Demand for long-term care for older people in England to 2031

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INTRODUCTION

How best to finance long-term care has been the subject of considerable debate in Britain, as in a number of other countries. The Government considered the issue sufficiently important and complex to warrant the establishment of the first Royal Commission for many years.[1] In turn, the recommendations of the Royal Commission on Long Term Care have prompted renewed interest in the financing of long-term care.

Concern about the future affordability of long-term care has arisen for a number of reasons. An important factor is the projected continuing growth in the numbers of older people. The Government Actuary's Department (GAD) projects that the number of people in England aged 65 and over will rise from 7.8 million in 1996 to 12.4 million in 2031, an increase of 60 per cent.[2,3] The number of very elderly people (aged 85 and over) will rise even more rapidly, by 88 per cent, from 0.9 million in 1996 to 1.7 million in 2031.[2,3]

The financing of long-term care raises a great many questions. How many older people are likely to require long-term care services in the coming decades? How much are these services likely to cost? Will the cost to public funds prove affordable? Who should pay? How should costs be divided between public expenditure and private sources of finance? In order to address these issues, reliable projections of two key variables are needed. The first variable is the likely level of demand for long-term care services under different scenarios. The second is the costs associated with meeting expected demand for care and the distribution of these costs between different sources of funding.

How best to finance long-term care has been the subject of considerable recent debate. One reason is that the numbers of people in England aged 65 and over are projected to increase by 60 per cent over the next 35 years. The Personal Social Services Research Unit (PSSRU) has developed a model to make projections of demand for long-term care for older people, to 2031. This article outlines the methodology and results of the model. PSSRU projections suggest that, under central assumptions, long-term care expenditure will need to rise by around 150 per cent in real terms over the next 30 years to meet demand.

In order to consider these issues and to inform debate on the financing of long-term care, the Personal Social Services Research Unit (PSSRU) at the London School of Economics has developed a model to project long-term care demand and expenditure. The study is part of the PSSRU's long-run research programme funded by the Department of Health. Details of the first version of the model were published in 1998.[4] PSSRU have subsequently improved and updated the model.

The aims of this article are to describe the methodology used in the revised PSSRU model and to present some new projections. The methodology is of particular interest and importance because the model was used extensively by the Royal Commission on Long Term Care. The article describes the current version of the model which differs from earlier versions in two ways. First, the model's base year has been updated to 1996 and more recent data have been incorporated. In particular, the model now uses the GAD's 1998-based population projections and 1996-based marital status projections, as the basis for the projections of older people by gender, age band and marital status. Second, various detailed improvements in the design of the model have been made. The institutional population, for example, is now modelled as a subset of the population with severe dependency rather than as a separate dependency group. There has been considerable recent interest in projections of the future age distribution of the population[3] and the composition of households.[5,6] The PSSRU model allows, in addition, for projections to be made of demand for long-term care.

The article begins by describing the PSSRU model, its structure and the assumptions in making projections. This is followed by a description of results using the model in the form of projections, variants of the projections derived from using the most recent compared with earlier population and marital status projections, and sensitivity analysis around the projections. The section on the sensitivity analysis explores issues around the projections, including the past performance of population projections and trends in disability. The analysis pays particular attention to the effect of using different assumptions about life expectancy and dependency on demand for long-term care. Finally, the article discusses the results and draws some conclusions.

THE PSSRU LONG–TERM CARE MODEL

The PSSRU model is concerned with long-term care for older people. Long-term care includes help with domestic tasks, such as shopping and preparing meals, and assistance with personal care tasks, such as dressing and bathing. Most long-term care for older people living at home is currently provided by informal carers. As part of the research described in this article, an analysis of the 1994/5 General Household Survey data on people aged 65 and over showed that 80 per cent of older people, who had help with domestic tasks, relied exclusively on informal help (spouse, other household members, relatives outside the household, neighbours and friends), 10 per cent relied on both informal and formal help and only 10 per cent relied exclusively on formal services. Formal services are provided by a range of agencies including local authority social services, community health services and independent sector residential care, nursing homes and home care services. Long-term care services are financed by the National Health Service, local authorities and by older people themselves, from their incomes and assets.

The overall aim of the PSSRU model is to make projections of likely demand for long-term care for older people under different scenarios. More specifically, the aims are to make projections of three kinds. First, the model makes projections of the estimated numbers of older people with different levels of dependency by age group, gender, and household type. Second, it makes projections of the estimated levels of

long-term care services demanded. Third, projections of estimated expenditure on long-term care services by funding source are made.

The development of the model was informed by earlier models. The Institute of Actuaries made projections of the likely numbers of disabled people in Great Britain and of the costs of caring for them on varying assumptions.[7] London Economics and the Institute for Public Policy Research built on the Institute of Actuaries' model and made projections of future patterns of demand and supply of long-term care and associated costs.[8] The Department of Health also made broad projections of expenditure on long-term care in England on a range of assumptions.[9] The PSSRU model has also been informed by studies from the United States, in particular the Brookings-ICF Long-Term Care Financing Model.[10]

The PSSRU model represents an attempt to consider in more detail than previous British studies the relationship between factors affecting the need for care, such as dependency and household type, and the provision of long-term care services.

STRUCTURE OF THE PSSRU MODEL

The study has involved the development of a cell-based (or macro-simulation) model to make projections of the likely demand for long-term care for older people for England to the year 2031. A variant was developed for the Royal Commission on Long Term Care that made projections for the United Kingdom to 2051.[1]

The PSSRU model consists of four main parts. The first part divides the projected older population into sub-groups, or cells, by age, dependency, household type and housing tenure. The second part of the model focuses on the receipt of long-term care services, by attaching a probability of receiving health and social care to each cell. The last two parts of the model are concerned with long-term care expenditures and their breakdown between the NHS, social services and service users. The structure of the model is illustrated in Figure 1. An outline of each part of the model is given below, with further details in Box 3 at the end of the article.
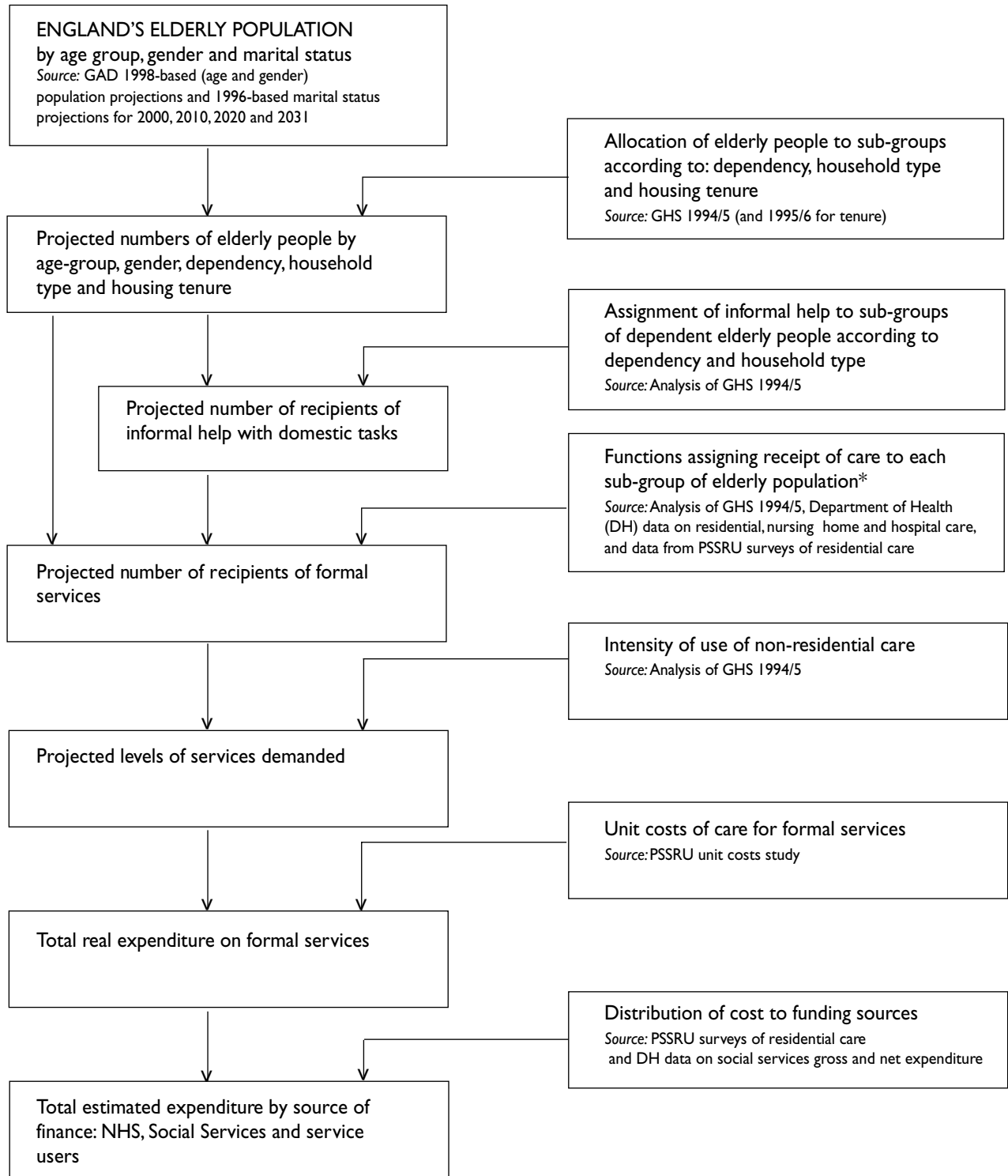
Projected numbers of older people

