SMF HEALTH PROJECT: BACKGROUND PAPER 2

Demography and Technology: External Pressures for Change

David Furness, Barney Gough, Dr Niall Maclean, Lyndsay Mountford and Charitini Stavropoulou

SMF HEALTH PROJECT: BACKGROUND PAPER 2

Demography and Technology: External Pressures for Change

David Furness, Barney Gough, Dr Niall Maclean, Lyndsay Mountford and Charitini Stavropoulou

Kindly supported by

Bupa

NHS Connecting for Health

Pfizer

STANDARD LIFE®

FIRST PUBLISHED BY
The Social Market Foundation, July 2008

11 Tufton Street, London SW1P 3QB

THE SOCIAL MARKET FOUNDATION

The Foundation's main activity is to commission and publish original papers by independent academic and other experts on key topics in the economic and social fields, with a view to stimulating public discussion on the performance of markets and the social framework within which they operate.

The Foundation is a registered charity and a company limited by guarantee. It is independent of any political party or group and is financed by the sale of publications and by voluntary donations from individuals, organisations and companies. The views expressed in publications are those of the authors and do not represent a corporate opinion of the Foundation.

DESIGN AND PRODUCTION BY
Rui Cravo Design Consultancy

ACKNOWLEDGEMENTS

The Social Market Foundation Health Project is made possible with the generous support of BUPA, NHS Connecting for Health, Pfizer and Standard Life Healthcare. We would like to thank the sponsors for their continuing support and encouragement.

The authors would like to thank Ann Rossiter and Natalie Tarry at the Social Market Foundation for their input, advice and support. We would also like to thank other colleagues at the Social Market Foundation who have provided research assistance, particularly Kelly Gerard, Elizabeth Hunt, Laura Pearson, Wendy Ransome, Matthew Sheldon and Giles Wilkes.

Last but not least, the Social Market Foundation Health Project has benefited enormously from the insights and ideas of our Steering Group. We would like to thank Dr David Colin-Thome, Professor Angela Coulter, Dr Tim Crayford, Nigel Edwards, Chris Exeter, Paul Lynes, Fergus Kee, Professor Julian Le Grand, Professor Peter Smith, Ben Page and Owen Smith for contributing so much to our work. While we have gained a great deal from their expert input, any errors or omissions remain the sole responsibility of the authors.

INTRODUCTION

This paper forms the second in a series of background papers which provide the background to the SMF Health Project. Other papers in the series consider the NHS in relation to high-level health systems characteristics, governance and productivity (Paper 1), Commissioning (Paper 3), Providers (Paper 4) and Patients (Paper 5).

All health systems need to plan for the future by attempting to predict what will be the most salient pressures in the short, medium and long term. In this paper, we have sought to identify and analyse the main financing pressures likely to confront the health system in England over the next 10–15 years. Our aim has been to lay a solid, empirically grounded foundation for the subsequent work of the SMF Health Project in suggesting the ways in which England's health system ought to change in order to meet these challenges. Although our focus has been on England, we have sought to use UK-wide studies and comparative data from other countries wherever this was instructive.

Our methodology has been twofold. First, we have sought to conduct a thorough review of the published literature in the field. We have summarised the most salient findings, identified conflicting views where they arise and have highlighted gaps in the evidence. Secondly, we have undertaken interviews with experts and key stakeholders to follow up on issues and themes that emerged from our literature review and which we believed would benefit from the input of those currently working at the cutting edge of the relevant subject areas. We plan to continue this outward-facing approach throughout the lifetime of the SMF Health Project.

What has emerged is a picture of demand-side pressures and stressors that is sometimes markedly at odds with prevailing views presented in the media. In setting out our findings, we hope to challenge these orthodoxies, and throughout this paper we will explore the possible ways in which the SMF Health Project could usefully contribute to debates on the issues we highlight, and suggest a number of possible avenues of further research.

The literature has traditionally considered real financing pressures to fall under three main headings: demographic changes, particularly the rate of ageing of populations; the advance of medical technology and with it the possibilities for treating more people and more diseases, to higher standards, than before; and rising expectations of the population at large for better and more expansive standards of care.

In this paper, we have chosen to concentrate on the first two of these issues, leaving a discussion of patients' expectations to Paper 5 of this series. This is partly because we think that a more critical and discerning scrutiny of the meaning and role of patients' expectations may suggest a more differentiated impact on healthcare demand than may have been traditionally presented. In addition, patient expectations only become a reality to the extent that they are permitted to influence healthcare commissioning and provider decisions: demand management is as much a feature of healthcare services management as is the incentivised provision of high-quality care. There are also important political consequences of user-generated demand that are sometimes based on a partial understanding of the issues. The political implications of patient expectations are also discussed in Paper 5. Consequently, we have placed a discussion of the issue in the context of recent NHS reforms which have emphasised the role of patient choice and empowerment, and consider how these policy developments, which are part of a trend towards a more patient-centred and personalised healthcare system, might affect how expectations feed through into healthcare planning and delivery in this paper.

A discussion which is often missing from the literature concerns the role of relative price changes and medical inflation in pre-empting healthcare resources. This issue has been the focus of a particularly lively debate in the context of the very large increases in real-terms resourcing going to the NHS since 2000, much of which has gone into large pay increases for some sections of the medical professions. We start with a retrospective view of this, to put in context the discussion about how to deal with real demand and supply-induced pressures on NHS budgets.

2 PRICE INCREASES IN HEALTHCARE

With recent investment in the NHS there has been much debate over whether improvements in health services have provided value for money, as previously explored in the first paper in this series, on health systems. A key aspect of this debate is the difference in relative price increases in healthcare and the economy at large. What some have termed "medical inflation"[1] may in fact be much higher than inflation in the rest of the economy. This means that increases in investment may simply be absorbed by rising prices in staffing, medicines and other technologies rather than leading to genuine transformation in the volume and quality of services.

There is consensus neither on the definition nor on the rate of medical inflation. There are also data available from many different countries, collecting different bits of information that make it difficult to make international comparisons about inflation in the medical sector. However, there is agreement that costs in healthcare are rising more quickly than in other areas of the economy.

WHAT FACTORS INFLUENCE MEDICAL INFLATION?

Perhaps because of the dominance of private insurance, where it is extremely important to understand and predict health costs, there is more information about trends in the US than in the UK. A US-based study by Pricewaterhouse Coopers (PwC) sought to identify key factors affecting medical cost trends. Those particularly relevant to the UK include changes in the unit price of medical products and services and changes in the volume of service used due to factors such as demographic or technological change.[2] Others, including changes to co-payment levels are less relevant to the NHS.

PwC also segmented the various factors resulting in increased unit costs in healthcare. They found that the services of clinical staff and the general cost of treatment as an inpatient were the key drivers of medical inflation, representing 36% and 30% of the total respectively.[3]

1 Moneyextra, "Medical Inflation," January 2008: www.moneyextra.com/dictionary/medical-inflation-moneyextra-004065.html.

2 Pricewaterhouse Coopers Health Research Institute, *Behind the Numbers: Healthcare Cost Trends for 2008 (London, Pricewaterhouse Coopers, 2007), 2.*

3 Ibid.

This example is not directly comparable to the UK, but we know that in the NHS the cost of employing consultants and GPs has risen significantly in recent years.

INSURANCE AS A CANARY

In the UK many attempts to quantify the rate of medical inflation have originated in the insurance sector. As in the US, it is in the interests of insurers to understand what drives their costs and to explain the resultant increases in insurance premiums to their customers. For example, the Association of Medical Insurance Intermediaries calculates medical inflation to be around 8%.[4]

However it is not possible to extrapolate to the whole of the UK health system from increasing private medical insurance costs. Private medical insurance typically covers only hospital-based treatments: primary and chronic care are not available. Additionally, unit costs in private hospitals can be very different (and generally much higher) from those in the NHS.

THE NHS EXPERIENCE

The King's Fund has undertaken work to analyse how much of the extra investment in the NHS since 2000 has been absorbed by higher pay, new drugs and other considerations beyond service development (see figure 1). It should be remembered that this analysis refers to years of comparative largesse for the NHS, with spending increases of 7–8%. With the new financial settlement announced in 2007, it may be that cost increases will absorb a significant proportion of the 4% real-terms annual increase we expect to see until 2010. This will change NHS priorities, with service improvements intrinsically linked to efficiency savings – there will be no other sources of funds.

4 Association of Medical Insurance Intermediaries, "Frequently Asked Questions," AMII: www.amii.org.uk/faq.php.

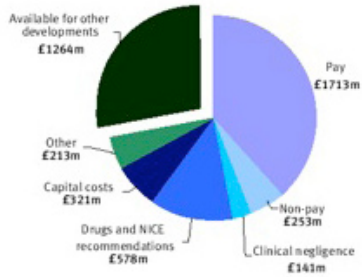

Figure 1: Of the £4.5 billion cash increase in 2006–7 for the hospital and community health services in England, 72% will be absorbed by higher pay and other cost pressures
Source: King's Fund briefing, *Where's the Money Going?*[5]

The think-tank Reform calculates NHS cost inflation to be 4–5% in the secondary sector and 4% in primary care, again indicating that medical-cost trends are running above the overall rate of inflation.[6] Official government statistics largely bear this out (see table 1).

