedure), there was a 40 per cent increase in the cholecystectomy rate. Even though the laparoscopic procedure was 25 per cent cheaper, the increased usage resulted in an overall increase in the cost of gall bladder surgery of 11 per cent[2].

Pharmaco-genetics

Looking ahead, possibly beyond the 20-year horizon of the Review, some experts believe that pharmaco-genetics - the study of different responses which patients have to drugs depending on their genetic make-up - has the potential to target drugs more effectively. This might reduce costs to the health service through reducing the use of drugs in those who will not benefit, faster identification of the best product for each individual patient and reducing adverse drug reactions (ADRs) in patients. ADRs have been estimated to account for 4 to 12 per cent of hospital admissions[3].

[1] Murphy S (1998), Does new technology increase or decrease health care costs? The treatment of peptic ulceration, *Journal of Health Services Research and Policy* 3:215-18.

[2] Harrison A, Dixon J, New B and Judge K (1997), Funding the NHS: Can the NHS cope in future?, *British Medical Journal* 314:139.

[3] Lazarou J et al (1998), Incidence of Adverse Reactions in Hospitalized Patients, *Journal of the American Medical Association* 279:1200-05.

10.7 The direction of the **cost effect** will vary according to the specific technology being considered. In some cases, the cost of a new technology will be greater than that of the old technology which it replaces, or the new technology may be designed to be used alongside an existing technology. Alternatively, the technology might be introduced in an area where little intervention was previously available. In other cases, the introduction of a new technology will result in lower unit costs for a particular procedure or period of treatment, or unit costs of a particular technology will fall over time as competitor technologies enter the market. Technological advance may also impact on other parts of the health service, for example through fewer hospital admissions, shorter length of stay in hospital or reduced need for long-term care.

10.8 In general, new technology tends to result in an increase in the **volume** of activity undertaken. New technologies and medical advances can both expand the range of possible medical interventions and open up the possibility of providing existing treatments to a wider group of people, for example by making particular procedures simpler and safer to perform.

10.9 New technology and research can also lead to changes in treatment thresholds and hence the number of people being treated. In other words, the definition of disease is not static. For example, in 1999 the WHO reduced the blood glucose level threshold used in its definition of diabetes, roughly doubling the estimated prevalence of the condition[3]. Estimates made by the National Horizon Scanning Centre (NHSC) at the University of Birmingham suggest that this might increase the percentage of the UK population diagnosed with diabetes from around 3 per cent to around 7 per cent.

10.10 In addition, the changing nature of treatment is important. It is possible that the next 20 years will see the development of new drugs which result in some key diseases, e.g. certain types of cancer, being increasingly managed as chronic conditions with patients being treated on an ongoing basis in much the same way as diabetics are currently treated. The next 20 years could also see a shift in the balance of treatment, with growth in the treatment of risk relative to the treatment of disease, e.g. through greater screening. These possibilities and others are considered in more detail later in this chapter.

10.11 Thus some technologies will be expenditure increasing and some will be expenditure reducing. While it may be possible to examine the relationship between costs and volume at the level of individual technologies, it is much more difficult to examine at an aggregate level. However, there is general agreement about the direction of the overall impact of technology and

[3] WHO (1999), *Definition, diagnosis and classification of diabetes mellitus and its complications*, WHO, Geneva.

medical advance on health spending: *"New technologies typically create pressure to increase spending because, although they may allow cheaper treatment per case, they also offer new opportunities for treatment or raise the quality or outcome of treatment and thus increase the number of people who may benefit."* [4]

10.12 In addition to the impact on health care spending, new health technologies will have many wider effects. They might impact on spending on other public services (for example, by reducing pressure on social services) and are likely to deliver benefits to individuals which are more difficult to quantify (for example, reduced surgical scarring). They are also likely to have a wider economic impact (for example, if they result in a generally healthier population and a compression of morbidity).

The current UK position

10.13 The UK has lagged behind other countries in the adoption and diffusion of new technologies. A study of technological change in heart attack care[5] categorises the UK (based on data for Scotland and the Oxford region of England) as a "late" and "slow" adopter of new technology, compared with "early" and "rapid" adoption of technology in the US. While Australia, Canada and France tend to be classified as "late" adopters of technology, once they start to adopt a new technology they are found to do so rapidly.