The first part of the model classifies the projected numbers of older people into cells, according to age bands, gender, dependency and other key characteristics. The model uses the GAD 1998-based population projections as the basis for the numbers of people by age band and gender in each year under consideration until 2031. The initial ten cells of the model contain the numbers of older people by five year age bands (65–69, 70–74, 75–79, 80–84 and 85 and over) by gender.

The projected older population by age band and gender are then separated into dependency groups. Dependency is a crucial factor in considering need for long-term care, as it is dependency rather than age which influences need for care. Studies by the Institute of Actuaries and by the Department of Health have shown that projections of long-term care expenditure are sensitive to assumptions about future rates of dependency among older people.[7,9] The model uses as a measure of dependency the ability to perform activities of daily living (ADLs) and instrumental activities of daily living (IADLs). These are frequently used in practice by local authorities to assess needs for residential care.[11] They are also used in the Brookings-ICF long-term care model for the USA.[10] Four dependency groups have been used in the model (Box One). Information from the 1994/5 General Household Survey (GHS) was used to break down the private household population into the four groups. The model does not take separate account of cognitive impairment (impaired intellectual functioning) as it is not covered in the GHS. This is currently the subject of further work at PSSRU.

Figure 1	Structure of the PSSRU Model

ENGLAND'S ELDERLY POPULATION
by age group, gender and marital status
Source: GAD 1998-based (age and gender)
population projections and 1996-based marital status
projections for 2000, 2010, 2020 and 2031

Allocation of elderly people to sub-groups
according to: dependency, household type
and housing tenure
Source: GHS 1994/5 (and 1995/6 for tenure)

Projected numbers of elderly people by
age-group, gender, dependency, household
type and housing tenure

Assignment of informal help to sub-groups
of dependent elderly people according to
dependency and household type
Source: Analysis of GHS 1994/5

Projected number of recipients of
informal help with domestic tasks

Functions assigning receipt of care to each
sub-group of elderly population*
Source: Analysis of GHS 1994/5, Department of Health
(DH) data on residential, nursing home and hospital care,
and data from PSSRU surveys of residential care

Projected number of recipients of formal
services

Intensity of use of non-residential care
Source: Analysis of GHS 1994/5

Projected levels of services demanded

Unit costs of care for formal services
Source: PSSRU unit costs study

Total real expenditure on formal services

Distribution of cost to funding sources
Source: PSSRU surveys of residential care
and DH data on social services gross and net expenditure

Total estimated expenditure by source of
finance: NHS, Social Services and service
users

* Functions assigning packages of care:
    Residential care is treated as a function of age group, gender and household type.
    Non-residential care is treated as a function of age group, dependency, household type, housing tenure and informal help with domestic tasks.

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Box one

DEPENDENCY GROUPS USED IN THE PSSRU MODEL

The four dependency groups used in the model are as follows:

1. People able to perform ADL (personal care) tasks and IADL (domestic care) tasks without difficulty.

2. People reporting difficulty with IADL but not ADL tasks.

3. People reporting difficulty with one ADL task.

4. People who live in the community and have difficulty with two or more ADL tasks, and people who are in institutional care (hospital, nursing home or residential care home).

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Another key factor in the receipt of long-term care is household type. Studies carried out using data from the 1980s suggested that household type was an important determinant of service receipt and that services, particularly community social services, were primarily provided to older people living alone.[12,13,14,15,16] More recent work has confirmed that household type remained an important determinant of service receipt in this country during the 1990s.[17] Household type is an important structural correlate of informal care, which is measured directly in the model, but household composition is also associated separately with receipt of formal services.[18] There are concerns about the impact of potential future changes in household type on demand for formal services. Concerns have been expressed about the rise in people living alone[6] and there may also be a continuing decline in the proportion of older people who live with their children or other relatives.[19,20,21]

The model breaks down the projected older population into four household types. These are as follows: people living alone; single, widowed or divorced people living with others; those living with their partner only; and those living with their partner and others. A breakdown by marital status was produced using the 1996-based GAD marital status projections.[22, 23] A further breakdown of the marital status groups into more detailed household types was achieved using data from the 1994/5 GHS. The resulting projected trend in the number of older people living alone (reported later in this paper) was similar to that in the household projections to 2021 produced by the Department of the Environment, Transport and the Regions (DETR).[5]

The model includes, for those living in private households, a simple breakdown by housing tenure, between those living in owner-occupied tenure and those living in rented accommodation. One reason for the inclusion of housing tenure is that it can be regarded as a simple proxy for socio-economic group. Another is that it is relevant, in the case of older people living alone, to the division between those who fund their own residential or nursing home care and those who are funded by their local authority or health authority. The current means test for public support in residential or nursing home care generally takes account of the value of the person's home (unless it is occupied by their spouse or an older or disabled relative). This means that older home-owners who live alone generally need to fund their residential or nursing home care privately, while older tenants and older home-owners living with their spouse are often eligible for public funding.

Projected amounts of services demanded

The second part of the model is concerned with projections of the volumes of services demanded. This is done by combining the output of the first part of the model (the projected numbers of older people by dependency, household type and other characteristics) with functions that assign packages of care to each sub-group of the older population. The services covered include a range of services relevant to meeting long-term care needs.