Table 1: NHS cost inflation, 1995–2006

	HCHS wage inflation* (%)	Total NHS inflation** (%)
1995–6	4.4	3.7
1996–7	3.3	2.9
1997–8	2.5	2.1
1998–9	4.9	3.9
1999-2000	6.9	4.6
2000–1	7.2	4.2
2001–2	8.3	4.8
2002–03	5.0	3.5
2003–4	7.3	4.9
2004–5	4.5	n/a
2005–6	4.7	n/a

Notes:
* Wage inflation is measured using the Health and Community Health Services (HCHS) pay cost index, which is a measure of the average paybill per head of those employed within the HCHS.
** The total NHS inflation index is no longer available for 2004–5 as it relies on the General Medical Service (GMS)/Personal Medical Service data series, which has discontinued since the introduction of the new GMS contract in 2004–5.
Source: Parliament Publications and Records.[7]

5 King's Fund, *Where's the Money Going? (London: King's Fund, 2006).*

6 Nick Bosanquet, Henry De Zoete and Emily Beuhler, *NHS in 2010: Reform or Bust (London: Reform, 2005), 7–8.*

7 Publications and Records, "House of Commons Written Answers for 07 January 2008": www.publications.parliament.uk/pa/cm200708/cmhansrd/cm080107/text/80107w0024.htm.

The figures in table 1 relate only to the NHS rather than to the entire health system and relate closely to the structure of the service (e.g. efficiency savings, staffing contracts) rather than to national or international trends. Should the NHS change, then the rate of inflation in its costs will change too. However, it is clear that in general terms healthcare costs rise more rapidly than those in the wider economy, and projections for the future of the health system should keep this firmly in mind.

3 THE IMPACT OF DEMOGRAPHIC CHANGES

INTRODUCTION

In this section we discuss the likely impact of demographic changes on future demand for healthcare in England. In contrast to the doom-laden predictions in the media about the impact of an ageing population (and to a lesser extent of migration) on the healthcare system, we argue that age is merely one possible driver of increased demand that must be factored into a holistic view that also takes into account other factors. When measured using the "proximity to death" methodology, and when comparative data from other countries are taken into account, the impact of ageing is not as drastic as is widely feared. This does not give grounds for complacency, however. The incidence rate of certain specific medical conditions is likely to rise in the short and medium terms, and the continued difficulties surrounding long-term care costs for the elderly could spill over into the health system and cause problems there also.

Over the past few decades, the UK has experienced significant changes to its demography. This has led to a vigorous debate on the economic and social consequences that an increased, and an ageing, population will have on the UK's public services. The impact on the NHS and wider health services is frequently considered to be perhaps the most far-reaching of all, and pessimistic predictions about the fate of the NHS in the face of these demographic changes have became commonplace.[8]

Clear thought and close attention to the available evidence are required in accurately predicting the impact of demographic changes on the NHS. In this chapter, we review the published literature in the field and suggest some possible lines of future research for the SMF Health Project.

8 BBC News, "Ageing population 'to strain NHS'," *BBC News, December 9, 2005: http://news.bbc.co.uk/1/hi/health/4512934.stm.*

DEMOGRAPHIC CHANGE IN THE UK

At a national level, the Government Actuary's Department is the main source of data on demographic change in the UK, and serves as the reference point for most of the published studies on the topic. Useful comparative data can be drawn from the Statistical Office of the European Communities (Eurostat). These are both highly reliable sources, and are be the two primary ones for our purposes here.

Population increases

The Government Actuary's Department reports that the UK population is projected to increase from an estimated 59.8 million in 2004 to 67 million by 2031. This is equivalent to an average annual rate of growth of 0.42%, or 12% over the next 27 years. Of the 7.2 million increase between 2004 and 2031, about 3.1 million (43%) is projected natural increase (more births than deaths), while the remaining 4.1 million (57%) is the assumed total number of net immigrants.[9] Eurostat, however, estimates that the UK population will rise at a slower rate, to reach 64.4 million by 2030.[10]

Population ageing

In common with most other developed countries, the UK has an ageing population. According to the Government Actuary's Department, there will be 27.2 million people aged 50 and over in the UK by 2031, representing a 36% increase from 2003. The same source also reports a substantial change in the age composition of older people. In 2003 those aged 50–59 represented 37.8% of the 50 and over population and those aged 80 and over amounted to 5.5%. These proportions are projected to be, respectively, 28.6% and 7.9% by 2031. So the population as a whole is ageing and, in addition, older people are getting older.[11]

9 Government Actuary's Department, *2004-based National Population Projections (New York: Palgrave Macmillan, 2006).*

10 Eurostat, *Europe in Figures – Eurostat Yearbook, 2006–2007 (Luxembourg: Office for Official Publications, 2007).*

11 Government Actuary's Department, *2004-based National Population Projections.*

Population ageing is primarily the result of sustained low fertility (a low number of births) and a decline in mortality (i.e. falls in the death rates at older ages). There is also a gender divide: older women outnumber older men. However, the improvement in mortality rates among older men has led to a narrowing of the gap. The gender ratio in 2003 (85 men aged 50 and over per 100 women of the same age group) is projected to change by 2031 to 90 men per 100 women aged 50 and over (see figure 2).

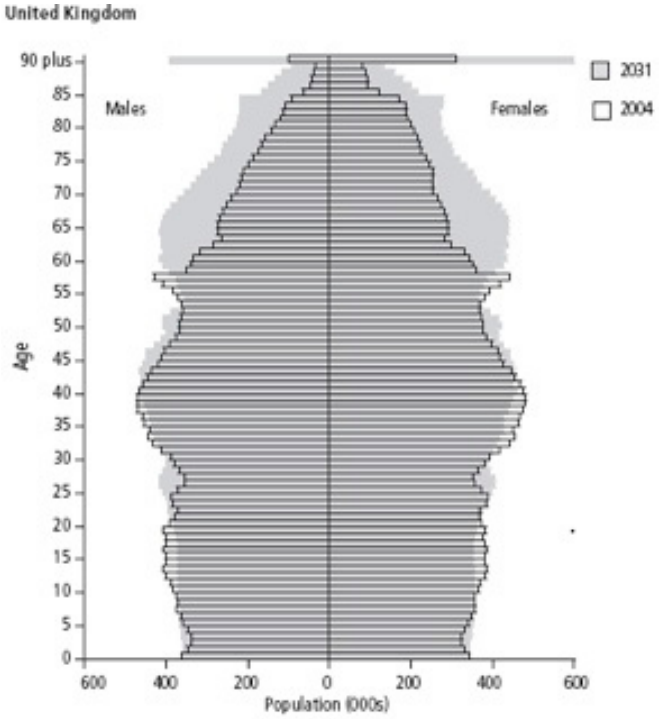

Figure 2: Age pyramid of population in 2004 and 2031
Source: Government Actuary's Department, *2004-based National Population Projections*.[12]

12 Ibid.

The underlying assumptions on which the Government Actuary's Department bases these projections are:

- *Family size*. The average completed family size in the UK, which has been falling from a peak of nearly 2.5 children per woman for women born in the mid 1930s, will level off at 1.74 children for women born after 1990.

- *Life expectancy*. The expectation of life at birth, based on the mortality rates for the year in question, is expected to rise from 76.7 years in 2004 to 81.4 years in 2031 for men and from 81.1 years in 2004 to 85.0 years in 2031 for women.

- *Migration*. Long-term net inward migration to the UK is estimated at 145,000 persons per year from 2007–8 onwards (an increase of 15,000 from 2002-based projections).[13] It is difficult to predict precisely what burdens such inward migration will place upon the health service. Aside from some small-scale case studies that do not allow for generalisation, there is a paucity of published literature on the likely health and disease profile of future immigrants to the UK.

THE IMPLICATIONS OF AN AGEING POPULATION FOR THE UK LABOUR MARKET

From the foregoing, we can see that the population is both growing and ageing, and we might expect this to lead to an increase in demand on the NHS. However, since the NHS is a predominantly tax-funded system, it is important to understand the impact of these demographic changes on the labour market: will demographic change lead to a change in the ratio between net contributors to the NHS (young, healthy, tax-payers) and net consumers of NHS services (older, less healthy, non-tax payers)?

The number of people of working age (currently defined as age 16–64 inclusive for men, and 16–59 inclusive for women) is projected to rise by 3.1%, from 37.1 million in 2004 to 38.2 million in 2010. Allowing for the planned raising of women's state pension age from 60 to 65 between 2010 and 2020, the working population will rise further to

13 Ibid.

40.5 million by 2020. It is then projected to remain at around this level. Without this change to the pensions system, the same time period would instead have seen the working-age population rise much more slowly, from 38.2 million in 2011 to 38.6 million by 2020.

The number of individuals of state pensionable age is projected to increase by 9.3%, from 11.1 million in 2004 to 12.2 million in 2010. Allowing for the change in women's state pension age, the population of pensionable age will then rise more slowly, reaching 12.5 million by 2020. However, a faster increase will then resume, with longer-term projections suggesting that the number of people of pensionable age will reach 15.3 million by 2031 and 17.5 million by the middle of the century unless the pension age is changed again.

