FUTURE DEMAND FOR LONG-TERM CARE, 2002 TO 2041: PROJECTIONS OF DEMAND FOR LONG-TERM CARE FOR OLDER PEOPLE IN ENGLAND

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March 2006

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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 are needed of future demand for long-term care and future long-term care expenditure.

This paper presents projections of demand for long-term care for older people in England to 2041 and associated future expenditure. The projections were produced using an updated and expanded version of the Personal Social Services Research Unit's (PSSRU) long-term care projections model. The version of the model used here has a base year of 2002 and incorporates the 2004-based official population projections.

The first part of the paper describes the PSSRU long-term care finance research programme and recent associated projects. The second part of the paper describes the updated and expanded PSSRU long-term care projections model, including details of the data used in this updated version. The third part presents a set of base case assumptions and the projections obtained using those assumptions. The fourth part investigates the sensitivity of the projections to changes in those assumptions. Section five discusses the findings. A final section sets out some conclusions.

1. The PSSRU study of long-term care finance

The PSSRU long-term care projections model was constructed as part of a project on long-term care finance, which is funded by the Department of Health. The project is concerned with two related policy issues on the funding of long-term care for older people. The first is whether expenditure, and specifically public expenditure, on long-term care will remain sustainable over the coming decades, despite demographic pressures and potentially rising expectations. The second is what should be the balance between public and private expenditure on long-term care.

A detailed account of the long-term care projections model and of the data and assumptions used can be found in Wittenberg et al (1998), a report that describes the first version of the model. The model has been regularly updated and expanded. A paper exploring sensitivity of an updated version of the model to various assumptions was published in Health Statistics Quarterly in 2001 (Wittenberg et al, 2001). Further updated projections can be found in Comas-Herrera et al (2003a) and Wittenberg et al (2004).

An important strand of work for the project has been how to model the supply of informal care and the relationship between informal care and formal services. The study has investigated in some detail the impact of changes in the availability of

informal care on projected future demand for services (Pickard et al, 2000, forthcoming).

The initial model was used to provide projections for the Royal Commission on Long-Term Care (1999). Revised versions of the model have been used to provide projections for the HM Treasury Health Trends Review (Wanless, 2002) and for the Institute of Public Policy Research (Wittenberg et al, 2002 and Hancock et al, 2003). The latter involved innovative linkage between the PSSRU model and a microsimulation model developed by the Nuffield Community Care Studies Unit (NCCSU) at the University of Leicester.

A version of the model that investigates future long-term care costs of cognitive impairment, using MRC CFAS data (MRC CFAS, 1998), has been developed with funding from the Alzheimer's Research Trust (Comas-Herrera et al, 2003b). This enabled separate projections to be made of services for older people with cognitive impairment under a range of assumptions about future prevalence rates of cognitive impairment.

The European Commission financed a comparative study of future long-term care expenditure in Germany, Spain, Italy and the UK (Comas-Herrera and Wittenberg, 2003; Comas-Herrera et al, 2006). This study involved the development of a number of scenarios for possible changes in patterns of care that were investigated across the four countries. They included changes in the balance between informal care and formal services and changes in the availability of formal home-based services (Pickard et al, 2006).

The National Assembly for Wales commissioned a version of the model that makes projections of future demand for long-term care in Wales (Comas-Herrera et al, 2003c and 2005). Projections of future demand for residential care in Wales were produced to match those produced for a Department of Health study of residential care supply in England (Comas-Herrera et al, 2001). Projections have also been prepared for individual local authorities in England and for all local authorities in Wales.

These projects, in particular the international study, have had a substantial influence on the core model. It has recently been expanded to be able to make projections under a wider range of future scenarios, especially on patterns of care.

2. Description of the PSSRU long-term care projections model

The PSSRU long-term care projections model aims to make projections of four key variables: the future numbers of disabled older people, the likely level of demand for long-term care services and disability benefits for older people, the costs associated with meeting this demand and the social care workforce required.

The model does not make forecasts about the future. It makes projections on the basis of specific assumptions about future trends. The approach involves simulating the impact on demand of specified changes in demand drivers, such as demographic pressures, or specified changes in policy, such as the introduction of free personal care. It does not involve forecasting future policies or future patterns of care.

The model is updated regularly as new data become available, in particular new versions of the General Household Survey, population projections, data on numbers of older people in care homes and on numbers of users of home care services and estimates of the unit costs of care. The version of the model that has been used to make the projections in this paper utilises data from the 2001/2 General Household Survey, 2004-based population projections, March 2003 data on residential care and home-based care and unit costs adjusted to 2002 prices.