Informal care is included both because it is important in its own right and because it is a key determinant of receipt of formal services. Future trends in the availability of informal care are likely to have considerable implications for demand for formal care, as illustrated by London Economics.[8] The probability of receipt of informal help with domestic tasks by dependent older people was examined using multivariate (logistic regression) analysis of the 1994/5 GHS elderly data. It was found to be statistically significantly associated with dependency and household type but not with age, gender or housing tenure. Results of this analysis are discussed in more detail elsewhere.[18]

The model includes key formal non-residential social services, such as home care, day care and meals. It also includes key non-residential health services, such as day hospital care, community nursing and chiropody. Private domestic help is also included, though this should be treated with caution as it may not be related to care needs. The probability of receipt of each of these services was estimated through multivariate (logistic regression) analysis of 1994/5 GHS data.[24] The independent variables were age, dependency, household type, housing tenure, and receipt of informal help with domestic tasks.[13] Separate analyses were undertaken for dependent and non-dependent older people, as few non-dependent older people received services other than chiropody and private domestic help.

For those with no dependency, age band and household type were found to be significantly associated with receipt of each service, but not gender or housing tenure. (An exception was private domestic help, for which age band and housing tenure were significant). For those with dependency, age band, level of dependency, and household type were all found to be significantly associated with receipt of almost every service. Housing tenure was significant for home help, private domestic help and day care only. Receipt of informal help with domestic tasks was significant for home help and private domestic help only. Gender was not significantly associated, in multivariate analysis, with receipt of any service.

Demand for domiciliary services was calculated by using the fitted values from the logistic regression models as the estimated probabilities of receipt of each service by age band, dependency, household type and the other factors described above. These fitted values were then multiplied by the projected numbers of older people within each cell by age band and other needs-related circumstances to produce estimates of the numbers of service recipients. Finally, these estimates of numbers of service recipients were multiplied by estimates of the average intensity of service receipt, i.e. the average number of home help hours or district nursing visits per recipient week. Information on intensity of service receipt by dependency was also obtained from the 1994/5 GHS.

The model also includes residential, nursing home and long-stay hospital care. Use of institutional care for older people rose rapidly in this country during the 1980s and, while numbers may now have stabilised, institutional care continues to account for a substantial proportion of expenditure on long-term care.[21,25] The need for long-stay residential care may be related to a number of factors, including age, dependency and household type.[26] In the PSSRU model, the total numbers of people in institutional care were obtained from national

statistics[27] (Box 3). These were then broken down by gender, age band and whether or not the resident lived alone before admission (using data from the PSSRU sample survey of residents in autumn 1996[26] and analysis of data from Hospital Episode Statistics[27]). This approach enabled the proportion of older people in residential, nursing home and long-stay hospital care to be estimated by age band, gender and household type.

Projected aggregate expenditure on long-term care services

The third part of the model projects the total expenditure on the formal services demanded. It covers the costs to the health service, social services and users of services, for those services included in the model. However, **this does not comprise the total costs** of long-term care to society. That would require the inclusion of the costs of a wider range of services to a wider range of public agencies and to service users and the opportunity costs of informal care.

A key input is the unit costs of care, for which information has been drawn from a PSSRU study.[28] The other input is the projected levels of services demanded as estimated in the second part of the model. Estimated expenditure on home care and community nursing services in 1996 has been grossed up broadly to match Department of Health data.

Projected breakdown of expenditure between funders

The fourth part of the model breaks down projected aggregate expenditure by source of funding: NHS, social services and service users. The costs of the health services included – hospital, day hospital, and a small proportion of nursing home care, district nursing and chiropody – are assigned to the NHS. The costs of the social services included – residential and nursing home care, home care, day care and meals – are divided between personal social services and service users. The aim is to examine aggregate net costs to health and social services. The projection for private expenditure should be treated with caution, as there are no national data on the quantities of privately funded care and it is therefore not clear that all privately funded care is covered in the model.

The division of social care costs between the personal social services and users is based on two key sources. These are information from PSSRU surveys of residential and nursing home care on the proportion of clients who fund their own care,[26] and Department of Health data on the proportion of the gross costs of all social services met by user charges. The full costs of privately funded residential and nursing home care and private domestic care, and a proportion of the costs of all other social services, are thus assigned to users.

BASE CASE ASSUMPTIONS

The PSSRU model does not make *forecasts* about the future. Rather it makes *projections* on the basis of specific assumptions about future trends. The assumptions that have been used in the base case of the model are outlined below and summarised in Box 2. The base case attempts to approximate what may happen if no changes are made in the quality of long-term care services, the patterns of care provided for different needs and the system of funding long-term care. It aims to take account only of external pressures exogenous to policy. The base case should be treated as a starting point for examination of the assumptions used in the model, not as a prediction of the future. The base case is a point of comparison when these assumptions are subsequently varied in alternative scenarios.

Box two

KEY ASSUMPTIONS UNDER BASE CASE OF **PSSRU** MODEL

Numbers of older people
- Older population changes in line with GAD 1998-based population projections
- Age/gender specific rates of dependency remain unchanged.
- Marital status rates change in line with GAD 1996-based marital status and cohabitation projections.
- There is a constant ratio of single people living alone to single people living with others and of couples living alone to couples living with others.
- Housing tenure changes in line with Anchor Housing Trust projections.

Demand for services
- Proportion of older people receiving informal care with domestic tasks, formal community care services and residential and nursing home care remains constant for each sub-group by age, dependency, household type and other needs-related circumstances.

Expenditure
- Social care unit costs rise by 1 per cent per year and health care unit costs by 1.5 per cent per year in real terms.

Breakdown between funders
- Proportion of residents who are privately funded in care homes rises in line with projected increase in home-ownership among older people living alone.
- Proportion of gross costs of social services recovered in charges remains constant.
- Division of funding responsibilities between agencies is unchanged.

Assumptions about the numbers of older people

The base case assumes that the older population will change in line with the 1998-based GAD population projections. It assumes that age/gender specific rates of dependency remain unchanged. The marital status rates, which affect household type, are assumed to change in line with the GAD 1996-based marital status and cohabitation projections.[29] The household composition projections also assume that there is a constant ratio of single people living alone to single people living with others and of couples living alone to couples living with others. The base case assumes that housing tenure will change broadly in line with the Anchor Housing Trust projections.[30]

Assumptions about demand for services

The base case assumes that patterns of care remain unchanged. The projections assume that there is an unchanged relationship between receipt of informal help with domestic tasks and dependency and household composition. They also assume that rates of receiving formal community care services remain an unchanged function of age, dependency, household type, housing tenure and receipt of informal care. Finally they assume that the proportion of older people by age group, gender and household type (prior to admission) in each type of institution remains constant.

Assumptions about expenditure

Financial projections over a substantial period of time are highly sensitive to assumptions about changes in the real unit costs of services. These will be affected by changes in input prices, especially real wages in the caring sector, changing technical efficiency of service provision, any changes in client dependency, and any changes in the quality of services and expected outcomes. The study takes as a base case an assumption that social care costs will rise by 1 per cent per year and health care costs by 1.5 per cent per year in real terms. These reflect the extent to which health and social care input pay and prices have risen in real terms on average over the last 15 years.

## Assumptions about the breakdown of expenditure between funders

The base case assumes that the proportion of residents who are privately funded in residential care and nursing homes will rise in line with the increase in home-ownership among older people living alone. It assumes that the rate of recovery of gross costs of social care in user charges will remain constant. Finally it assumes that the division of funding responsibilities between agencies will not be changed.

RESULTS

Demographic characteristics of the older population.

The demographic pressure on long-term care is evident from the projections illustrated in Figure 2. There will be many more older people. The numbers aged 65 years and over in England are projected by GAD to grow from 7.8 million in 1996 to 12.4 million in 2031, an increase of 60 per cent. The numbers of very elderly people, who account for much of the need for long-term care among the older population, are projected to grow much faster. The numbers of people aged 85 and over are projected to grow by 88 per cent, from 0.9 million in 1996 to 1.7 million in 2031.