The increase in the proportion of people over the age of 65 will cause demographic support ratios (i.e. the relative sizes of the working-age and non-working-age populations) to fall.[14] In 2004, there were 3.33 people of working age for every person of state pensionable age. This ratio is projected to fall to 2.62 by 2031.[15]

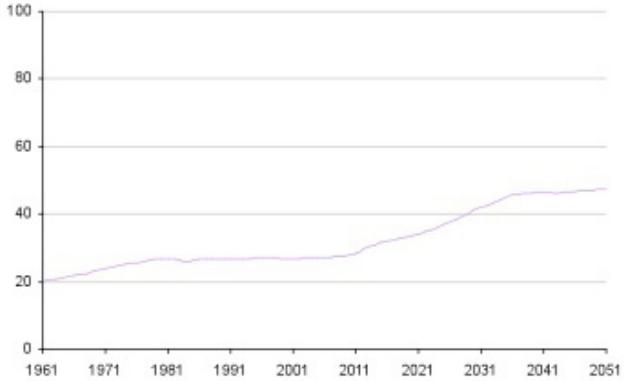

Figure 3: Old-age dependency ratio, UK 1961–2051 (%)
Source: Government Actuary's Department, "2003-based principal population projections."[16]

14 The support ratio figures take into account the change in women's state pension age from 60 to 65, which will be phased in between 2010 and 2020.

15 Government Actuary's Department, *2004-based National Population Projections.*

16 Government Actuary's Department, *2003-based Principal Population Projections: www.gad.gov.uk/Publications/docs/National_population_projections_2004_based_report.pdf.*

Eurostat estimates that the proportion of the population aged 65 and over in the UK will reach 19.5% in 2020 and 22.9% in 2030.[17] The same source projects that the old-age dependency ratio (i.e. the ratio between the total number of elderly persons of an age when they are generally economically inactive – i.e. 65 plus – and the number of persons of working age – i.e. 15–64) will rise from 24.4 in 2005 to 25.1 in 2010, then to 30.3 in 2020 and finally to 37.4 in 2030 (see figure 3, which takes the projection up to 2051). While this number is still smaller than the EU-15 average, which is estimated at 32.8 in 2020 and 41.2 in 2030, we can conclude that the ratio between net contributors to the NHS and net consumers is set to alter as a result of demographic changes across the UK as a whole.

Table 2 sets out the predictions made by Eurostat and the Government Actuary's Department. The Government Actuary dataset projects the old-age dependency ratio to be higher in each year than the Eurostat dataset. This may be explained by the difference in the definition of the working-age population described above. Both datasets clearly show that the old-age dependency ratio is projected to increase.

Table 2: Old-age dependency ratio: UK 2005–2050 (%)

Source	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Government Actuary[18]	27.1	28.1	31.4	33.7	36.7	41.1	45.0	46.4	46.5	47.2
Eurostat[19]	24.4	25.1	28.1	30.3	33.2	37.4	41.4	43.8	44.2	45.3

Note: Government Actuary defines the working-age population as people aged between 20 and 64; Eurostat defines the working population as people aged between 16 and 64

17 Eurostat, *Europe in Figures – Eurostat Yearbook, 2006–2007.*

18 Government Actuary's Department, *2003-based Principal Population Projections.*

19 Eurostat, *Europe in Figures – Eurostat Yearbook, 2006–2007.*

OLDER PEOPLE IN BETTER OR WORSE HEALTH?

The foregoing projections show that the UK population is growing and ageing. However, it would be unwise to draw simple conclusions from this regarding the overall impact on demand for healthcare. In contrast to the depressing predictions alluded to in our introduction, there is in fact some evidence to suggest that while the overall number of older persons is set to increase in the UK, the impact on future demand for healthcare may be mitigated to some extent by improvements in the overall health status of these older persons.[20] This mirrors trends in other developed countries with advanced healthcare systems, such as those found in Europe[21] and the US.[22] For example, one study found that the US elderly population's disability rate had been declining annually since the 1980s, with an increase in the reduction rate from 0.38% to 0.56% during the late 1990s.[23]

However, a less optimistic picture is painted by the recent study conducted by Faiza Tabassum and colleagues.[24] Their study investigated the compression of morbidity hypothesis (the idea that the period of ill-health between the onset of disease and death might be compressed, with a consequent lowering of pressure on health services[25]) as applied to the middle-aged and elderly population in England. The study utilised cross-sectional data from Wave-1 of the English Longitudinal Study of Ageing (ELSA), and some 11,391 men and women aged 50 years or above were included in the analyses. The outcome measures included self-rated health, disability index and the official life-table data of England. Results showed that 75% of men and women aged 50–54 years were likely to survive the next 25 years (according to official life-tables). A linear trend by age in the self-rated

20 European Commission, Council of the European Union, *Supporting National Strategies for the Future of Healthcare and Care for the Elderly (Brussels: European Commission, 2003).*

21 Wolfgang Lutz and Sergei Scherbov, "Will population ageing necessarily lead to an increase in the number of persons with disabilities? Alternative scenarios for the European Union," *Vienna Yearbook of Population Research (2005).*

22 Larry S. Corder, Kenneth G. Manton and Eric Stallard, "The dynamics of dimensions of age-related disability 1982 to 1994 in the US elderly population," *Journals of Gerontology Series A: Biological Sciences and Medical Sciences 53, no. 1 (1998).*

23 Ibid., 221.

24 Faiza Tabassum, Edlira Gjonça, James Nazroo and Michael Marmot, *"Compression of morbidity among the English population: evidence from English Longitudinal Study of Ageing" (paper presented at the 2006 Annual Conference of the British Society for Population Studies, London, UK, 18–20 September 2006).*

25 The compression of morbidity hypothesis was introduced by Professor James F. Fries in 1980; see J. F. Fries, "The compression of morbidity: near or far?," *The Milbank Quarterly 67, no. 2 (1989), 208–32.*

health and disability index was observed in both men and women. The rates of poor self-rated health were slightly higher in men aged 55–59 than in women of the same age. In older ages, the mean disability index was higher among both men and women. The mean disability index from ELSA was combined with the official life-tables to establish the proportion of people alive without disability. If these data were for a cohort, 83% of men and 82% of women would be free of disability in the age group 50–54, and of these only 25% of men and 23% of women would be alive and free of disability 30 years later. As such, the study concludes that there is little evidence of compression of morbidity in the English population in either men or women. Thus, this study showed that an increased life expectancy has *not* been translated into a morbidity-free or disability-free life.

It nevertheless remains uncertain whether people will age in better or worse health: the evidence presents genuinely contradictory results. When making predictions regarding the future impact of ageing on healthcare costs, good practice suggests that we should take into account *both* scenarios: people living longer in good health and people living longer in worse health.

SPECIFIC MEDICAL CONDITIONS

Despite the previously described ambivalence, it is certainly much clearer that some *specific* medical conditions are very likely to become more prevalent in the years to come, thereby imposing financial pressures on the health system. A recent study predicting the burden of cardiovascular disease by the year 2031 estimates that the number of cases of coronary heart disease will rise by 44% (with associated hospital admissions rising by 32%), the number of cases of heart failure will rise by 54% (with related hospital admissions increasing by 55%) and the number of cases of atrial fibrillation will increase by 46% (with associated hospital admissions rising by 39%).[26] The authors of the report argue that these trends could have far-reaching financial implications.[27]

26 Paul Aylin and Azeem Majeed, *"The ageing population of the United Kingdom and cardiovascular disease," BMJ 331 (2005).*

27 Ibid.

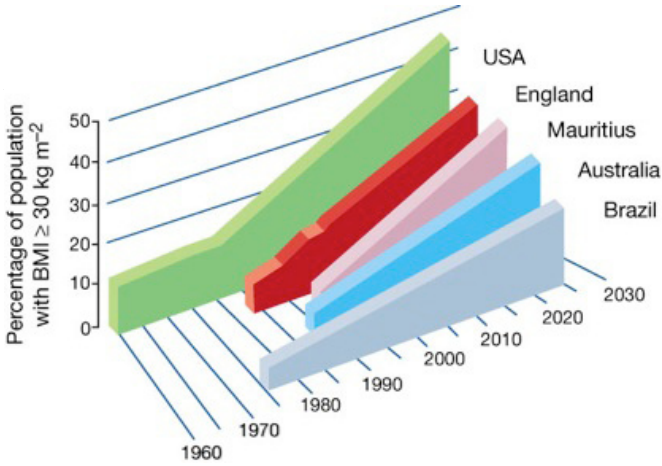

Figure 4: Rising prevalence of obesity in selected countries
Source: International Obesity Task Force, "Rising prevalence of obesity in selected countries."[32]

Obesity is also increasingly a problem for the UK, as a project The International Obesity Task Force (IOTF) provides some interesting comparative data on the current and future prevalance of obesity (see figure 4). The IOTF further forecasts that in the UK 24% of boys and 32% of girls aged between 5 and 17 will be overweight by 2025, which may reinforce growing obesity rates in the population.[33]

Predictions on the future prevalence of diabetes are also pessimistic. A study examining the prevalence of type 2 diabetes in the UK (as well as the associated healthcare costs for the period 2000–60) predicted that population ageing would cause approximately 20% more cases of type 2 diabetes by 2036. Cases of diabetes-related complications will increase rapidly to peak at 20–30% above present levels between 2035 and 2045, before showing a modest decline. The cost of healthcare for

28 Foresight, "Trends and drivers of obesity: a literature review for the foresight project on obesity": www.foresight.gov.uk/Obesity/Outputs/Literature_Review/Literature_review.htm.

29 Department of Health, "Obesity general information": www.dh.gov.uk/en/Policyandguidance/Healthandsocialcaretopics/Obesity/DH_078098.

30 House of Commons Health Committee, *Obesity (London: HMSO, 2004).*

31 National Audit Office, *Tackling Obesity in England (London: HMSO, 2001).*

32 International Obesity Task Force, "Rising prevalence of obesity in selected countries": www.iotf.org/media/iotfprojection.jpg.