The model is cell-based (a macro-simulation model) and takes the form of a spreadsheet. It consists of five main parts. The first part estimates the numbers of older people with different levels of disability by age group, gender, household type and housing tenure. The second part estimates the levels of long-term care services required, by attaching a probability of receiving health and social care services to each cell, and disability benefits. The third part of the model estimates total health and social services expenditure, and, in the fourth part, total expenditure is allocated to the various sources of funding. Finally, a fifth part relates to the social care workforce.

Projected numbers of older people

The first part of the model divides the older population according to a number of characteristics relevant to the use of services, such as the level of functional disability (measured in terms of activities of daily living), marital status, whether living alone, with a partner or children, housing tenure, and receipt of informal care by spouses, children or others. The model uses the Government Actuary's Department (GAD, 2005) 2004-based population projections as the basis for the numbers of people by age band and gender in each year under consideration until 2041.

The projected older population by age band and gender are separated into disability groups. Disability is a crucial factor in considering need for long-term care, as it is disability rather than age which influences need for care. Various studies have shown that projections of long-term care expenditure are sensitive to assumptions about future rates of disability among older people (Nuttall et al, 1994; House of Commons Health Committee, 1996; Wittenberg et al, 2001; Lagergren and Batljan, 2000; Rothgang et al, 2003; Karlsson et al, 2005). The model uses as a measure of disability the ability to perform activities of daily living (ADLs) and instrumental activities of daily living (IADLs). The section on disability in the projections model has recently been updated and expanded, using data from the 2001/2 General Household Survey (GHS). It now includes six categories of functional disability (box 1), ranging from no disability to inability to perform two or more activities of daily living (ADL) without help.

> **Box 1: Disability groups used in the PSSRU model**
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> The six disability groups used in the model are as follows:
> 1. People able to perform ADL (personal care) tasks and IADL (domestic care) tasks without difficulty or need for help.
> 2. People who have difficulty performing IADL but not ADL tasks.
> 3. People who have difficulty bathing.
> 4. People with difficulty with other ADL tasks.
> 5. People who cannot perform at least one ADL task without help.
> 6. People who live in the community and cannot perform two or more ADL tasks without help, and people who are in care homes or long-stay hospital.

There are currently nearly two-and-a-third million disabled older people in England. Of these, approximately two million live in their own homes and around 350,000 in residential care homes, nursing homes or long-stay hospitals. Almost 600,000 of those in their own homes are unable to perform at least one ADL without help. Eighteen per cent of men and 21% of women aged 85 and over in their own homes fall into this category.

Another key factor in the receipt of long-term care is household type (Arber et al, 1988; Davies et al, 1990; McNamee et al, 1999). In general, older people who live alone are more likely to receive formal services than those living with others (Evandrou, 2005), while those living with others are more likely to receive informal care (Pickard et al, 2000). Because of the close relationship between household type and informal care, there is a single classification in the model for household type/informal care.

The projections of household composition/informal care in the PSSRU model are driven by the 2003-based GAD marital status and cohabitation projections (ONS, 2005). The model incorporates the GAD marital breakdown by age and gender to 2031 and then assumes that the proportion of the population, by age and gender, who are married/cohabiting remains constant from 2031 onward.

The household type/informal care classification in the model is based, in the first instance, on *de facto* marital status. Older people who are married or cohabiting are distinguished from those who are single, separated, divorced or widowed. The two marital status groups, those who are *de facto* married and those who are *de facto* single, are broken down into five household types using official national statistics and the 2001/2 GHS. The following five household type categories are distinguished: single alone, single with children, single with others, couple alone and couple with others. Multivariate (logit) analysis of the GHS data found that, where single people are concerned, living alone, with children or with others is significantly associated with gender and disability. Consistent with findings elsewhere, single older women in private households with high levels of disability are considerably less likely to live alone than are those with lower levels of disability (cf Grundy 1992). For married people, living with a partner only or with a partner and others is significantly associated with age band, with the proportion of couples who live with others declining with advancing age. The projections assume a 'steady state' regarding the propensity within marital status groups to live alone, with children or with others.