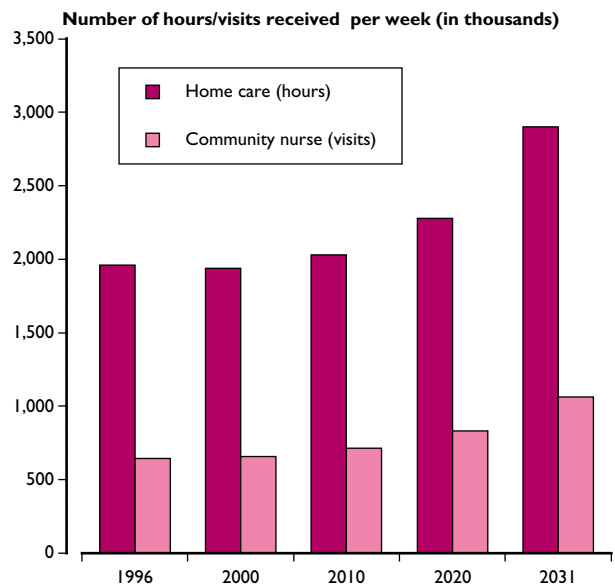**Figure 2** Projected numbers of older people by age group, England, 1996–2031

Numbers of older people (in thousands)

Legend: 65–69, 70–74, 75–79, 80–84, 85 and over
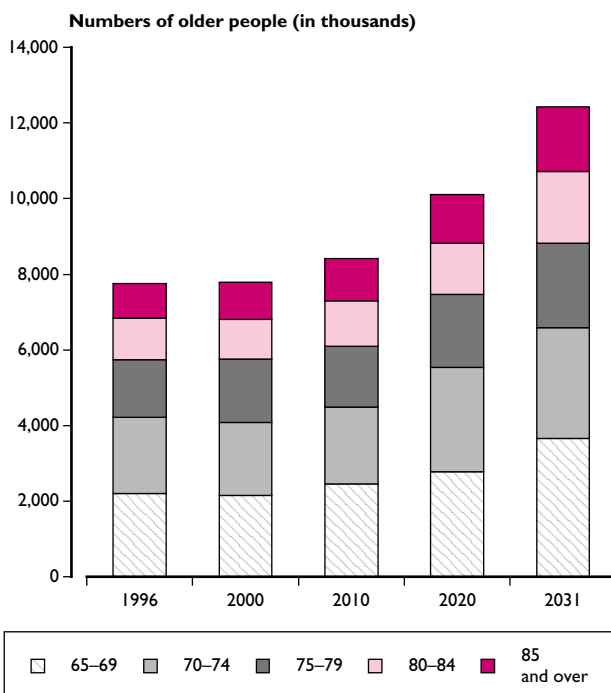
Source: ONS mid-1996 population estimates and GAD 1998 - based population projections.
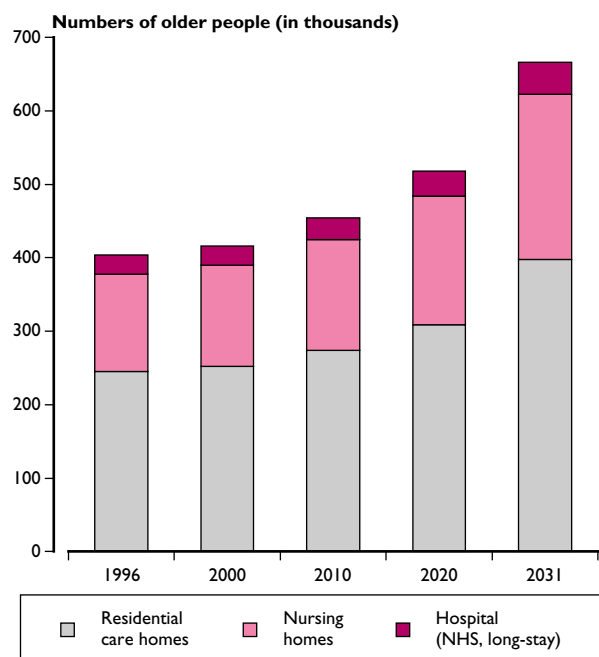
Use of long-term care

Long-term care services for older people need to expand to keep pace with demographic pressures. Residential places (in residential care establishments, nursing homes and hospitals) would need to expand from approximately 400,000 in 1996 to 450,000 in 2010 and 670,000 in 2031, an increase of around 65 per cent between 1996 and 2031. The number of home care hours would need to increase from just under 2 million per week in 1996 to over 2 million per week in 2010 and to approximately 2.9 million per week in 2031, an increase of around 48 per cent between 1996 and 2031 (Figures 3 and 4).

**Figure 3** Projected receipt of domiciliary services, England, 1996–2031

Number of hours/visits received per week (in thousands)

Legend: Home care (hours), Community nurse (visits)

Source: PSSRU model estimates.

Figure 4 Projected numbers of older people in institutional care, England, 1996–2031

Numbers of older people (in thousands)

Legend: Residential care homes, Nursing homes, Hospital (NHS, long-stay)

Source: PSSRU model estimates.

Expenditure on long-term care

Long-term care expenditure would need to rise by around 148 per cent in real terms between 1996 and 2031 to meet demographic pressures and allow for real rises in care costs (Figure 5). This would mean an overall increase in expenditure from around £9.8 billion in 1996 to £12.8 billion in 2010 and £24.3 billion in 2031. Although expenditure would increase nearly two and a half times by 2031, the economy is also forecast to expand. Assuming that gross domestic product (GDP) grows by 2.25 per cent per year,[31] long-term care expenditure would increase from about 1.6 per cent of GDP in 1996 to around 1.8 per cent of GDP in 2031.

Figure 5 **Projected expenditure by funding source, England, 1996–2031**

Source: PSSRU model estimates.
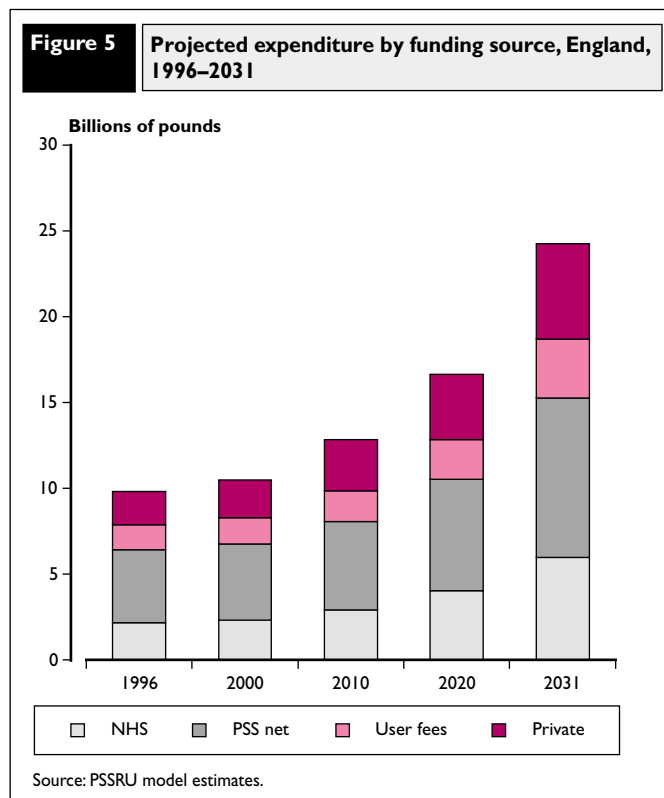
Division between funders

If no change is made to the way residential and nursing home care is funded, the model projects that public expenditure would fall slightly as a proportion of total expenditure over the next thirty years. The share of public expenditure is projected to fall from around 65 per cent of the total in 1996 to around 63 per cent in 2031(Figure 5). Nevertheless, it should be noted that public expenditure is still projected to increase by 138 per cent in real terms, from around £6.4 billion to around £15.3 billion between 1996 and 2031. The share of private expenditure is expected to rise from around 35 per cent of the total in 1996 to around 37 per cent in 2031, primarily because of the projected increase in home ownership. Private funding is projected to more than double, from £3.4 billion in 1996 to £9 billion in 2031, an increase of 166 per cent in real terms.