33 International Obesity Task Force, *Waiting for a Green Light for Health? (London: IOTF, 2003): www.iotf.org/media/euobesity2.pdf.*

patients with type 2 diabetes rises by up to 25% during this period, but due to reductions in the economically active age groups, the relative economic burden of the disease can be expected to increase by 40–50%. The study concludes that within the next 30 years type 2 diabetes will present a serious clinical and financial challenge to the NHS. [34]

Cancer continues to contribute significantly to the overall burden of disease in the UK. International comparisons show that the UK, along with Denmark, has lower survival rates for all cancers combined than countries that spend similar amounts on healthcare.[35] A study by Moller et al. predicts that for all cancers taken together, there will not be much change in age-standardised incidence *rates* in 2020. However, the total number of new cancer *cases* per year in England is predicted to increase by 33%, from 224,000 cases in 2001 to 299,000 in 2020. Moller et al. argue that this increase is mainly due to the effects of population growth and ageing.[36]

Mental disorders remain amongst the most prevalent of medical conditions. An international analysis conducted by the Centre for Public Mental Health showed that around 14% of the worldwide burden of disease is the result of "neuro-psychiatric disorders."[37] Furthermore, it has been argued that "the definition of mental health disorders is increasingly inclusive, and more and more problems that could be seen as social issues will be treated as individual psychological disorders."[38] We might therefore expect that psychiatric disorders will form an increasingly important part of the overall burden of disease.

34 Adrian Bagust et al., "The projected healthcare burden of type 2 diabetes in the UK from 2000 to 2060," *Diabetic Medicine 19 (2002), 1.*

35 Franco Berrino et al., "Survival for eight major cancers and all cancers combined for European adults diagnosed in 1995–99: results of the EUROCARE-4 Study," *The Lancet Oncology 8 (2007).*

36 Henrik Moller et al., "The Future Burden of Cancer in England: Incidence and Numbers of New Patients in 2020," *British Journal of Cancer 96 (2007), 1484.*

37 Institute of Psychiatry, "Mental illness contributes significantly to global disease burden," King's College London: www.iop.kcl.ac.uk/news/?id=134.

38 Stefan Priebe, "Psychiatry in the future," *Psychiatric Bulletin 28 (2004), 315–16: http://pb.rcpsych.org/cgi/content/full/28/9/315.*

To conclude, there is a clear weight of evidence to show that the prevalence of certain specific medical conditions will increase in the short to medium terms. As such, we can confidently predict that this will be a driver of increased health costs, especially since treatments for these diseases are unlikely to get appreciably less expensive.

ANALYSING THE IMPACT OF AGEING ON HEALTH EXPENDITURE

The simplistic and pessimistic view is that population ageing is straightforwardly a driver of increased health expenditure, because older people seem to be the main consumers of healthcare. However, there is growing support for the argument that population ageing will have *less* impact on health expenditure than it is commonly believed.[39] Some argue that the measurement of this impact should be based on proximity to death rather than calendar age, since health costs associated with old age are largely a consequence of treatment when people are close to dying (rather than somehow being caused by ageing per se).

Separating the cost of the last year of life from other costs

It has been suggested by Derek Wanless that any analysis of demographic pressures that does not separate costs in the last year of life from other acute care costs risks overestimating the impact on demand for healthcare levied by an ageing population.[40]

A study in Oxfordshire showed that, while both age and proximity to death have significant effects on quarterly hospital costs, the quantitative importance of age was small compared with proximity to death.[41] A similar study using data from hospitals across England found a small positive association between age and health expenditure, but demonstrated that the large (tenfold) increase in costs from five years prior to death to the last year of life greatly overshadowed the 30% increase in costs from ages of 65 to 85.[42] The authors of the study

39 Ed Harding and Suzanne Wait, *The State of Ageing and Health in Europe (London: International Longevity Centre, 2006); Alastair Gray, "Population ageing and healthcare expenditure," Ageing Horizons 2 (2005).*

40 Derek Wanless, *Securing our Future Health: Taking a Long-Term View (London: HMSO, 2002).*

41 Alistair Gray and Meena Seshamani, "Ageing and health-care expenditure: the red herring argument revised," *Health Economics 13, no. 4 (2004), 303–14.*

42 Alistair Gray and Meena Seshamani, "A longitudinal study of the effects of age and time to death in hospital costs," *Health Economics 23, no. 2 (2004), 217–35.*

concluded that expenditure projections must consider remaining life expectancy and not simply age. Similar results are confirmed by studies in the US using data from Medicare.[43]

A cross-country comparison conducted by the OECD looked at projections of health and long-term care expenditures in a number of developed countries by separating different kinds of costs.[44] The study distinguished between healthcare costs for survivors, the adjustment for "healthy ageing" and death-related costs. While the pure ageing effect was reported to be significant in some countries, this may be compensated by better average health status amongst the elderly. Death-related costs were described as accounting for only a small fraction of the increase in expenditure as a share of GDP: these costs increase from around 5% of total health spending in 2005 to 7% by 2050.

The OECD study also described how the aggregate effect of demographic factors on healthcare expenditure displays wide cross-country variation. It ranges from virtually zero in Sweden to 1.6% of GDP for Korea (see figure 5). This can be related to differences in evolving population structures, e.g. changes in old-age dependency ratios. However, on average, the demographic effect only accounts for a small increase in expenditure, from 5.7% in 2007 to 6.3% by 2050, or 0.6 percentage points of GDP. In the UK, costs attributable to ageing are even lower than this average, accounting for less than 0.4% of GDP. The survey admits that the "healthy ageing" assumption may render the simulation of demographic effects relatively optimistic, but the assumption is in line with observed patterns of health status in many OECD countries.

43 Edward C. Norton, Sally C. Stearns and Zhou Yang, "Longevity and healthcare expenditures: the real reasons older people spend more," *Journals of Gerontology Series B: Psychological Sciences and Social Sciences 58, no. 1 (2003), S2–S10.*

44 OECD, "Projecting OECD health and long-term care expenditures: what are the main drivers?" *OECD Economics Department Working Papers 477 (2006).*

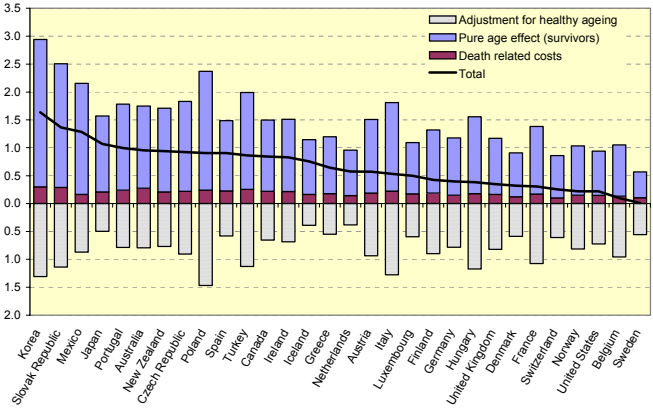

Figure 5: Public healthcare expenditure for OECD countries
Source: OECD, "Projecting OECD health and long-term care expenditures: what are the main drivers?"[45]

The above results tally with previous studies conducted by the OECD: an analysis of the years 1960–90 revealed that ageing explained only a very small part of the total increase in health expenditure. According to the OECD in these earlier studies, the most important factors driving health expenditure are income growth, technological development and increases in real healthcare prices.[46]

An ENEPRI Research report questions whether societies can afford to live longer in better health again by separating out different aspects of health costs.[47] Particular attention is given to three factors:

- a large proportion of healthcare spending relates to time to death, rather than to age;
- life expectancy may increase much faster than current demographic projections suggest;
- average health status may continue to improve in the future.

45 Ibid.

46 OECD, "OECD health systems – facts and trends 1960–1991," *Health Policy Studies 1, no. 3 (1993); OECD, "Ageing in OECD countries – a critical policy challenge," Social Policy Studies 20 (1996).*

47 Frank Pellikaan and Ed Westerhout, "Can we afford to live longer in better health?" *ENEPRI Research Report 10 (2005).*

The ENEPRI model separates healthcare costs during the last years of life into an acute healthcare component and a long-term healthcare component. Under the "living longer scenario", they calculate an additional increase in public expenditure for the UK of 0.1% of GDP (EU average: 0.4%), while the additional increase for long-term healthcare is 0.7% (EU average: 0.4%). Under the "living in better health scenario", acute healthcare expenditures will decrease in the UK by 0.3% of GDP (EU average: 0.8%) and long-term healthcare costs will decrease by 0.3% (EU average: 0.2%). Finally, under the "living longer in better health scenario", acute healthcare expenditure will decrease by 0.2% of GDP, while long-term healthcare will increase by 0.4% (EU average: 0.1%). Clearly, there seem to be more gaps in long-term healthcare than in acute healthcare in the UK.

To conclude, it seems that population ageing will undeniably exert some upward pressure on health costs in the UK, but the increase in costs will not be as dramatic as the ones feared by those holding to the pessimistic view we described in our introduction. This conclusion is lent further weight when the impact of ageing is assessed on the proximity to death methodology, and when comparative evidence from other countries is taken into account.