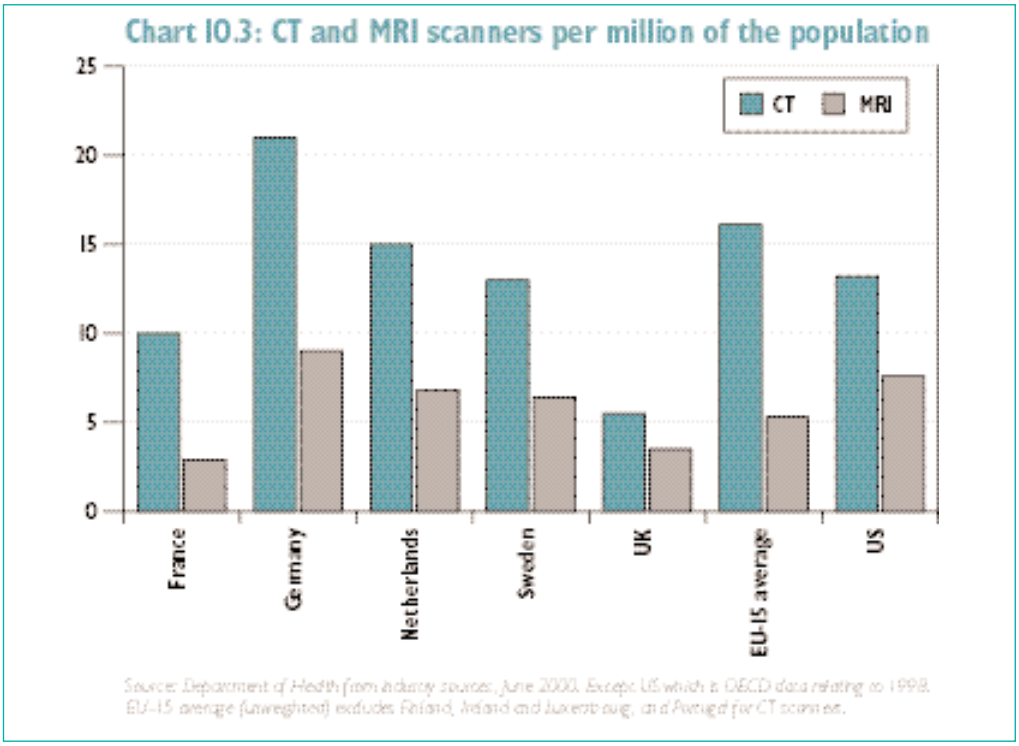
10.14 The study suggests that an important reason for these differences is likely to be the incentives and budgetary controls facing health care providers in different countries. The US is characterised by the provision of additional reimbursement to hospitals based on the treatment provided and limited regulatory restrictions on the particular technology adoption decisions of hospitals, while the UK has cash-limited budgets and greater central control over technology-adoption decisions.

10.15 Chart 10.3 shows a shapshot of the number of Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) scanners per million of the population in European countries compiled by the Department of Health from industry sources in June 2000. The UK lags significantly behind most other countries. The UK also has a low number of linear accelerators (used for radiotherapy treatment). The UK's 3.7 machines per million of the population compares with a European average of around 6 per million. The age profile of equipment in the UK has been a factor that has influenced the ability to provide modern imaging techniques. Recent central capital initiatives have begun to address this issue for scanners, but mechanisms to upgrade equipment in the future are still not in place.

[4] Harrison A, Dixon J, New B and Judge K (1997), Funding the NHS: Can the NHS cope in future?, *British Medical Journal*, 314:139.

[5] McClellan M, Kessler A et al (2001), Technological change around the world: Evidence from heart attack care, *Health Affairs*, May/June 2001:25-42.

10.16 Utilisation of such equipment within what are regarded as normal working hours appears to match or exceed that of other countries. Such high utilisation rates means that cases must be prioritised and there is little flexibility to deal with unexpected pressures. Opportunities to make use of this type of equipment for more than 12 hours a day appear to have been limited by an inadequate number of trained staff, although there are current workforce initiatives which aim to address this issue.



10.17 Evidence indicates a similar picture for pharmaceuticals, with the uptake of new drugs in the UK at best half of that in Germany and a third of that in France[6]. It also shows the UK lagging France and Germany in the use of diagnostic testing for viral disease and cancer.

10.18 The above illustrates clearly how the UK lags behind other countries in the use of technology in the health sector. There is undoubtedly a gap to be closed in order to catch up with best practice elsewhere in the world. However, that does not necessarily mean that the UK should aim to match the position of the most technology-rich health services in other countries. Some countries have over-invested in certain technologies to the point of inefficiency.

[6] McKinsey and Company, *Patients expectations: A perspective on 2020*, in Health Trends Review: Proceedings of a conference held at the Barbican Centre, London on 18 and 19 October 2001, HM Treasury, November 2001.

10.19 The optimal timing, speed and extent of technological diffusion depends importantly on the expected impact of technology on health outcomes. The appropriate response to new technologies is for rapid and consistent diffusion across the health service once robust evidence of cost effectiveness is available. The National Institute for Clinical Excellence (NICE) will have a pivotal role to play in providing this evidence base given its responsibility for assessing the clinical benefits and the costs of health care interventions. Diffusion will also rely crucially on resources being made available to purchase the technologies.

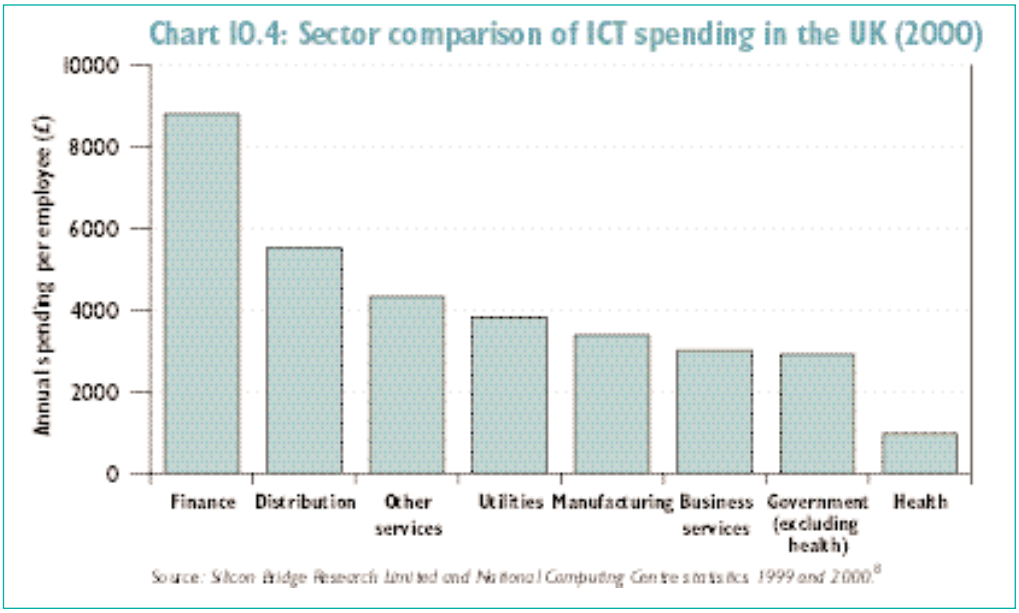
10.20 However, estimates of the likely impact of technology on health outcomes can be difficult to produce. In only half of the 22 topics -– made up roughly equally of drugs and devices – on which NICE had issued guidance by March 2001 was there an estimate available of cost per quality-adjusted life year (QALY) or per life year gained, i.e. relating cost to health gains. For the other technologies, NICE judged that this measure of cost effectiveness was either 'very difficult' or 'impossible' to estimate, mainly due to a lack of data on the impact of the technology on patients' quality of life[7].