COMPARISON WITH PREVIOUS PROJECTIONS

An earlier version of the model produced somewhat different results. The initial version of the model, published in 1998,[4] had used the GAD's 1996-based population projections and 1992-based marital status projections. The current version of the model uses the GAD's 1998-based population projections and 1996-based marital status projections. The impact of using these two new sets of data on the projections can be considered separately using the model.

Comparison with 1996-based population projections

The main effect of using the 1998-based population projections is that they suggest that there will be more older people in 2031 than was suggested by the 1996-based projections, largely because of the higher life expectancy assumptions used in the later projections.[3,32] This particularly affects the older age groups. The 1996-based projections had suggested the numbers of people aged 85 and over would increase by 75 per cent between 1996 and 2031, but the 1998-based projections anticipate an increase of 88 per cent in this age group (Table 1).

The projected increase in the very elderly population has an impact on demand for long-term care, with marked increases in the projected numbers of very dependent older people and the projected numbers in institutional care (Table 1). The result is an increase in projected expenditure on long-term care. The revised population projections add nearly a billion pounds to the estimated cost of long-term care in 2031, compared with earlier population projections.

Comparison with 1992-based marital status projections

The 1996-based marital status projections anticipate that more older people will be married or cohabiting in future years than did the 1992-based projections.[22,23] As a result, as the DETR household projections show, the 1996-based figures anticipate that fewer older people will be living alone.[5,18] This reduces slightly projected demand for formal services (Table 2). In addition, the 1996-based figures produce lower projections for the numbers of older owner-occupiers living alone and this in turn affects the projected numbers of privately funded residents of care homes. The result is to reduce slightly the extent to which private funding is projected to increase as a percentage of overall expenditure.

Table 1 **1996-based and 1998-based population projections: effects on demand for long-term care, 1996, 2010 and 2031, England**

	1996	2010	2031	Percentage increase, 1996–2031
1996-based projections				
Numbers aged 65 and over	7,750	8,300	12,130	57
Numbers aged 85 and over	910	1,090	1,600	75
Numbers with dependency	2,500	2,690	3,920	57
Numbers with greatest dependency	790	850	1,240	58
Numbers of home care hours	1,960	1,990	2,800	43
Numbers in institutional care	400	440	640	59
Total expenditure (£ billion)	9.8	12.6	23.4	139
Total expenditure as a percentage of GDP	1.6	1.5	1.7	-
1998-based projections (base case)				
Numbers aged 65 and over	7,750	8,420	12,430	60
Numbers aged 85 and over	910	1130	1710	88
Numbers with dependency	2,500	2,740	4,050	62
Numbers with greatest dependency	790	870	1280	63
Numbers of home care hours	1,960	2,030	2,900	48
Numbers in institutional care	400	450	670	65
Total expenditure (£ billion)	9.8	12.8	24.3	148
Total expenditure as a percentage of GDP	1.6	1.5	1.8	-

Units of measurement:
Numbers of older people are measured in thousands.
Numbers with greatest dependency are defined as those with 2 or more ADLs.
Numbers of home care hours are measured in thousands. Expenditure is measured in billions of pounds (where one billion equals one thousand million). Projections of expenditure as a percentage of GDP assume that GDP grows at 2.25 per cent per year.[31]
Source: PSSRU model estimates.

| Table 2 | 1992-based and 1996-based marital status projections: effects on demand for long-term care, 1996, 2010 and 2031, England | | | |

	1996	2010	2031	Percentage increase 1996–2031
1992-based marital status projections				
Numbers of people aged 65 and over*	7,750	8,420	12,430	60
Numbers of single people aged 65 and over	3,690	3,950	6,340	72
Numbers of single people aged 65 and over living alone	2,980	3,180	5,120	72
Numbers of single home owners aged 65 and over living alone	1,440	1,880	3,260	127
Numbers of home care hours	1,960	2,040	3,050	56
Numbers in institutions	400	450	680	68
Private expenditure (£ billion)	3.4	4.8	9.4	178
Public expenditure (£ billion)	6.4	8.1	15.3	138
Total expenditure (£ billion)	9.8	12.9	24.7	152
Private expenditure as a percentage of total expenditure	35	37	38	-
Total expenditure as a percentage of GDP	1.6	1.5	1.8	-
1996-based marital status projections (base case)				
Numbers of people aged 65 and over*	7,750	8,420	12,430	60
Numbers of single people aged 65 and over	3,690	3,830	5,560	51
Numbers of single people aged 65 and over living alone	2,980	3,090	4,480	51
Numbers of single home owners aged 65 and over living alone	1,440	1,820	2,840	98
Numbers of home care hours	1,960	2,030	2,900	48
Numbers in institutions	400	450	670	65
Private expenditure (£ billion)	3.4	4.8	9.0	166
Public expenditure (£ billion)	6.4	8.1	15.3	138
Total expenditure (£ billion)	9.8	12.8	24.3	148
Private expenditure as a percentage of total expenditure	35	37	37	-
Total expenditure as a percentage of GDP	1.6	1.5	1.8	-

* 1998-based population projections by age and gender.
Units of measurement:
Numbers of older people are measured in thousands.
Numbers of home care hours are measured in thousands.
Expenditure is measured in billions of pounds (where one billion equals one thousand million).
Projections of expenditure as a percentage of GDP assume that GDP grows at 2.25 per cent per year.[31]
Source: PSSRU model estimates.

SENSITIVITY ANALYSIS

The model can show how sensitive the results are by using alternative assumptions. The key assumptions regarding long-term care financing concern the numbers of older people, the proportion of the older population with dependency needs, household composition and future real rises in care costs. Each set of assumptions is considered separately here and the results of the sensitivity analysis are shown in Tables 3 to 6.

Sensitivity to numbers of older people

Projections of the numbers of older people depend particularly on past fertility and on assumptions about future mortality rates. The numbers of older people are expected to continue to rise partly because of the baby booms of the late 1940s (post Second World War) and early 1960s and partly because of recent and expected future reductions in mortality rates. Mortality change is becoming an increasingly important determinant of population ageing in low-mortality societies, yet there is inevitably some uncertainty about future mortality rates and hence future life expectancy.[33] Official population projections have tended to underestimate the growth in the numbers of very elderly people, especially those aged 85 years and over.[34] As already indicated, the 1998-based GAD projections, which the model now uses, suggest that

the numbers of very elderly people will grow faster than was suggested by earlier GAD projections.