Impact of ageing on long-term care

In the UK, long-term care is usually taken to mean *social* care: help with domestic tasks, assistance with personal care tasks and nursing care. Most long-term care for older people living at home is currently provided by informal carers (relatives, friends, etc.). Formal services are provided by a range of agencies, including local authority social services, community health services (under the NHS), independent-sector residential and nursing homes and home-care services.[48]

However, the division between healthcare and social care is not clear-cut and the debate on who should fund long-term care – which has both a healthcare component, as well as 'purely' social elements – is still very much alive. Most of the data on long-term care merges both health and social care aspects. The most recent study was conducted by the Personal Social Services Research Unit (PSSRU). It projects that

48 Adelina Comas-Herrera, Ruth Hancock, Linda Pickard and Raphael Wittenberg, "Who will pay for long-term care in the UK? projections linking macro- and micro-simulation models," *Fiscal Studies 24, no. 4 (2003), 387–426.*

the number of disabled older persons is likely to increase by nearly 40% between 2002 and 2022 if age-specific disability rates remain constant.[49] Demand for long-term care services is projected to increase markedly, even if informal care rises in line with demand. The PSSRU model projects that to keep pace with demographic pressures over the next 20 years, residential and nursing-home places would need to expand by about 40% and home-care hours by nearly 40%. Resulting from the same pressures, the numbers of recipients of disability benefits are projected to increase by just under 40%.

The PSSRU model also projects that long-term care expenditure will need to rise by around 110% in real terms over the next 20 years to meet demographic pressures and to allow for likely real rises in care costs. This projection is highly sensitive to the projected growth in the number of older people, future disability rates, and future real rises in care costs. Although expenditure is projected to increase, the economy is also forecast to expand. Assuming that the economy grows in line with the HM Treasury projections, long-term expenditure would increase from about 1.5% of GDP in 2002 to just 1.9% in 2022. The PSSRU model is built on a number of assumptions, including the assumption that disability *rates* (as reported in the 2001 General Household Survey) will remain unchanged over time. Nevertheless, it acknowledges that the projections are sensitive to changes in some of these key assumptions and examines different scenarios to identify possible outcomes.

Since, as we discussed above, long-term care includes both healthcare and purely social care elements, is it possible to tease out the health-specific element from this data? We asked Julliette Malley and Raphael Wittenberg at the LSE to aid us in this task. Table 3 is the result of their work and shows the projected NHS expenditure on long-term care for older people. The projections relate to the base case as described in the original PSSRU model.[50]

49 Juliette Malley et al., "Long-term care expenditure for older people, projections to 2022 for Great Britain, report to IPPR." PSSRU discussion paper DP2252 (2005).

50 Ibid.

Table 3: Projected NHS expenditure on long-term care for older people in England, £ million, 2002/3 prices

	2002	2007	2010	2012	2017	2022	2026	2031
NHS	3,000	3,400	3,800	4,100	5,000	6,100	7,300	9,100

Note: NHS expenditure includes: community nursing, chiropody and NHS day-care, residential continuing-care recipients, the nursing element of nursing homes and long-stay hospital.
Source: PSSRU model, by Julliette Malley and Raphael Wittenberg for the SMF Health Project.

In addition to the PSSRU data, we can add the report on long-term care produced by the Joseph Rowntree Foundation which claims that the UK has not yet found a clear, fair and adequate system to finance long-term care as the population ages.[51] Since its publication, the authors of this report have produced updated projections. These are based on the latest official population projections and on specific assumptions about future trends in dependency rates and other relevant factors. They include:

1 Long-term care spending in the UK will need to rise by around 315% in real terms between 2000 and 2051 in order to meet demographic pressures and to allow for real rises in care costs (assuming dependency rates, patterns of care and funding arrangements remain unchanged).

2 On this basis, spending on long-term care will need to increase from about 1.4% of GDP in 2000 to around 1.8% of GDP in 2051, assuming a real increase of 2.25% a year in GDP.

3 This projection of 1.8% of GDP in 2051 using the 2002-based official population projections updates an earlier projection of 1.6% of GDP in 2051 using the 2000-based population projections.

4 These projections are, of course, sensitive to assumptions about trends in life expectancy, dependency rates and real unit costs of care, as well as changes in patterns of care and funding systems;

51 Raphael Wittenberg et al., *Future Demand for Long-term Care in the UK; A Summary of Projections of Long-term Care Finance for Older People to 2051 (York: Joseph Rowntree Foundation, 2004).*

5 Public expenditure on long-term care is projected to reach around 1.2% of GDP in 2051 under current funding arrangements and around 1.5% of GDP in 2051 under a policy of free personal care with an assumed 25% increase in demand for domiciliary services;

6 The share of total long-term care costs met publicly is projected to be almost 80% in 2051 under a policy of free personal care, as against around 66% under current funding arrangements.

Demographic change and potential family support

More optimistic are the projections regarding demographic changes and potential family support, and the effect that these changes will have on the provision of informal care to older people.

A study by Kalogirou and Murphy in nine European countries, including the UK, concludes that in all countries the proportion of older people with a spouse will increase much more quickly than that of those without a spouse over the next 30 years or so (although in both cases the numbers will increase).[52] For the purpose of assessing care needs in decades to come, these marital status projections may suggest a possible shift towards care given by spouses and away from formal modes of provision. Malley et al. concur, arguing that in the UK care by spouses is likely to increase significantly in the near future, in light of official marital status projections. They conclude that care by spouses is likely to become an even more important source of informal care for older people than care by their children.[53] However, a UK study by Murphy et al. argues that informal care provided by children to their elderly parents is unlikely to lose its significance in the near future.[54]

From the foregoing, we can conclude that an ageing population in the UK will increase long-term care costs, although informal care by spouses and the children of elderly persons is likely to offset these costs somewhat. It seems that population ageing will have a greater impact

53 S. Kalogirou and M. J. Murphy, "Marital status of people aged 75 and over in nine EU countries in the period 2000–2030," *European Journal of Ageing 3, no. 11 (2006), 74–81.*

53 Malley et al., "Long-term Care Expenditure for Older people."

54 M. J. Murphy, P. Martikainen, and S. Pennec, "Demographic change and the supply of potential family supporters in Britain, Finland and France in the period 1911–2050," *European Journal of Population 22, no. 3 (2006), 219–40.*

on the purely social care element of long-term care expenditure than on the healthcare element. However, unless social care funding and provision evolve to become capable of meeting the challenges posed by changing demographics, this could in itself exert cost pressures on the health service (when, for example, individuals with unmet social care needs develop healthcare needs as a result).[55]

CONCLUSIONS

The UK population is growing and ageing. While there is a lot of uncertainty about how fast these changes will occur, and about whether people will be living longer in better or in worse health, all the future projections on the impact of demographic changes on healthcare expenditure are at least *sensitive* to the range of possible scenarios. Most of the studies measuring the impact of ageing on health expenditure make predictions using a sub-set of favoured (i.e. especially likely) scenarios in order to illustrate the range of possibilities.

Summing up the evidence from these studies, there seems to be growing agreement that the impact of ageing on health expenditure should be measured by distinguishing between the costs of dying and the costs of long-term care required by older people. Studies premised on this methodology seem to confirm that although ageing is driving up health expenditure, the increase is not as dramatic as is frequently reported by the media.[56] There is simply not enough evidence that ageing is the *main* driver of health expenditure. Comparisons with other countries show that the UK is doing relatively well in terms of coping with the likely impact of future demographic changes on healthcare expenditure. In part, this may be because the UK does not rely greatly on informal care for older people, and has therefore developed some pre-existing institutional capacity to deal with future demand.

55 Derek Wanless, *Securing Good Care for Older People: Taking a Long-Term View (London: King's Fund, 2006).*

56 BBC News, "Ageing population 'to strain NHS."

In conclusion, there is of course a debate still to be had about the future funding of healthcare in the UK. However, it is important that the participants in this debate come armed with the belief that ageing is not a "problem" in itself, and nor is it likely to be the main driver of healthcare expenditure. It is a social trend to be dealt with as any other, and its significance ought not to be overplayed lest we lose sight of more important factors. We will discuss one such factor in the next chapter – the impact of new medical technologies.

4 MEDICAL AND TECHNOLOGICAL ADVANCES

INTRODUCTION

This chapter is given over to discussing the development of medical technology, the concomitant (likely) growth in the range of available treatments and the net effect of these treatments on costs. Advances in health technology are crucial in determining the range of treatable conditions and hence the scope of services available to patients. They aim at improving health and extending lives, but they may also have an upward impact on health costs.

Our overall aim in this chapter, therefore, is to examine the future impact of health technologies on healthcare expenditure in the UK. In order to do so, we begin by examining the market for health technologies in the UK so as to isolate the factors that determine demand for (and supply of) such technologies. We will consider how these factors are likely to change over the coming years. This analysis will be used to inform our investigation into the likely impact of new technologies on healthcare expenditure. Throughout, international comparisons will be used to show the performance of the UK in relation to other developed countries.

In the UK, concerns have been expressed by some that the NHS "is lagging behind many countries in the introduction of new medical equipment"[57] and that "innovations do not reach patients quickly enough, partly due to structural flaws in the NHS."[58] We also consider, therefore, factors which might determine the rate of diffusion of healthcare technologies.