Information and communication technology

10.21 Information systems to support the improvement of service quality must be a major feature of the changing health service over the next 10 years. Improving the quality of information and use of ICT is fundamental to the concept of integrated care, considering the needs of patients rather than institutions, introducing a 'whole system' approach to break down traditional care boundaries and delivering an integrated system.

10.22 The UK health service has a poor record on the use of ICT - the result of many years of serious under-investment. Chart 10.4 compares the health care sector with other sectors in the UK. The contrast is striking, with the health sector spending less per employee than any other sector of the economy. The banking sector is estimated to spend around nine times as much on ICT per employee as the health sector, distribution over five times as much, and business services and government (excluding health) around three times as much.

[7] Raftery J (forthcoming), *NICE, faster access to modern treatments? A review of its guidance in 2000.*



10.23 Such sectoral differences are not just a feature of the UK. The health care industry tends to spend proportionately less than other industries on ICT investment across the world. For example, the US health care industry ranked 38th out of 53 industries in a survey[9] of IT investment per worker in 1996, spending around 70 per cent less than the average across the economy, five times less than business services and around ten times less than financial institutions. A key difference, however, is that while spending on ICT is currently around 1½ per cent of total health spending in the UK, it is around 6 per cent in the US.

10.24 Current plans commit to a £1 billion investment in modernising NHS information and systems over the lifetime of the NHS Information Strategy[10] – 1998 to 2005. By the end of 2002, hospitals and GPs should be routinely exchanging structured electronic messages for referrals, discharge summaries, laboratory and radiology requests and results. By 2005, it is planned that there will be electronic patient record systems for all acute hospitals and 24-hour emergency care access to patient records.

10.25 Given the starting point, the challenge of putting in place the necessary ICT infrastructure should not be under-estimated. However, it is a crucial step which must be taken before the health service can start to introduce the applications which will allow it to begin to realise the benefits which a modern and integrated ICT system has to offer. These are considered later in this chapter as one of the key factors likely to influence the resource requirement over the next 20 years.

[8] Silicon Bridge Research Limited (2001), *Evaluating the market impact of ehealth*: a presentation to the European Summit for Health IT Industry Executives, July 2001.

[9] US Department of Commerce, Office of Policy Development, Economic Statistics Administration (1999), The Emerging Digital Economy II, Washington DC.

[10] Department of Health (2001), Building the information core – Implementing the NHS Plan, NHS Information Strategy.

TECHNOLOGY AND MEDICAL ADVANCE *10*

Drivers of technology growth

10.26 There is no straightforward way of calculating what level of resources will be required for spending on new technology and medical advance over the next 20 years. A number of factors need to be considered in attempting to make such a judgement. These include:

- **the current UK position:** as set out above, the UK lags behind other countries in the use of technology in the health sector. While some countries have over-invested in certain technologies, there is undoubtedly a real gap to be closed to catch up with other countries;
- **public awareness and pressure:** there will be a growing public awareness of the equipment and drugs which are potentially available, for example through media reporting, greater use of the internet by patients for information gathering or increased 'direct to consumer' advertising by manufacturers. Direct to consumer advertising has been a major driver in the US in recent years and seems likely to be an increasing feature in the UK over the next decade. Increasingly, informed consumers will demand access to the latest in new technology and medical advances; and
- **the nature of medical advance:** whether the next 20 years are broadly similar to the past 20 years in terms of the pattern and pace of medical advance or whether they prove to be significantly different will have a major bearing on the resources that will be required. This relates not only to the nature of new drugs and devices, but also to developments in screening, diagnostics and prevention. This is explored later in this chapter.

10.27 It is also important to bear in mind that the adoption and diffusion of new technology has implications for other parts of the health service such as investment in buildings and the workforce. For example, some new technologies may require highly-trained staff to operate or administer them, while the nature of other new technologies might be such that they require less expertise and skills on the part of the user.

Estimating the impact of technology

10.28 Data limitations make it difficult to measure directly the impact of technology on aggregate health spending and estimates typically fall into one of two categories:

- **top-down** estimates which rely on an indirect approach, attempting to estimate the contribution of technology to growth in health spending as a residual; and

- **bottom-up** estimates which consider the impact of individual health technologies on spending, looking at the impact on activity and unit costs.

10.29 An obvious difficulty with the bottom-up approach is in being able to cover a large enough number of technologies to constitute a significant share of total health care spending. Work undertaken for the Review by the NHSC has explored a variant of the bottom-up approach - a 'meso' approach - which looks at diseases or groups of technologies rather than individual technologies. The work has considered seven case studies covering around 20 per cent of current NHS spending and looked back as well as forward to assess likely pressures on spending over the next two decades. The work is described in a paper in the Proceedings of the Health Trends Review Conference published alongside this report[11].