To assess the effects of further increases in the numbers of older people, three different scenarios were simulated (Table 3). In the first of these, a scenario was simulated in which the numbers of people aged 85 years and over rises by 1 per cent per year faster than the GAD 1998-based principal projection. This scenario was chosen because it corresponds roughly to the extent of past under-estimation of the numbers of very elderly people.[34] The remaining scenarios are based on variants to the 1998-based principal population projections produced by GAD.[35] The principal population projection, which is used in the base case of the PSSRU model, assumes that mortality rates will fall by 0.5 per cent a year by 2032. However, GAD has also produced high and low life expectancy variants. The high life expectancy variant assumes that mortality rates will fall by 1 per cent per year by 2032, while the low life expectancy variant assumes that mortality rates will be constant by 2032.[36]

Under the first scenario, in which the numbers of very elderly people rise by 1 per cent per year faster than the 1998-based GAD principal

| Table 3 | Projections under different assumptions about the numbers of older people, 1996, 2010 and 2031, England | | | |

	1996	2010	2031	Percentage increase, 1996–2031
GAD principal population projection: mortality rates falling by 0.5 per cent per year (base case)				
Numbers aged 65 and over	7,750	8,420	12,430	60
Numbers aged 85 and over	910	1,130	1,710	88
Numbers with dependency	2,500	2,740	4,050	62
Numbers of home care hours	1,960	2,030	2,900	48
Numbers in institutions	400	450	670	65
Total expenditure (£ billion)	9.8	12.8	24.3	148
Total expenditure as a percentage of GDP	1.6	1.5	1.8	-
1 per cent per year additional growth in people aged 85 and over GAD principal projection				
Numbers aged 65 and over	7,750	8,590	13,150	70
Numbers aged 85 and over	910	1,300	2,430	166
Numbers with dependency	2,500	2,860	4,540	82
Numbers of home care hours	1,960	2,140	3,320	69
Numbers in institutions	400	490	810	102
Total expenditure (£ billion)	9.8	13.7	28.6	192
Total expenditure as a percentage of GDP	1.6	1.6	2.1	-
High life expectancy variant: mortality rates falling by 1 per cent per year				
Numbers aged 65 and over	7,750	8,500	12,840	66
Numbers aged 85 and over	910	1,160	1,890	108
Numbers with dependency	2,500	2,780	4,240	70
Numbers of home care hours	1,960	2,060	3,050	56
Numbers in institutions	400	460	710	76
Total expenditure (£ billion)	9.8	13.1	25.7	162
Total expenditure as a percentage of GDP	1.6	1.5	1.9	-
Low life expectancy variant: constant mortality rates				
Numbers aged 65 and over	7,750	8,330	12,000	55
Numbers aged 85 and over	910	1,090	1,540	69
Numbers with dependency	2,500	2,700	3,850	54
Numbers of home care hours	1,960	2,000	2,750	40
Numbers in institutions	400	440	620	54
Total expenditure (£ billion)	9.8	12.6	22.9	133
Total expenditure as a percentage of GDP	1.6	1.5	1.7	-

Units of measurement:
Numbers of older people are measured in thousands.
Numbers of home care hours are measured in thousands.
Expenditure is measured in billions of pounds (where one billion equals one thousand million).
Projections of expenditure as a percentage of GDP assume that GDP grows at 2.25 per cent per year.[31]
Source: PSSRU model estimates.

projection, the numbers aged 85 and over would increase by 166 per cent between 1996 and 2031, compared to 88 per cent under the base case (Table 3). Because of the accelerated increase in the numbers of very elderly people, the numbers of dependent older people would also rise faster than in the base case. They would rise by 82 per cent, compared to 62 per cent under the base case. Expenditure on long-term care would rise to £28.6 billion in 2031 rather than £24.3 billion under the base case. Under the high life expectancy variant, the numbers of dependent older people would increase by 70 per cent between 1996 and 2031 and expenditure would rise to £25.7 billion in 2031. Under the low life expectancy variant, the numbers of dependent older people would increase by 54 per cent between 1996 and 2031 and expenditure would rise to £22.9 billion in 2031. The differences in the projected increases in expenditure are not as large as might be expected, primarily because of the effect of the assumption about real rises in unit care costs. Overall, however, the differences between the scenarios indicate that the projections are sensitive to increases in the projected numbers of elderly, particularly very elderly, people.

Sensitivity to future dependency rates

A key variable in determining the future demand for and cost of long-term care services is the health of older people. There is considerable debate as to whether 'future generations will live longer but more disabled lives or increasingly healthy lives', as Wiener et al succinctly put it.[10,37,38] A pessimistic view is that there will be an expansion of morbidity and that the projected continued increase in life expectancy will be associated with an increase in the average number of years with disability. An optimistic view is that there will be a compression of morbidity and that the expansion of life expectancy will be associated with no increase, or even a contraction, in the average number of years with disability.

Analyses of past trends could be used to support either argument. A recent analysis found that, although both life expectancy and healthy life expectancy increased in Britain between 1981 and 1995, healthy life expectancy did not increase by as much as life expectancy, with the result that both men and women are living more years in poor health or with a limiting long-standing illness.[39] These conclusions were confirmed by a cohort analysis of some of the same health survey data.[6] An earlier analysis of healthy life expectancy in England and Wales found that there had been no improvement in expectation of life without self-reported limiting long-standing illness, that is, without mild to moderate disability.[40] However, it also found that expectation of life with independence in performing activities of daily living, that is, without severe disability, had increased in line with life expectancy. This suggests that years of severe disability requiring long-term care may not be increasing. It is a finding consistent with evidence from other countries.[37] A recent analysis of trends in disability in the United States, where longitudinal data are available, found evidence of a decline in the prevalence of disability for people aged 65 and over between 1982 and 1994.[41]

Past trends may or may not prove a reliable guide to future trends. Much may depend on the future management of disabling conditions as well as their future incidence. To assess the effects of varying dependency rates on long-term care, three different scenarios were simulated (Table 4). The first is a pessimistic scenario in which age-specific dependency rates rise by 1 per cent per year. The second is an optimistic scenario in which age-specific dependency rates fall by 1 per cent per year. The third is another optimistic scenario in which, as life expectancy rises, years without dependency rise by the same amount, while years with dependency remain constant. In this scenario, elderly disability rates decline so that, for each age group, the rate of dependency in 2031 is the same as the dependency rate for people five years younger in 1998. For example, a person aged 70 in 2031 would

have the same chance of being dependent as a 65-year-old in 1998. This scenario is based on a similar scenario developed by Wiener et al. at the Brookings Institution[10] and is referred to here as the 'Brookings' scenario.[42] These three scenarios are compared to the base case, which assumes that age/gender specific dependency rates remain unchanged.

Under the pessimistic scenario, in which dependency rates rise by 1 per cent a year, the numbers of dependent people are projected to increase by 125 per cent by 2031, compared with 62 per cent under the base case (Table 4). In contrast, under the optimistic scenario, in which dependency rates fall by 1 per cent a year, the numbers of dependent people would increase by only 14 per cent by 2031. Under the Brookings scenario, in which people live less disabled lives, the numbers of dependent people also increase by only 14 per cent by 2031. The projected numbers of people with dependency under the Brookings scenario are similar to the numbers projected when dependency rates are assumed to decrease by 1 per cent a year.

Projected expenditure follows a similar pattern. Under the pessimistic scenario, with dependency rates rising by 1 per cent a year, long-term care expenditure would need to increase by 222 per cent by 2031. Under the optimistic scenario, with dependency rates falling by 1 per cent a year, long-term care expenditure would need to increase by only 84 per cent between 1996 and 2031. Under the Brookings scenario, the low disability scenario, long-term care expenditure would need to increase by only 73 per cent by 2031. These three scenarios can be compared to the base case, which assumes constant age-specific dependency rates, resulting in an increase of 148 per cent in

Table 4	Projections under different assumptions about future dependency rates, 1996, 2010 and 2031, England