Ideally, new technologies which are highly efficacious and cost-effective, would become rapidly disseminated and used. Some evidence, however, suggests that such technologies often tend to be diffused rather slowly, while technologies of questionable value diffuse rapidly and others which should be curtailed or abandoned tend to

57 BBC News, "NHS 'lags behind over technology," *BBC News, April 7, 2005: http://news.bbc.co.uk/1/hi/health/4421097.stm.*

58 BBC News, "Innovations not reaching patients," *BBC News, November 17, 2007: http://news.bbc.co.uk/1/hi/health/4018619.stm.*

persist.[59] The term "technological cancer" has been used to describe the "failure to excise outdated and inappropriate technologies from the practice of medicine, coupled with the unchecked growth of new technologies."[60] The introduction of formal techniques for evaluating the costs and benefits of healthcare technologies (Health Technology Assessment – HTA), such as the studies undertaken by England's National Institute for Clinical Excellence (NICE), has become an increasingly prominent activity. But, as discussed below, HTA probably does not have a significant effect on the diffusion of technologies. HTA can also be seen as a tool both for demand management and for the establishment of clinical guidelines and, accordingly, more detailed discussion of NICE is reserved for Background Paper 3 in this series, which deals with commissioning and quality.

DEFINING 'HEALTH TECHNOLOGIES'

We have adopted the definition of "health technologies" as set out in the Australian Productivity Commission's Research Report. There, the term is taken to include physical equipment and instruments, pharmaceutical products, clinical procedures, and the knowledge and support systems within which healthcare is provided.[61] It includes all technologies that are *applied* in the health industry, such as information and communications technologies. Advances or innovations in medical technology are understood to encompass innovations both in products (i.e. new or improved pharmaceuticals) and processes (i.e. new or improved surgical procedures, or patient-management systems).

59 A. L. Greer, "The state of the art versus the state of the science: the diffusion of new medical technologies into practice," *International Journal of Technology Assessment in Health Care 4 (1988), 5–26.*

60 S. N. Davidson, "Technological cancer: its causes and treatment," *Healthcare Forum Journal (March–April 1995), 52–8*

61 Productivity Commission, *Impacts of Advances in Medical Technology in Australia (Melbourne: Productivity Commission, 2005).*

A very recent review by Darzi[62] predicts that in the next 10–15 years there will be a number of significant technological breakthroughs, including:

- advances in molecular genetics, with the progress of the Human Genome Project identifying the genes responsible for causing monogenetic disorders such as cystic fibrosis, and for causing genetic susceptibility to polygenetic disorders such as coronary artery disease;

- the development of bioengineering to produce artificial body parts and organs, a process that is predicted to replace organ transplantation within 30 years;

- further developments in minimally invasive surgery (a form of surgery predicted to account for half of all surgical interventions within the next 10–15 years), and in image-guided surgery (exploiting developments in magnetic resonance imaging);

- the use of robotics in surgery (thereby increasing accuracy and consistency), and in rehabilitation.

THE MARKET FOR HEALTH TECHNOLOGIES

Demand for health technologies

The literature on advances in medical technology has identified a number of factors that influence demand for health technologies. Among the most important of these are population growth, ageing of the population (with associated increases in overall burden of disease) and public expectations and preferences.

As discussed in the previous chapter, the population of the UK is projected to get larger and older. A study projecting overall societal burden of disease in 2030 reveals that the list of the ten leading causes of death in high-income countries is dominated by chronic diseases: mainly heart disease, cancer and dementia.[63] Similarly, the same study

62 Ara Darzi, *Healthcare for London: A Framework for Action (London: NHS London, 2007).*

63 Colin D. Mathers, and Dejan Loncar, "Projections of global mortality and burden of disease from 2002 to 2030," *PloS Medicine 3, no.11 (2006), 2011–30.*

reports that the ten leading causes of disability in high-income countries include chronic mental conditions, heart diseases and cancer.

The public generally expects a great deal of the NHS.[64] Where access to new medical technologies is concerned, public expectations are arguably even higher. In a recent study, the IPPR has shown that of the 1,003 British citizens they surveyed, some 31% stated that the NHS should provide "all drugs and treatments, no matter what the cost."[65] A further 40% held that the NHS should provide the "most effective treatment, no matter what the cost." Only 28% stated that the NHS should provide the "most effective and value-for-money treatments." As such, it seems that the majority of people do not regard value for money as the primary consideration when deciding which treatments to make available. Most individuals clearly expect access to all effective treatments – an unrealistic expectation that is fuelled by a media ever on the look-out for a new "breakthrough" treatment (witness, for example, the controversy over the availability of Herceptin).

In conclusion, it seems reasonable to assume that population ageing, the burden of chronic conditions and high public expectations regarding the availability of drugs and treatments will serve to ensure that demand for new technologies in the United Kingdom will continue to rise in the foreseeable future.

Supply of health technologies

The supply of new medical technologies largely reflects research and development (R&D) and the subsequent bringing to market of new products (after meeting safety and other regulatory requirements). The Global Forum for Health Research shows that the total global expenditure on R&D for health continues to increase significantly, as shown in figure 6.[66] The main sources of funds for health research are the public sector (45%) and the private for-profit sector (48%), while the private not-for-profit sector and a number of public and private non-domestic sources make up the remaining 7% of funds. Private for-profit funded R&D responds to potential demand and public preferences, while publicly funded R&D reflects the disease areas prioritised by government.

64 See Paper 5, which reviews the literature on patient expectations.

65 Jennifer Rankin, *Public Expectations and the NHS (London: Institute for Public Policy Research, 2006).*

66 Andres de Francisco and Stephen Matlin (eds.), *Monitoring Financial Flows for Health Research (Geneva: Global Forum for Health Research, 2006).*

Estimates of total expenditures on research for health (US$ billions)

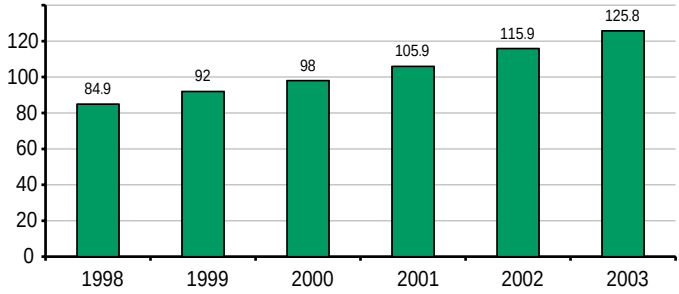

Figure 6: Estimates of total expenditures on research for health (in US$ billions)
Source: Francisco and Matlin, *Monitoring Financial Flows for Health Research*, p. 35.[67]

The Global Forum for Health Research estimates that the UK's contribution to the global distribution of expenditure in R&D for health is approximately 7%. This puts the UK in third place, behind the United States (50%) and Japan (11%), and above Germany (6.5%), France (5%) and Canada (3%). UK medical research by public bodies approached £2.5 billion in 2002/3, while research by UK pharmaceutical companies was £2.9 billion during the same period. That makes a total annual investment of research funds in the UK healthcare sector of approximately £5.3 billion. The government is currently committed to increasing R&D expenditure, and it is likely that pharmaceutical companies will follow suit. Although there is no straightforward linear relationship between R&D spend and the development of entirely novel treatments (for example, concern has been expressed from both within and outside the pharmaceutical industry about the production of relatively modest modifications of existing products rather than "breakthrough" treatments), it is likely that increased R&D spend in the UK will produce sufficient numbers of desirable new treatments to exert a significant upward cost pressure on the healthcare system.[68] The precise magnitude of this cost pressure is difficult to quantify.

67 Global Forum for Health Research estimates based on data from official reports to OECD and RICYT, national surveys, pharmaceutical association and other publications.

68 Alistair McGuire and Maria Raikou, "Inferring the value of medical research to the UK," *LSE Working Paper 5 (2007).*

It might be interesting for the SMF Health Project to conduct further research into the likely impact upon R&D of changes to the Pharmaceutical Price Regulation Scheme (PPRS) suggested recently by the Office of Fair Trading.[69] The OFT has recommended that the existing system of profit-capping and price-cutting be replaced with a scheme whereby the NHS pays for drugs in accordance with the clinical benefits they bring. The aim is to ensure the NHS obtains better value for money from its drug spend.

Factors affecting adoption and diffusion

The conclusion of the previous section masks an important issue, however: while increasing numbers of new treatments might become available, how quickly will these technologies be adopted (i.e. used for the first time) and how quickly will their use become diffused (i.e. incorporated over time into common clinical practice)? A cross-country comparative study examined the trends in adoption and diffusion of technologies for heart-attack treatment in 17 countries.[70] The study shows that medical practice in the treatment of heart attacks has changed dramatically around the world in the past ten years: in general, treatment has become more intensive, with greater use of medications and intensive procedures in the acute phase of an attack.

However, the study identified three very different *patterns* of change. The US illustrated an early start/fast growth pattern: intensive procedures tended to diffuse *early*, resulting in relatively high treatment rates in the overall population in any given time period. This pattern is also associated with a relatively rapid *rate* of diffusion.

69 Office of Fair Trading Market Studies, "Pharmaceutical Price Regulation Scheme": www.oft.gov.uk/advice_and_resources/resource_base/market-studies/price-regulation.

70 The Technological Change in Healthcare Research Network, "Technological change around the world: evidence from heart attack care," *Health Affairs 20, no. 3 (2001), 25–42.*

The study identified a second pattern in other countries, marked by late start and fast growth. These countries typically show relatively rapid diffusion of intensive technologies; however, diffusion *starts* later than in countries that adopt new technology early. Overall diffusion rates in these countries are similar to those in the US, but the overall intensity of treatment at any given time tends to be somewhat lower because of the later start. The study also examined the diffusion of procedures among the elderly patients in these countries and concludes that it tends to be slower. Countries with this pattern include Australia, Belgium, most Canadian provinces, France, Italy, Singapore and Taiwan.