10.30 This Review has followed both approaches. The top-down approach has been used to help gain an understanding of the historical contribution of technology to growth in health expenditure. But recognising that past experience will not by itself be a good guide to the future, the Review has considered the extent to which the next 20 years are likely to be different to the past 20 years and the likely main drivers of spending on technology, drawing on the conclusions of the NHSC work.

The top-down approach

10.31 A commonly-adopted approach to examining the link between technology and health spending is what is known as the 'residual' approach. This methodology has been widely considered in the health economics literature, for example by Newhouse[12] and Cutler[13] and is a methodology used, among others, by the US Government's Centers for Medicare and Medicaid Services (formerly the Health Care Financing Administration).

10.32 Based on the growth accounting methodology in macroeconomics[14], this decomposition approach estimates the historical impact of technology (broadly defined, including for example intensity of treatment) on health spending as a residual after accounting for the impact of other factors

[11] Raftery J, Barrett B et al (2001), *The impact of technology on costs*, The National Horizon Scanning Centre, in Health Trends Review: Proceedings of a conference held at the Barbican Centre, London on 18 and 19 October 2001, HM Treasury, November 2001.

[12] Newhouse JP (1992), Medical care costs: How much welfare loss?, *Journal of Economic Perspectives* 6(3):3-21.

[13] Cutler DM (1995), *Technology, health costs, and the NIH*, Harvard University and the National Bureau of Economic Research, National Institute of Health Economics Roundtable on Biomedical Research, Boston.

[14] Jorgenson DW and Griliches Z (1995), Issues in Growth Accounting: a reply to Edward R Denison, in Jorgenson DW (ed), *Productivity Volume 1: Postwar US Economic Growth,* MIT Press, Cambridge Massachusetts.

thought to drive health spending. As such, the results need to be interpreted and applied with care. There will, in practice, be a number of factors not separately identified which influence health spending - in either direction - which will be captured along with technology in this residual. For example, the residual may capture impact of changing patient expectations and government policy changes.

10.33 The Review has followed the approach of the recent Project HOPE report[15] in the US, decomposing the growth of total health spending between 1977 and 2000 into the impact of:

- demographics (both the overall population size and changes in its age structure);
- economy-wide inflation;
- inflation in the health sector, in excess of economy-wide inflation; and
- the element not accounted for by the above factors, i.e. the residual.

10.34 Population data produced by the Office for National Statistics (ONS) indicate that the total UK population has grown by an average of 0.3 per cent a year since the late 1970s. At the same time, the population has been ageing. As discussed in Chapter 9, average health spending per head is particularly high for births and the elderly. Applying this age-cost curve (see Chart 9.1) to the change in the age structure of the UK population over the past 20 years, population ageing is estimated to have contributed an average of 0.2 percentage points to annual nominal health spending growth. The combined demographic effects are therefore estimated to have accounted for around 0.5 percentage points of annual health spending growth over the period, around 5 per cent of the total.

10.35 Over the full period, economy-wide inflation – as measured by the GDP deflator – is estimated to have accounted for around two thirds of UK nominal health spending growth, while the excess of medical inflation (as measured by the HCHS weighted pay and prices index[16]) over economy-wide inflation accounts for a little over 10 per cent. As economy-wide inflation has fallen over the past decade, the proportion of health spending growth accounted for by economy-wide inflation has fallen to around 50 per cent, while the proportion accounted for by the excess of medical inflation over general inflation has been relatively stable.

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[15] Project HOPE (2001), *The impact of medical technology on future health care costs: Final report,* 28 February 2001, Center for Health Affairs, Bethesda, Maryland.

[16] Public Expenditure on Health and Personal Social Services 2000, Memorandum Received from the Department of Health Containing Replies to a Written Questionnaire from the Health Select Committee, HC 882, 27 October 2000. Tables 4.4.5 and 4.4.6 provide details of the Hospital and Community Health Services (HCHS) Pay and Prices Index.

10.36 However, some economists argue that it is wrong to treat medical inflation in this way and that without accurate, quality-adjusted measures of medical inflation it is impossible to distinguish increased costs due to medical advances from higher prices paid for existing health services (or increases due to inefficiency and low productivity in the provision of medical services). They believe that a large part of the observed excess of medical inflation over general inflation is actually due to genuine technological advance and so do not account for it separately in the decomposition.

10.37 For the UK, the prices component of the HCHS index has closely mirrored the GDP deflator over the past 20 years and indeed has been on average a little lower. Thus the excess of medical inflation over general inflation has not reflected a faster rise in medical prices than general prices, but rather above-inflation rises in health service pay. The latter may in part reflect technology-driven productivity gains.

10.38 Various US studies using this residual approach have looked at the impact of other variables, including real income per head, the extent of health insurance coverage (although this seems unlikely to be a significant factor in the UK) and changes in administrative efficiency. However, views tend to differ between studies over both the validity and the impact of including such variables, and this Review has generally followed the Project HOPE methodology which does not explicitly include these additional factors. In other words, if they exist they are part of the identified residual.

10.39 The one exception is real income per head, which both Cutler and Newhouse include in their calculations. The estimate obtained depends critically on the assumption made about the income elasticity of demand – the responsiveness of demand for health care to a change in income. Estimates based on time series and cross country data typically suggest that the income elasticity of demand for health care is one or more, i.e. that health care is a 'luxury' good, the demand for which rises faster than income. However, such estimates do not hold technology constant. Holding technology constant, as required for this residual analysis, points to a lower income elasticity. Cutler uses an income elasticity of 0.2 and while Newhouse bases his figuring on a range of around 0.2 to 1.3, he concludes that the relevant elasticity for such analysis should be "well under one".