	1996	2010	2031	Percentage increase, 1996–2031
Base case (constant age/gender specific dependency rates)				
Numbers with dependency	2,500	2,740	4,050	62
Numbers of home care hours	1,960	2,030	2,900	48
Numbers in institutions	400	450	670	65
Total expenditure (£ billion)	9.8	12.8	24.3	148
Total expenditure as a percentage of GDP	1.6	1.5	1.8	-
Pessimistic scenario (1 per cent increase in dependency rates)				
Numbers with dependency	2,500	3,150	5,620	125
Numbers of home care hours	1,960	2,250	3,720	90
Numbers in institutions	400	520	890	119
Total expenditure (£ billion)	9.8	14.5	31.5	222
Total expenditure as a percentage of GDP	1.6	1.7	2.3	-
Optimistic scenario (1 per cent decrease in dependency rates)				
Numbers with dependency	2,500	2,380	2,850	14
Numbers of home care hours	1,960	1,830	2,260	15
Numbers in institutions	400	390	470	16
Total expenditure (£ billion)	9.8	11.4	18.0	84
Total expenditure as a pereentage of GDP	1.6	1.3	1.3	-
Brookings scenario (low disability scenario)				
Numbers with dependency	2,500	2,410	2,850	14
Numbers of home care hours	1,960	1,850	2,270	16
Numbers in institutions	400	380	410	3
Total expenditure (£ billion)	9.8	11.3	16.9	73
Total expenditure as a percentage of GDP	1.6	1.3	1.2	-

Units of measurement:
Numbers of older people are measured in thousands.
Numbers of home care hours are measured in thousands.
Expenditure is measured in billions of pounds (where one billion equals one thousand million).
Projections of expenditure as a percentage of GDP assume that GDP grows at 2.25 per cent per year.[31]
Source: PSSRU model estimates.

expenditure on long-term care between 1996 and 2031. Long-term care expenditure would represent 2.3 per cent of GDP in 2031 under the pessimistic scenario compared with 1.3 per cent under the optimistic scenario and 1.2 per cent under the Brookings scenario, the figure for the base case being 1.8 per cent. These results confirm the findings of other studies that projections of long-term care are highly sensitive to assumptions about future rates of dependency among older people.

Sensitivity to changes in household composition

People living alone are more likely than those living with others with similar levels of dependency to receive residential care or home care.[17,26] Household type is closely related to the availability of intensive informal care for older people, much of which is provided by spouses or children. The model takes into account the projected availability of care from spouses through the use of the GAD marital status projections. It does not, however, take similar account of potential changes in the availability of care from children.[18] A trend that could affect the availability of care from co-resident children is explored in the scenario below.

The numbers of older people living alone in the future would be increased if there was continuation in the decline of co-residence of older people with their adult children. The proportion of older people who live with their children has declined rapidly in the recent past, falling from 42 per cent in 1962 to 14 per cent in 1986, with a further decline during the late 1980s.[19,21] It therefore seems plausible to anticipate a further decline in the proportion of older people living with others.

A scenario was simulated in which the number of co-resident older people was projected to fall by allowing for a decline in the proportion of single older people living with others. The projected older population in the model was, as described in Box 3, divided into four household types: living alone; single living with others; married/cohabiting living with partner only; married/cohabiting living with partner and others. The base case of the model holds constant the proportion of single older people who are projected to live alone. A scenario was tested in which the proportion of single older people living with others was assumed to halve, from around 20 per cent currently to around 10 per cent in 2031.

A similar scenario, which explored a decline in households formed by single dependent older people moving in with their children, was included in Pickard *et al*.[18]

The results of the projections under this scenario are that the numbers of people projected to live alone in 2031 (Table 5) would increase considerably. They would increase by 69 per cent between 1996 and 2031, compared to 51 per cent under the base case. There would be approximately half a million more older people living alone in 2031 under this scenario than under the base case. Yet, overall expenditure would increase by only 154 per cent under this scenario, compared to 148 per cent under the base case. This suggests that projections of long-term care expenditure in England are not particularly sensitive to even quite significant changes in household composition.

Sensitivity to rises in care costs

Expenditure projections over an extended period are inevitably sensitive to assumptions about real rises in the unit costs of care, such as the cost of an hour's home care or a community nurse visit. Yet, there is inevitable uncertainty about future rises in the unit costs of care. As long-term care services are labour-intensive, a key factor is future rises in the real wages of care staff. If demographic trends lead to a shortage of care staff, real wages in this sector may rise considerably. Another important factor is future changes in the technical efficiency of service provision. This could potentially offset part of the upward pressure from real wage increases.[18]

As Table 6 shows, if care costs remained constant in real terms, projected expenditure in 2031 would be only 61 per cent higher than in 1996, as against 148 per cent higher under the base case, which assumes increases in real terms of 1 per cent per year for social care and 1.5 per cent for health care. If, however, care costs increased by 1 per cent per year faster than under the base case assumption, projected expenditure in 2031 would be 249 per cent higher than in 1996. Long-term care expenditure would represent 1.2 per cent of GDP in 2031 with constant unit costs, 1.8 per cent of GDP under the base case assumption and 2.5 per cent of GDP with unit costs rising 1 per cent per year faster than under the base case. This suggests that expenditure projections are arguably even more sensitive to assumptions about rises in real care costs than to assumptions about future mortality and dependency rates.

Table 5	**Projections under different assumption about household composition, 1996, 2010 and 2031, England**

	1996	2010	2031	Percentage increase, 1996–2031
Base case (proportion of single people who live with others remains constant)				
Numbers living alone	2,980	3,090	4,480	51
Numbers of home care hours	1,960	2,030	2,900	48
Numbers in institutions	400	450	670	65
Total expenditure (£ billion)	9.8	12.8	24.3	148
Total expenditure as a percentage of GDP	1.6	1.5	1.8	-
Proportion of single people who live with others halves by 2031				
Numbers living alone	2,980	3,160	5,020	69
Number of home care hours	1,960	2,050	3,060	56
Numbers in institutions	400	460	690	70
Total expenditure (£ billion)	9.8	12.9	24.9	154
Total expenditure as a percentage of GDP	1.6	1.5	1.8	-

Units of measurement:
Numbers of older people are measured in thousands.
Numbers of home care hours are measured in thousands.
Expenditure is measured in billions of pounds (where one billion equals one thousand million).
Projections of expenditure as a perecentage of GDP assume that GDP grows at 2.25 per cent per year.[31]
Source: PSSRU model estimates.

Table 6	**Projections under different assumptions about changes in unit costs of care, 1996, 2010 and 2031, England**

	1996	2010	2031	Percentage increase, 1996–2031
Base case (rises of 1 per cent per annum for social care, 1.5 per cent per annum for health care)				
Total expenditure (£ billion)	9.8	12.8	24.3	148
Total expenditure as a percentage of GDP	1.6	1.5	1.8	-
No real rises in unit costs of care				
Total expenditure (£ billion)	9.8	10.8	15.7	61
Total expenditure as a percentage of GDP	1.6	1.3	1.2	-
Unit costs rise 1 per cent per annum more than under base case				
Total expenditure (£ billion)	9.8	14.7	34.2	249
Total expenditure as a percentage of GDP	1.6	1.7	2.5	-

Units of measurement:
Expenditure is measured in billions of pounds (where one billion equals one thousand million).
Projections of expenditure as a percentage of GDP assume that GDP grows at 2.25 per cent per year.[31]
Source: PSSRU model estimates.

CONCLUSION

The results of the sensitivity analysis using the PSSRU model show that future demand for long-term care services is sensitive to the projected numbers of older people and future dependency rates. They also show that future long-term care expenditure is highly sensitive to assumed real rises in the unit costs of care. These findings, which are consistent with those of earlier studies,[7,9,10] are summarised in Figure 6.

The dependency scenarios considered produced a wider range for projected long-term care expenditure than the life expectancy scenarios examined here. This suggests that projected demand for long-term care may be more sensitive to assumptions about dependency rates than mortality rates, although this is at least partly a function of the range of assumptions tested.[36] It can be shown that GAD's high life expectancy variant would, if combined with a small decline in age/gender specific dependency rates,[43] produce projections for services and expenditure that are similar to the principal population projections combined with unchanged dependency rates. The implication is that, if the projected extra years of life are years of good health, this could more than compensate for quite substantial increases in the numbers of elderly people above the GAD principal projection.