The UK falls into the third of the patterns observed in the study, marked by late start/slow growth (i.e. later adoption and slower diffusion of new medical technologies). Other countries following this pattern are most of the Scandinavian countries, and (at least on some measures) the province of Ontario in Canada. The study concluded that this pattern appears to be related to economic and regulatory incentives within the countries' healthcare systems.

The TECH project on heart-attack patients also looked at factors influencing the adoption of cardiac technologies.[71] The authors identified healthcare systems characterised as "public contract systems" and "reimbursement systems" as having higher adoption rates than what they termed "public integrated healthcare systems" (such as the UK). Also, they found that central funding of investments was negatively associated with adoption rates, and that GDP per capita also had a strong role (particularly in the initial adoption of technologies). The impact of income and institutional characteristics on the utilisation rates of these procedures diminishes over time. The evidence presented by the TECH Project shows that the UK lags behind in adopting and diffusing new technologies, in comparison to some European countries and the US.

Work undertaken for the OECD Ad Hoc Health Project has also looked at factors determining the diffusion of medical technologies.[72] Studies of diffusion of technologies tend to divide into those which

71 Michael Bech et al., "How do economic incentives and regulatory factors influence adoption of cardiac technologies? result from the TECH Project," *TECH Working paper (2006).*

72 The OECD Health Project, *Health Technologies and Decision-Making (OECD 2005).*

consider the issue in general terms, and those which focus on a specific technology or technologies. In the first category, factors which have been identified as influencing the rate of adoption of technologies are:

- aggregate level of income
- organisational behaviour
- reimbursement mechanisms
- healthcare
- organisation
- regulation
- health technology assessment

Studies of the relationship between income and the level and rate of technological diffusion have found that higher-income countries tend to adopt new technologies earlier, but after this period of rapid diffusion, variations in availability declined. In countries where incomes are lower, there is greater pressure by regulators to limit the diffusion of expensive medical technologies, and, in addition, it may be that expensive medical technologies are more likely to be invented in higher-income countries, so that diffusion reflects the location of production.[73]

Behavioural explanations emphasise the impact of a few innovators and early adopters who are opinion leaders, or "ideas champions", in their field, and who influence peers into a wider consensus. A similar mechanism is found in one study which identified clinician involvement in clinical trials as an important factor.[74]

73 E. P. Slade and G. F. Anderson, "The relationship between per capita income and diffusion of medical technologies," *Health Policy 58 (2001),1–14.*

74 D. Ketley and K. L. Woods, "Impact of clinical trials on clinical practice: example of thrombolysis for acute myocardial infarction," *The Lancet 342 (1993), 891–94.*

Evidence of the impact of reimbursement mechanisms on technological diffusion tends to come from the US, since it provides a natural experiment in contrasting systems of payment for healthcare: fee-for-service arrangements, which were prevalent in the 1960s and 1970s, gave way to prospective reimbursements based on diagnosis-related-groups (DRGs) in the 1980s and beyond. Studies of the impact of prospective reimbursement on the diffusion of new technologies have found there to be significant impacts, depending on the terms of reimbursement and the type of technologies (cost-saving or cost-increasing) concerned. Unsurprisingly, restrictive rate-setting tends to have a negative effect on the adoption of cost-enhancing technologies, and the opposite effect on cost-lowering technologies. Any difference between the reimbursement rate under the DRG to which the technology is assigned and the cost of providing it will give a financial incentive in favour of, or against, the technology concerned. It follows that relatively high tariffs can be used to promote the use of particular technologies.

The literature has also examined a number of influences on technology diffusion associated with the organisation of care, such as the degree of competition between providers, whether they are publicly or privately owned, size, location and affiliation or not with a medical school. Studies in the US have indicated that less competitive markets were associated with lower use of technologies, suggesting that hospitals do compete in part by acquiring technologies to attract and retain physicians and patients.[75] However, one study found that this led to an oversupply of technology, in this case cardiac catheterization labs.[76] In the UK, Rosen and Mays have argued that, although the purchaser–provider split presented an opportunity to use financial incentives to ensure that diffusion of technology was research-linked, in practice contracts have been too crude to influence technological innovation.[77]

75 R. A. Hirth. M. E. Chernew and S. M. Orzol, "Ownership, competition, and the adoption of new technologies and cost-saving practices in a fixed-price environment economy," *Inquiry 37 (2000), 282–94.*

76 S. C. Hill and B. L. Wolfe, "Testing the HMO competitive strategy: an analysis of its impact on medical care resources," *Journal of Health Economics 16 (1997), 261–559.*

77 R. Rosen and N. Mays, "The impact of the UK NHS purchaser-provider split on the "rational" introductions of new medical technologies," *Health Policy 43 (1998), 103–23.*

Little evidence is available on the impact of regulatory controls on technology diffusion. Furthermore, a recent survey of Health Technology Assessment (HTA) initiatives throughout the European Union found that, generally speaking, clinicians have not actually changed their practice to agree with HTA results.[78] A UK-based study has suggested that HTA may have a higher degree of influence than this, but that its impact is ad hoc and unsystematic.[79] However, where HTA has been influential, its impact can be dramatic. The Department of Health has financed the production of a series of "Effective Healthcare Bulletins", targeted at decision-makers in healthcare. An impact of the evaluation of the Bulletin on persistent glue ear in children estimated that almost 90,000 fewer procedures were conducted in the four years after the Bulletin than would otherwise have been carried out, resulting in savings of £27 million.[80]

As such, one possible avenue of further research for the SMF Health Project is to suggest ways in which the UK could improve its adoption and diffusion of new technologies (should this in itself be considered a desirable thing to do). Currently, researchers at the London School of Economics conduct work on the topic and we are in contact with them with a view possibly to including aspects of their research in our work. We shall return to these issues below.

IMPACT OF NEW TECHNOLOGIES ON HEALTHCARE EXPENDITURE

There seems to be increasing evidence to support the proposition that new technologies form one of the most significant drivers of increased health expenditure. On the aggregate level, measuring the expenditure impact of new health technologies is rather difficult. Two methods, both with significant limitations, have been proposed to measure this impact – namely, the residual method and the direct method. The former quantifies the impact of *other* determinants of health expenditure and attributes the unexplained (residual) component to advances in health technology. The latter approach uses the health

78 D. Banta and W. Oortwijn, "Health technology assessment and health care in the European Union," *International Journal of Technology Assessment in Health Care 16 (2000), 626–35.*

79 R. Rosen and N. Mays, "Controlling the introduction of new and emerging medical technologies: can we meet the challenge?" *Journal of the Royal Society of Medicine 91 (1998), 3–6.*

80 J. Mason, N. Freemantle and G. Browning, "Impact of effective health care bulleting on treatment of persistent glue ear in children: time series analysis," *British Medical Journal 323 (2001), 1096–97.*

R&D expenditure as a proxy to measure the effect of technology on healthcare expenditure.

While quite a few studies have used the residual approach, most focus on countries other than the UK and have little specific information on, or relevance to, this country. Table 4 summarises the studies that used the residual approach, with only the Wanless Report trying to apply it specifically to the UK.[81]

Table 4: Some key residual studies

Study	*Expenditure Data*	*Determinants of growth*	*Magnitude of residual*
Cutler (1995)	Real US healthcare expenditure per capita 1940 – 1990	• Excess health in□ation • Private insurance • Income growth • Ageing • Administration costs	49% of total percentage increase in health expenditure
Fuchs (1972)	Nominal US health expenditure 1947 – 1967	• Population growth • In□ation (general and excess health) • Income growth	0.6 percentage points of the annual growth in health expenditure (7.5% of the annual growth in expenditure)
KPMG Consulting (2001)	Nominal Victorian inpatient expenditure 1996-97 to 1999-00	• Population growth • Ageing and gender • In□ation • Dialysis	1.7 percentage points of the annual growth in health expenditure
Mushkin and Landefeld (1979)	Nominal US health expenditure 1930 - 1975	• Population growth • Ageing • In□ation (general and excess health) • Income growth • Third-party payments	-0.5 percentage points of the annual growth in health expenditure

81 Wanless, *Securing our Future Health.*

Newhouse (1992)	Real US personal health expenditure per capita 1929 – 1990	• Ageing • Private insurance • Income growth • Supplier-induced demand	>50% of the total percentage increase in health expenditure
Oxley and MacFarlan (1994)	Real health expenditure OECD countries 1960 – 1990	• Ageing • Income growth • Public insurance	40% to 79% of total percentage increase in average OECD health expenditure (income elasticity of 1 and 0.2 respectively)
Mohr et al. (2001)	Real personal US health expenditure 1960 – 1998	• Population growth • In□ation (general and excess health)	Estimates range from 4% to 64% of the average annual growth in health expenditure across years
Smith, S (2001)	Real per capita US health expenditure 1940 – 1990	• Excess health in□ation • Income • Ageing • Insurance • Supplier-induced Demand	2.2 percentage points of the annual growth in health expenditure
Wanless (2001)	Nominal UK health expenditure 1977 – 2000	• Population growth • Ageing • In□ation (general and excess health)	1.9 percentage points of the annual growth in health expenditure (19% of the average annual growth in expenditure)

Source: Productivity Commission, *Impacts of Advances in Medical Technology in Australia* (Melbourne: Productivity Commission, 2005).