10.40 Taking account of real income per head and applying an elasticity of 0.2 to the UK data suggests that growth in real income per head accounts for an average of around 5 per cent of the growth in health spending over the past 20 years, contributing around 0.4 percentage points to annual spending growth.

10.41 Table 10.1 summarises the results of this analysis, consistent with the methodology used by Project HOPE and therefore not separately identifying real income per head in the decomposition. The estimated residual values vary quite significantly from year to year, and the results focus on the average over a run of years.

10.42 The results suggest that between 1977 and 2000 the residual, the proxy for the impact of technology and medical advance, accounted for around 20 per cent of the growth in health spending in current prices - contributing on average around 2 percentage points a year to annual spending growth. Looking over the past decade, the proportion of growth accounted for by the residual rises to around 30 per cent, although this largely reflects lower levels of economy-wide inflation. In real terms (i.e. excluding economy-wide inflation) the residual accounts for around 50 per cent of health spending growth over both periods, contributing around 2 percentage points to average annual spending growth in real terms.

Table 10.1: Estimated impact of technology on UK health spending

	UK health spending[1]	Percentage points of annual health spending growth attributed to: (Percentage of annual growth in brackets:)			
		Inflation:			
	Average annual growth, per cent	Economy-wide inflation[2]	Excess medical inflation[3]	Demographics[4]	Residual
1977–2000	10.0	6.4 (64)	1.2 (12)	0.5 (5)	1.9 (19)
1980–1989	11.4	7.6 (66)	1.5 (13)	0.6 (5)	1.8 (16)
1990–2000	7.4	3.5 (47)	1.4 (18)	0.4 (6)	2.1 (29)

[1] Total health expenditure, current prices. Source: OECD Health Data 2001. Figure for 2000 is an estimate.
[2] GDP deflator at market prices. Source: ONS.
[3] Excess of medical inflation over GDP deflator inflation. Medical inflation measured by the HCHS Pay and Prices Index. See footnote 16.
[4] Impact of overall growth in population (source: ONS) and change in population age structure calculated using age-cost curve (source: Chart 9.1). Source: HM Treasury estimates.

10.43 These results are broadly similar to the results for the US produced in the Project HOPE study. Project HOPE found that over a longer period between 1960 and 1998, the residual accounted for just over 30 per cent of health spending growth in nominal terms, contributing 3.3 percentage points to average annual spending growth. Over the period 1977 to 1998, the Project HOPE results put the residual contribution at around 2.3 percentage points, while over the period between 1990 and 1998 it is estimated to be 2 percentage points. Both are very close to the UK results presented above. The results are also broadly similar to those reported by Newhouse and Cutler, although the use of different time periods and their inclusion of some additional determinants and assumptions makes direct comparison difficult.

10.44 Thus, the UK results produced on the same basis as the Project HOPE results suggest that the residual has historically contributed around 2 percentage points to annual health spending growth. Including real income per head as an explanatory factor reduces the estimated residual, while taking the view that part of the excess of medical inflation over general inflation is due to technological change increases the estimated residual. On balance, the estimate that technological change has contributed around 2 percentage points a year to growth in health spending seems to be a reasonable best estimate using this methodology.

10.45 Two points are particularly important to recognise:

- these estimates of the historical contribution of technology to health spending growth do not provide information on whether past spending on technology has been adequate. Undoubtedly in the UK it has not and has been constrained by the overall resources which successive governments have allocated to health care; and
- although the work indicates that technology has accounted for a similar proportion of, and percentage point increase in, total health spending growth in the UK and the US, this has resulted in a significantly higher level of spending on technology in the US given the much higher level of health spending in the US.

The bottom-up approach

10.46 Having produced estimates of the historical contribution of technology and medical advance to health care spending, this section considers the extent to which the next 20 years are likely to prove different to the past 20 and what implications this might have for the resources required for spending on new technologies.

10.47 Forecasting the future scope and pace of technological development inevitably involves a high degree of uncertainty, and as with all forecasts the further ahead one looks the more uncertain the forecasts become. However, the lag which is typically involved between the development of new medical technologies and the point at which they reach the market provides some assistance in looking ahead to what the next 10 years might hold in store. This is particularly the case for pharmaceuticals, where the discovery of a new medicine, its development, testing, clinical trial stages and final marketing approval typically takes well over 10 years. Drugs which are currently in late-stage clinical trials are therefore the ones which will be coming onto the market over the next decade.

TECHNOLOGY AND MEDICAL ADVANCE *10*

10.48 This section first considers the likely developments and trends over the next 10 years, driven by both technological advance and government policy. Many of these trends are likely to continue over the second decade covered by the Review. This period also has the potential to deliver benefits from more radical and far-reaching medical advances, in particular in some areas of genetics and stem cell research where technology is still at a relatively early stage. But there is inevitably considerable uncertainty over the likely extent and pace of developments in these areas.

Key developments and trends

10.49 The general view of those who the Review has consulted to date is that the next 10 years will not look radically different to the past 10 years in terms of the nature, scope and pace of technological advance. In other words, the majority of expert opinion appears to be that the next 10 years will not see a major transformation in the nature of medical technology with, for example, the development of cures for major cancers or mental illness. That said, it would be a mistake to rule out the possibility of major technological developments over the period, particularly towards its end, including in some of the areas discussed in paragraphs 10.54 to 10.60 below.