The importance of the results of the sensitivity analysis lies in the fact that it is beyond the present state of knowledge to set probabilities for future trends in the factors examined here. Yet it is important for policy and planning purposes to demonstrate the extent of sensitivity of future long-term care expenditures to assumptions about these trends. The findings suggest that policy-makers need to plan for uncertainty in future demand for long-term care. Future mortality and dependency rates and rises in care costs, which are inevitably uncertain, could have substantial implications for demand for long-term care. This means that consideration of any changes to the system for funding long-term care needs to take account of the extent of uncertainty about the future public expenditures that could arise.

It should be stressed that no allowance has been made here for changes in public expectations about the quality, range or level of care. The

projections presented here assume an unchanged relationship between age, gender, dependency, household type and housing tenure and receipt of care. Rising expectations, associated with rising real pensioner incomes, could clearly have a substantial impact on future demand for long-term care. Indeed, they could have a larger impact than demographic changes.

In addition, the projections presented here assume unchanged policies on the organisation and funding of long-term care and unchanged patterns of care. In practice, patterns of care may change as the result of changing public policies and/or changing private preferences of older people and their carers. Changes in care technologies may also impact on patterns of care, especially if they alter the relative cost and cost-effectiveness of caring for older people in different care settings.

Box three

THE PSSRU LONG-TERM CARE FINANCING MODEL

DEFINITIONS OF KEY VARIABLES AND FURTHER DETAILS OF DATA SOURCES

Dependency. Dependency has been defined in terms of ability to perform five activities of daily living or ADLs (bathing, dressing, feeding, washing, and getting to and from the toilet) and five instrumental activities of daily living or IADLs (shopping, laundry, vacuuming, cooking a main meal and handling personal affairs). Those who could not perform a task at all, could perform it only with help or could perform it but with difficulty were included in the definition of those with dependency.

Household type. The classification of household type has four categories: those living alone; single, widowed or divorced people living with others; those living with their partner only; and those living with their partner and others. The 1996-based marital status projections, which are used in the model, include projections by both legal and de facto marital status.[22,23,29]

Housing tenure. The Anchor Housing Trust projections, used in the model, are projections of the numbers of older people expected to own their own homes.[30] The trends in owner-occupation implied in its analyses suggest an increase in the proportion of older people in owner-occupier households from around 63 per cent in 1994/5 to around 75 per cent in 2010.

Informal care. The measure of informal care includes only help with domestic tasks and not help with personal care tasks. Information on help with personal care tasks was not available in the GHS on a similar basis.[18] However, the inclusion of *household type* in the model also acts as an indicator of informal help.

Institutional care. Three types of institutional care – residential care, nursing home care and long-stay hospital care (defined as stays exceeding 55 days) – have been included. Information on numbers of older people in residential care and nursing homes in March 1996 was obtained from the Department of Health.[27] Information on numbers of older people in hospital for over 55 days as at 31 March 1996 was obtained from the Hospital Episode Statistics for 1995/6.

Figure 6	Projected total expenditure on long-term care as a percentage of GDP, under different scenarios, England, 1996 and 2031
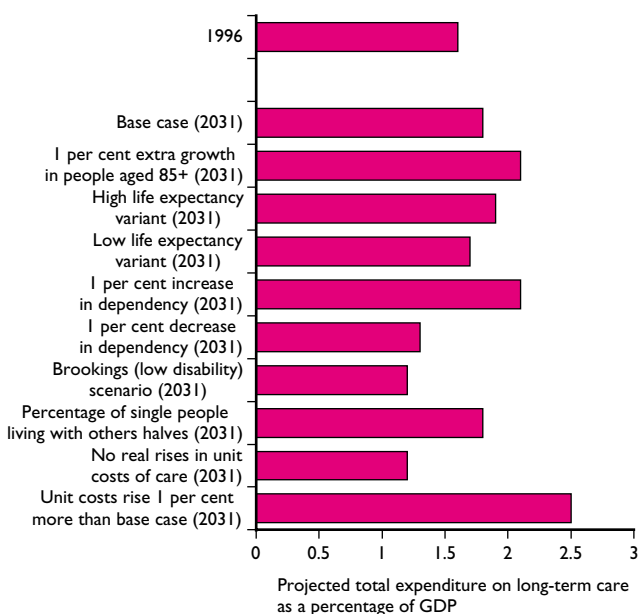
Projected total expenditure on long-term care as a percentage of GDP

Projections of expenditure as a percentage of GDP assume that GDP grows at 2.25 per cent per year.[31] For definitions of scenarios see text.
Source: PSSRU model estimates.

If current policies remain unchanged, an increasing share of expenditure on long-term care would fall to private individuals, although public expenditure would still need to more than double by 2031. Current policies, particularly with regard to the division of responsibility between private individuals and public expenditure, are subject to intense debate. Indeed, this was one of the main issues addressed in the report of the Royal Commission on Long Term Care.[1] The recommendations of the Commission implied a significant redistribution of funding from private to public expenditure.

The Government's response to the Royal Commission implied a more limited measure of redistribution between private and public funding in England than had been recommended by the Commission.[44] The Government decided that nursing care should be free in all settings including nursing homes but that personal care should remain subject to means test. The Government also announced detailed changes to the means test, in particular that housing assets should be disregarded for the first three months of residential care. The precise implications of these changes for the balance of funding between sectors will depend on the details of their implementation and remain to be assessed.

ACKNOWLEDGEMENTS

Key findings

- To keep pace with demographic pressures over the next thirty years, residential and nursing home places would need to expand by around 65 per cent and numbers of hours of home care by around 48 per cent, assuming unchanged dependency rates.
- Long-term care expenditure would need to rise by around 148 per cent in real terms between 1996 and 2031 to meet demographic pressures and allow for real rises in care costs of 1 per cent per year for social care and 1.5 per cent per year for health care.
- The GAD's 1998-based population projections add around a billion pounds to projected expenditure on long-term care in 2031, compared with 1996-based projections. This is largely because the later projections anticipate more elderly people in future years, especially in the older age groups.
- These projections are highly sensitive to the projected growth in the numbers of older people and to future dependency rates, but are less sensitive to future household composition.
- The GAD variant population projections have rather different implications for future demand for long-term care from the principal population projections.
- Rising or falling age and gender specific dependency rates have markedly different implications for future demand for long-term care from unchanged dependency rates.
- The expenditure projections are highly sensitive to assumed future real rises in care costs, as well as to projected numbers of older people and future dependency rates.

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35. GAD produced the variants for the whole of the United Kingdom. As the model only covers England, the GAD variants were adapted by applying to the projected population in England the ratio of the number of people projected by the UK variants to that for the UK principal projection.

36. It should be noted that the assumptions underlying the GAD high and low variants produce a range in life expectancy at birth which is somewhat narrow compared with variants produced by other organisations (Personal correspondence with GAD).

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42. Between 1998 and 2031, life expectancy for people in England and Wales is projected to increase by 4.3 years for men, and 3.6 years for women under the GAD's principal projection. Because the PSSRU model is based on 5-year bands it would be difficult to move the age-specific dependency rates by less than 5 years at a time.

43. The decline in age/gender specific dependency rates on which this statement is based is 0.2 per cent per year between 1996 and 2031.

44. Department of Health. *The NHS Plan. The Government's response to the Royal Commission on Long Term Care*. Cm 4818-II. TSO (London: 2000). In Scotland, proposals for long-term care are currently being considered by the Care Development Group, established in January 2001.