The Wanless Report considered nominal UK health expenditure data from 1977 to 2000. It looked at three drivers of increased expenditure: population growth, ageing and inflation. It concluded that the magnitude of the residual (i.e. health technology) accounts for just under two percentage points of the annual growth in health expenditure, and suggested that in order to catch up (and keep up)

with other countries over the next 20 years, technology spending will need to grow at a faster rate than over the past 20 years. However, the report admitted that the residual method used has major limitations and that more research is needed to measure adequately the impact of health technology in overall healthcare expenditure.[82]

Regarding studies that use the direct approach to measuring the contribution of health technologies to health expenditure, once again most of the evidence focuses on international comparisons of countries other than the UK. Okunade and Murthy use total US R&D and US health-specific R&D expenditure as proxies for technological change.[83] They found evidence of a stable long-term relationship between real US health expenditure per capita, real GDP per capita, and technological change in the US between 1960 and 1997. Dreger and Reimers use three different proxies for technological progress: life expectancy, infant mortality and the percentage of the population older than 65.[84] They examine the relationship between real health expenditure per capita, real GDP per capita and each of the technological change proxies across 21 OECD countries. Another study carried out in the US and Canada using a direct method, argues that once technological change is accounted for, ageing and income explain a relatively small proportion of expenditure variation.[85] A study in OECD countries by Blomqvist and Carter identifies technological change (as proxied by time trend) as accounting for two percentage points of the annual growth in real health expenditure.[86]

Finally, an Australian report on the impact of technological change in the health sector uses the direct method in arguing that advances in medical technology have been a major driver of the growth in real healthcare expenditure over the past ten years. Advances in technology are estimated to have contributed about one-third of the average annual growth in real health expenditure over this time period. The study also suggests that other important contributors to the increase

82 Ibid.

83 Albert A. Okunade and Vasedeva N.R. Murthy, "Technology as a major driver of healthcare costs: a cointegration analysis of the Newhouse conjecture," *Journal of Health Economics 21 (2002), 147–59.*

84 Christian Dreger and Hans-Eggert Reimers, "Healthcare expenditures in OECD countries: a panel unit root and cointegration analysis," *Institute for the Study of Labor Discussion Paper 1469 (2005).*

85 Larry Di Matteo, "The macro determinants of health expenditure in the United States and Canada: assessing the impact of income, age distribution and time," *Health Policy 71, no.1 (2005), 23–42.*

86 Ake G. Blomqvist and Robin A. L. Carter, "Is healthcare really a luxury?" *Journal of Health Economics 16 (1997), 207–29.*

in health expenditure include population and income growth and (to a lesser extent) ageing of the population and rising private health insurance coverage.[87]

Overall then, and in conclusion, there is strong evidence, supported mainly by international studies, that health technologies are an important driver of increased healthcare expenditure. The *extent* to which they will impact on expenditure in the future is more difficult to quantify with any degree of certainty. The studies mentioned here describe how new technologies exert an upward pressure on costs in *aggregate* terms: that is, even assuming that some new technologies will produce financial benefits, the overall effect is to increase costs. However, it is worth going into a little more detail on the clinical as well as the financial benefits of new treatments.

BENEFITS OF NEW MEDICAL TECHNOLOGIES

New medical advances can bring many kinds of benefit, including reduced mortality, a greater chance of patients being treated at home and lower rates of re-hospitalisation. It is obvious that these clinical benefits often provide spin-off cost benefits (e.g. lowered downstream costs). However, it is both difficult and potentially unwise to quantify the benefits of new medical technologies at a high level of generality: while some novel treatments represent considerable improvements on existing forms of care, others present far more modest advantages. We have chosen here to focus on a small number of concrete examples.

A study conducted by Cutler et al. explored the benefits of new technologies in cardiovascular disease and found that changes in medical treatments used in the management of acute myocardial infarction (AMI) accounted for 55% of the reduction in mortality in cases between 1975 and 1995.[88] They also noted that the long-term improvement in mortality may be even more substantial than the acute improvements.

87 Productivity Commission, *Impacts of Advances in Medical Technology in Australia (Melbourne: Productivity Commission, 2005)*

88 David M. Cutler, Mark McClellan and Joseph Newhouse, "The costs and benefits of intensive treatment for cardiovascular disease," *National Bureau of Economic Research Working Paper DP225 (1998), 11–29.*

Developments in drugs for the treatment of cancer frequently present good examples of very tangible medical benefits. A recent study by Coombes et al. found that an extra 1,300 lives a year could be saved in the UK if all women with breast cancer were given new drugs that deprive the tumour of oxygen.[89] A new class of drugs called aromatase inhibitors have been approved by the National Institute for Clinical Excellence (NICE) as they have been shown to reduce the chances of breast cancer returning. NICE recommended the use of the new drugs alongside the gold-standard treatment tamoxifen, which for decades has been prescribed to some women for five years after surgery.[90]

However, a recent report by the King's Fund shows that the UK has lower five-year survival rates for most forms of cancer than comparable European countries.[91] There may be many factors explaining these differences, some of which may even be attributed to variations in disease definition. The King's Fund report argues that in some of the cases, e.g. gastrointestinal cancers, the UK has been relatively slow to adopt some of the most recent surgical techniques and forms of radiotherapy. The report also argues that, as the population ages, the overall burden of illness from cancer will inevitably increase (although a dramatic decrease in the number of smokers would have the potential to modify this rise). Consequently, it is argued that the increasing cancer burden will drive demand for service expansion, as will new forms of treatment as they become available. The report also argues that there is little doubt that technological advances will ensure that new forms of cancer treatment will continue to develop, reflecting the large sums of money spent worldwide in research and development. What is less clear is the timescale over which these developments will have an impact on survival, how they will impact on the overall burden of cancer and what they will mean for the way that cancer services are provided.

89 Charles Coombes et al., "A randomized trial of exemestane after two or three years of tamoxifen therapy in postmenopausal women with primary breast cancer," *New England Journal of Medicine 350, no.11 (2004), 1081–92.*

90 Sarah Boseley, "New cancer drugs may save 1,300 lives a year, test shows," *Guardian, 13 February 2007: www.guardian.co.uk/medicine/story/0,,2011769,00.html#article_continue.*

91 Rebecca A. Rosen, Alex Smith and Anthony Harrison, *Future Trends and Challenges for Cancer Services in England (London: King's Fund, 2006).*

In addition, a report by the House of Commons Health Committee claims that the potential benefits of new medical technologies are frequently not realised, and argues that "the UK is a world leader and centre of excellence for the development of new medical technologies, but it lags behind many countries in the implementation of these innovative products."[92] The report states that there are many reasons for the slow rate of progress. It argues that the NHS comprises a "federation" of some 700 trusts with inconsistent policies and practices in relation to the development of new technology. In addition, NHS application and purchasing policies create difficulties for suppliers and result in variations in the availability of technologies to patients. The use of different and incompatible types of equipment leads to many problems, including the need for training in the use of each piece of equipment. Furthermore, there remains a preference amongst some NHS organisations (especially PCTs) to focus on short-term financial planning.

On the basis of these findings, potentially fruitful areas of further research by the SMF health project include the following:

- The possible future impact of immigration on demand for health services.
- Whether the changing age of death will have an impact on the cost of death for the NHS.
- How might changes in morbidity and mortality trends, particularly at a local level, impact on commissioners and service providers in particular areas and regions?
- What impact will the changing structure of the population have on healthcare needs?

92 House of Commons Health Committee, *The Use of New Medical Technologies within the NHS (London: HMSO, 2005).*

- What can be done to overcome the logistical problems currently hindering the uptake and diffusion of new technologies, e.g. the speed at which staff are trained to use new pieces of equipment? This possible avenue of work might perhaps link to our proposed research on NHS workforce issues.[93]

- How can we alter the attitude of fiscal short-termism in some NHS management circles, which frequently ensures that investment in new medical technologies that will yield benefits in the future is rendered secondary to the pursuit of (possibly lesser) benefits in the immediate term?

- To what extent are choices made by individual clinicians affecting the adoption and diffusion of new medical technologies? Particularly salient in this regard might be drug treatments and new forms of information technology.

The above avenues for further research are premised on the belief that the current pattern of adoption of new medical technologies in the UK is unjustifiable – but is it? If we have arrived at an overall state of late start/slow growth as a result of decisions made on the ground by local NHS trusts, who are arguably best placed to judge the health needs of their local populations, might this lend justificatory weight to the overall pattern? This can only be assessed by carefully analysing how these decisions are made on the ground. As such, we might perhaps consider a stream of work in our empirical research to investigate with the relevant NHS professionals exactly how these decisions are made.

93 This research is set out fully in Paper 4 of the SMF Health Project.

CONCLUSIONS

International evidence shows that advances in medical technology are major drivers of increased healthcare expenditure. The UK is no exception. Moreover, there is good reason to expect the upward pressure on costs exerted by medical technology to continue in the foreseeable future. This is so for several reasons. The population of many countries (including the UK) continues to grow and age. The incidence of chronic diseases continues to rise. Citizens levy high expectations on their healthcare system (a topic we will discuss at greater length in paper five). Finally, global and national increases in spending for research and development in healthcare lends weight to the proposition that the *supply* of new technologies will continue to grow in the future.

The costs of new medical technologies cannot be considered in isolation from the benefits they bring, and there is some evidence to suggest that the UK seems to lag behind other counties in the adoption and diffusion of certain new treatments. Important questions remain about the most appropriate way to balance the costs of new medical treatments against their benefits.