10.50 During the next decade there will, of course, continue to be a large number of new technologies coming onto the market. Estimates put the number of drugs in late-stage development worldwide at around 1,500 including around 200 cancer drugs, 100 anti-infectives (including drugs for HIV) and 50 drugs for heart failure[17]. Some of these drugs will result in significant improvements in the management of certain diseases and possibly effective cures for some specific diseases. For example, although it seems unlikely that there will be an early cure for Alzheimer's disease, its management is becoming more medicalised through drug therapies and is resulting in a shift in some of the costs of the disease from informal carers to the formal health care system. The next 10 years will also see wider diffusion of existing technologies and the effective combination of existing and new technologies (see Box 10.2). For example, many new drugs in breast cancer are being taken in combination or in sequence with existing drugs.

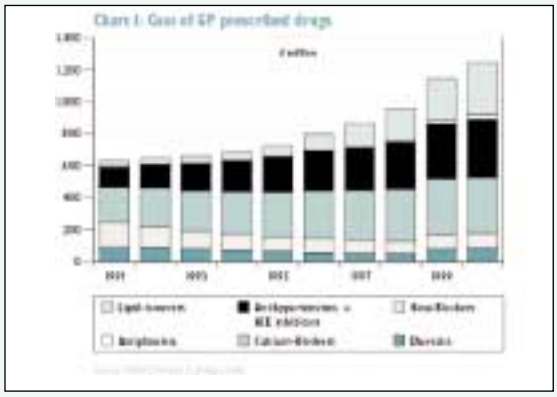
[17] Lehman Brothers Pharmapipelines database.

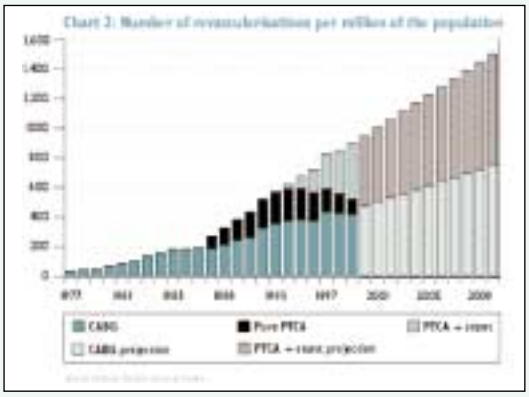
Box 10.2: Prevention and treatment of CHD

In work produced for this Review, the National Horizon Scanning Centre (NHSC) at the University of Birmingham has considered trends and likely developments over the next 10 years in a number of disease areas including the prevention and treatment of coronary heart disease (CHD)[4]. As set out in Chapter 8 of this report, CHD is the commonest cause of death in the UK.

Chart 1 shows how the cost of GP prescribed drugs for both primary and secondary prevention of CHD increased sharply during the second half of the 1990s, from around £700 million in 1995 to over £1.2 billion in 2000. This has reflected both an expansion of the patient group and the development of multiple new technologies. As illustrated in the chart, lipid-lowerers or statins (drugs used to treat raised blood cholesterol) have accounted for much of the most recent growth. The NHSC estimate that increased use of statins in the implementation of the NSF for CHD will cost an additional £2 billion a year. The NHSC has also examined both past and likely future developments in coronary revascularisation (a procedure to improve the blood supply to the heart) and Chart 2 plots the growth in the number of revascularisations per million of the population over the past 25 years and the increase required by 2010 to meet the target set in the NSF for CHD.

In addition to showing the rapid overall growth in the procedure, the chart highlights the impact of developing technologies over the period: in particular, the rapid expansion of percutaneous transluminal coronary angioplasty (PTCA) in the early 1990s and the rapid growth in the use of coronary stents (a device inserted into the coronary artery following PTCA to prevent re-blockage of the artery) in the late 1990s. The latter trend is expected to continue over the next 10 years with further developments of the technology (e.g. drug-coated stents) having an impact.





This case study reinforces several key points discussed in this chapter:

- the wider diffusion of existing technologies as well as the diffusion of new technologies is important in considering future spending pressures;
- new technologies often complement existing ones, with new technologies being combined with existing ones to produce more effective treatments, e.g. the use of stents in PTCA;
- the role of Government policy, particularly the NSFs, as a driver of technology spending; and
- the impact of prevention activity, where costs to the health service might be significantly different depending on whether such activity is primarily focused on drug prevention or encouraging and persuading individuals to make changes to their lifestyles.

[4] Raftery J, Barrett B et al (2001), *The impact of technology on costs*, The National Horizon Scanning Centre, in Health Trends Review: Proceedings of a conference held at the Barbican Centre, London on 18 and 19 October 2001, HM Treasury, November 2001.

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Increasing prevalence of diseases as chronic conditions

10.51 Over the next 10 years and beyond there will be an increasing prevalence of some diseases as drug therapies and other technologies improve and those diseases are treated increasingly as chronic rather than acute conditions. It is uncertain how quickly this might occur and in which disease areas the biggest impact will come, but certain forms of cancer could, for example, fall into this category. If this results in patients receiving ongoing treatment over a much longer period of time than would previously have been the case, perhaps years longer, this has the potential to increase spending significantly. This might also be one of the drivers of greater development and diffusion of technology for self-treatment and for care and monitoring in the home, including the miniaturisation of technology and spread of remote communications.

Prevention and treatment of risk

10.52 It is also important to consider how the focus on prevention and treatment of risk might develop. As discussed later in this chapter, in the longer term genetic medicine may open up a large battery of tests which will enable individuals' risks of developing a wide range of specific diseases and conditions to be identified. But even without such tests, there is currently a significant amount of evidence about the increased probabilities individuals face of developing specific diseases (or of them recurring after treatment), particularly related to the lifestyles which they lead. For example, research suggests that a reduction in bodyweight reduces the risk of developing diabetes, while someone who quits smoking will reduce their risk of developing lung cancer. Screening for a wider range of diseases will become available as the National Screening Committee develops it work.

10.53 The extent to which individuals are willing to take personal responsibility for their health may have a significant impact not only on health outcomes but also on health spending over the next two decades. Pharmacological developments may increasingly be focused on the treatment of risk rather than disease (in the way that statins have developed in recent years for the treatment of risk in CHD). There is the potential for widespread use of such drugs across the population with significant cost implications. However, increased risk may be due to lifestyle factors and in many cases it is likely to be significantly more cost effective to address problems such as high blood pressure or high cholesterol which increase the risk of heart disease through changes to peoples' diet and exercise than through ongoing drug treatments such as statins, which as noted in Chapter 8 and Box 10.2, have major cost implications for the health service. A major challenge will be for

the health service to get these messages across to the public. If successful, there appears to be significant scope for cost savings on both drug prevention and the need for future treatment.

Genetics and stem cell technology

10.54 There are some areas of medical science which hold out the prospect of major technological developments and the potential to transform significantly the way in which medicine is practised in years to come. Genetics and stem cell research fall clearly within this category. Ultimately, for example, genetic medicine could enable the prediction, prevention and cure of disease as well as diagnosis and the management of symptoms. This section considers these areas briefly – it is impossible to address such complex subjects adequately in this report.

10.55 **Genetics** is the study of biological information and how it is inherited. Within this genomics studies the genetic material of organisms. Research into this area is a multi-billion pound industry, much of it being undertaken within the commercial sector (mainly by pharmaceutical companies). There are three main areas:

- genetic testing offers the potential to target monitoring and preventive regimes at those at high risk and to reduce levels of intervention for those at low risk. Tests are currently available for many single-gene disorders such as Huntingdon's disease. Tests for familial subsets of more common diseases such as breast and bowel cancer, where presence of the gene(s) confers a high risk of developing the disease, are already in use, with other tests (for example, for cardiomyopathy) under development. Research leading from the Human Genome Project is starting to yield some tests to help predict an individual's pre-disposition or susceptibility to disease. The development of testing may run ahead of a full understanding of the interactions both between genes and environmental factors and between different genes. But such knowledge in cancer, heart disease and mental illness is where the major gains from such technology would come in terms of improving health outcomes and having the potential to reduce longer-term costs to the health service;
- pharmaco-genetics is a study of different responses which patients have to drugs depending on their genetic make-up and offers the potential to target drugs more effectively and create individualised drug therapies for patients (see Box 10.1); and
- gene therapy has the potential to treat gene disorders, cancer and infections by replacing faulty genes or targeting curative therapy to the appropriate cells.

10.56 Views differ on the likely advent of these various developments. Participants in the Nuffield Trust Genetics Scenario Project[18] felt it likely that pharmacogenetics would make a more immediate and potentially greater impact on health services than the use of genetic tests in the prevention of disease. And there is general agreement that advances in gene therapy are behind the developments based on testing. Overall some believe that genetics will begin to have a significant impact on health care and health spending over the next few years while others believe that a major impact will not be felt until rather later in, or indeed beyond, the 20-year horizon of this Review. Next year's Green Paper on genetics will provide a welcome addition to the debate.

10.57 In addition to the pace of development, there are also important issues about ethics, public acceptability and reaction to learning the results of genetic tests, reliability, affordability and cost effectiveness of such technologies. Factors which seem likely to influence the way in which knowledge and technology relating to genetics will evolve and the impact they have on health care will include the extent to which:

- health care professionals are able to absorb new areas of knowledge and adjust practice accordingly;
- the health care system is able to adjust, for example through new screening programmes;
- more tailored risk reduction regimes are more effective than blanket approaches; and
- patients react, for example either demanding more health services following their use of pre-disposition tests available on the internet or resisting the use of testing because of fears about the results of tests or the use of the data.

10.58 A **stem cell** is a cell which has the capability of transforming itself into a different type of cell. Stem cell technology offers the theoretical potential to replace dead or dying cells in the body with healthy ones.

10.59 Use of embryonic stem cells, which have much greater scope for differentiation into different tissues than do those from adults as currently used (for example, in bone marrow transplants), has the potential to change radically the scope of modern medicine and open up a huge range of new possibilities for treatment and cure of major diseases. As with genetics, the likely pace of advance is highly uncertain. However, such developments are widely thought to be a number of years away, with cell replacement therapy unlikely to be available until at least the end of the Review's 20 year horizon,

[18] Zimmern R and Cook C (2000), *Genetics and health: The Nuffield Trust genetics scenario project,* The Nuffield trust and the public health genetics trust, The Stationery Office, London.

and then only in limited areas. Such technology is also the subject of much ethical and political debate given the current focus of research on embryonic stem cells, adding to the uncertainty about the likely impact on health care over the next 20 years.

10.60 This section highlights the significant uncertainties which exist about the likely development of medical technology over the next 20 years. Views clearly differ, in some cases quite significantly, about both the scope and pace of advance. The Nuffield Trust Genetics Scenario Project noted last year that "Participants to the workshops were divided as to whether major developments in genetics would impact upon health and health services in the near or distant future". But this is clearly an important issue in forming an assessment of the resources which will be required for the health service over the next 20 years and the Review is keen to receive further views and examine additional evidence in the next stage of the consultation process.

Low-cost technologies

10.61 It should be noted that discussion of technology and medical advance frequently concentrates on the upper end of the spectrum in terms of the complexity and cost of technologies. However, there is also a wide range of technologies which are relatively simple and low cost and have the potential to make a significant impact both on individuals' health and well-being and health care costs. For example, the use of equipment and devices in the home such as motion detectors for lighting and motors to adjust the height of cupboards and work surfaces might make the difference between someone being able to live independently at home or not, potentially reducing some peoples' need for hospital and residential care[19].

The impact of government policy

10.62 An important driver of spending on medical technology over the coming years will be government policies to improve health, in particular the current and future NSFs which are discussed in detail in Chapter 8. These NSFs specify what is required in key areas to catch up with international best practice, including through the wider and faster diffusion of existing and new technology such as statins in the primary and secondary prevention of CHD (see Box 10.2).

10.63 The way in which NICE and other bodies with a role in technology assessment develop and the decisions that they take will clearly also have an important bearing on spending on technology over the period.

[19] Heywood F (2001), *Money well spent: The effectiveness and value of housing adaptations,* Joseph Rowntree Foundation, The Policy Press.

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Information and communication technology

10.64 As noted earlier, the health service faces a key challenge in putting in place a robust and integrated ICT infrastructure. Only when such an infrastructure is in place will it be able to invest fully in applications with the potential to improve the quality, safety and efficiency of the service.

10.65 In line with the impact which successful implementation of ICT applications has already had in other sectors of the economy, it should be possible to realise significant gains across many aspects of the health service over the next 20 years through the increased and better use of ICT. Some examples of high potential technologies are set out in Chapter 8. For example, ICT has the potential to:

- provide a higher quality service for patients with better coordination of care;
- allow patients to increasingly interact with the health service from their own homes, including through greater electronic availability of health information, direct contact with health professionals via the internet and interactive digital TV and the possibility of remote self-testing and monitoring of certain conditions;
- enable health care professionals to spend more of their time directly with patients by reducing the time spent on administrative tasks and record keeping and helping them to work from various locations;
- ensure more efficient use of resources, including better coordination between primary and secondary care, electronic booking of treatment and savings in transaction costs;
- improve clinical governance and safety through access to medical records from all locations, 'real time' sharing of medical information, keeping medical staff up-to-date with latest developments, prompting recommended care paths and safer prescribing; and
- facilitating the development of new medical technologies in areas such as remote monitoring and testing and genetics.

10.66 These are just a few of the potential benefits from greater use of ICT in the health service. There are undoubtedly many more and they are likely to have a significant impact on many of the other areas being considered in this Review – on the quality of service provided, on clinical governance, on the way in which the health workforce operates and develops and importantly on the productivity of the service. At the same time, there are important issues of patient confidentiality and equity of access which need to be taken into account.

10.67 The Review will be considering and consulting further on these issues, in particular examining which areas should be the main priorities in the health service for investing in ICT and what the potential benefits will be. To realise these benefits, significant investment in ICT will be required.

Conclusions

10.68 Projecting what resources will be required over the next 20 years to fund technology and medical advance is subject to widespread uncertainties. But what seems clear is that previous decades have seen slower rates of adoption and diffusion of technology than in other countries and this has left the UK health service trailing behind best practice in technology.

10.69 Although subject to significant uncertainty, top-down estimates suggest that technology and medical advance may have contributed around 2 percentage points to the average annual rate of growth in nominal health spending. This is likely to represent a 'floor' to what will be required over the next 20 years. Delivering a high quality service with up-to-date technology matching standards in other countries will require more resources than have historically been made available for new technology in the UK.

10.70 While some technologies may reduce unit costs, spending on technology is likely to continue to be driven upwards as more people are treated for longer periods of time. Opinion gathered by the Review to date suggests that the next 10 years are unlikely to be significantly different from the past 10 years in terms of the nature, scope and pace of technological development in aggregate terms.

10.71 However, there is likely to be pressure to adopt and diffuse both new and existing technologies at a faster rate than in the past in order to catch up and keep up with international best practice, including as envisaged in the NSFs, and to meet the needs of what are likely to be increasingly demanding consumers. The case study work produced by the NHSC found no examples of any expected large cost savings among the 20 per cent of health spending considered, but several instances which point to large technology-driven increases in costs over the next 20 years. In addition, significant investment will be required to realise the benefits from much wider use and integration of ICT across the health service.

10.72 Advances in relatively new fields of medical science such as genetics and stem cell technology offer the prospect of radical changes in the way in which medicine is practised in the future. Some developments are already having an impact and this will continue to be the case. But in other areas there is huge uncertainty over what might be possible by when and what the impact on health care and health spending will be. The Review is keen to receive further views and examine additional evidence in the next stage of the consultation process.

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Questions for consultation

Technology:

Q10.1 Is it right to conclude that, in aggregate, technology and medical advance will increase expenditure?

Q10.2 Have the main drivers of future spending on technology been identified? Which do you expect to be the most important in terms of impact on the health service over the next 20 years?

Q10.3 Is the top-down approach the best way to estimate the historical impact of technology growth and does the Review's preliminary estimate that technology has historically contributed around 2 percentage points to health spending growth provide a plausible floor to what will be required in future?

Q10.4 What rate of growth of technology spending do you think will be required over the next 20 years?

Q10.5 How much of an impact do you expect genetics and stem cell technology to have over the next 20 years and what will be the implications for health spending?

Productivity:

Q10.6 What should be the main priorities for the health service in increasing investment in information and communication technology (ICT)?