The five household type groups are then further broken down by receipt of informal care to produce an eight-fold classification by household type and informal care (box 2). Informal care in the model is based on analyses of receipt of unpaid help with domestic tasks by disabled older people using the 2001/2 GHS. Multivariate (logit) analysis of the GHS data found that, for single disabled people living alone, receipt of informal care is significantly associated with gender, severity of disability, housing tenure and the interaction between disability, tenure and gender. Women with IADL problems who rent their homes are more likely to receive informal care than women with IADL problems who own their homes. For disabled married older people living in a couple only, receipt of informal care is associated with type of disability and age band. Married people with difficulty bathing are significantly less likely to receive informal care than other disabled married people, while as age increases, it is increasingly likely that informal care is provided from outside the household rather than by a spouse.

In modelling receipt of informal care in future years, it is important to distinguish between informal care by spouses and by children. Whereas care by spouses is likely to increase in future years, care by children may decrease (Allen & Perkins 1995; Evandrou & Falkingham 2000; Pickard *et al*, 2000). The PSSRU model now distinguishes between different sources of informal care for disabled older people, using additional data supplied for the first time with the 2001/2 GHS (Pickard *et al* forthcoming). Three principal sources of informal care are identified: care from children, from spouses and from others. The projections assume a steady state regarding the propensity, within household type/informal care groups, to receive care from a spouse, child, spouse and child, or others.

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. The current means test for public support in care homes 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 care privately, while older tenants and older home-owners living with their spouse are often eligible for public funding.

The rates of home ownership, by age, gender and marital status, for 2002 are from the Family Resources Survey. Projected rates for future years to 2022 are from projections by the University of Essex (Hancock, 2005), which derive from a microsimulation model. Home ownership rates are then assumed to remain constant, by age, gender and marital status, from 2022 onward.

The model divides the population into 1,000 cells. Forty of these relate to the institutional population by age (5 bands), gender, previous household type (2 categories) and previous housing tenure (2 categories), and 960 to the household population by age (5 bands), gender, disability (6 groups), household type/informal care (8 categories) and tenure (2 categories).

Box 2: Household type/informal care classification used in the PSSRU model

The eight different categories used in the model are as follows:
1. Single, living alone, no informal care
2. Single, living alone, with informal care
3. Single, living with children
4. Single, living with others
5. Couple, living with partner only, no informal care
6. Couple, living with partner only, with informal care
7. Couple, living with partner only, with informal care from outside the household
8. Couple, living with partner and others

Projected numbers of service recipients and recipients of disability benefits

The second part of the model projects the volumes of services demanded by combining the output of the first part of the model (the projected numbers of older people by disability, informal care/household type and other characteristics) with functions that assign receipt of services to each sub-group of the older population. The services covered include a range of health and social services relevant to meeting long-term care needs. Disability benefits are also included.

Residential care

The number of older people receiving residential, nursing home or long-stay hospital care was estimated using a combination of data. Official national statistics were used on the total numbers of local authority supported residents in residential care and nursing homes in England on 31 March 2003 (Department of Health, 2003) and estimates of the numbers of privately funded and NHS funded care home residents. A proportionate breakdown of care home residents by age band, gender, previous household type and previous housing tenure was derived from PSSRU surveys of residential care (Netten et al, 1998) and applied to the totals.

2001 Census data on the numbers of older patients by age and gender were used as estimates of the numbers in long-stay hospital care. In the absence of data on this group's previous household type and housing tenure, a breakdown from the PSSRU survey data on nursing home residents was applied to hospital residents.

This approach enabled the proportion of disabled older people in residential home care, nursing home care and long-stay hospital care to be estimated for the model base year, 2002. The number of older people in these care settings was expressed as a proportion of the overall number of highly disabled older people (those unable to perform two or more ADLs without help or in care homes), for each subgroup by age band, gender, previous household type and previous housing tenure. These proportions were then used in making projections for future years.

The total numbers of care home residents were divided between respite care and other residents on the basis of data from the PSSRU surveys of residential care. Residents receiving personal care and not nursing care were divided between local authority and

independent sector care homes, using official data for March 2003. As the numbers of residents of local authority homes have been falling, the projections assume that all growth will relate to independent sector homes.

Non-residential care

The probability of receipt of each non residential service was estimated through multivariate (logit) analysis of the 2001/2 GHS data. Logistic regression analyses were run to determine the factors associated with receipt of each of the services: local authority home help, private help, district nursing services, meals, day centre services, chiropody, and any one or more of these services (other than chiropody). In each analysis, the dependent variable was receipt of the service. The intensity of service use was not accounted for at this stage. Separate analyses were undertaken for disabled and non-disabled older people, as few non-disabled older people received services other than chiropody and private domestic help. The independent variables were age, gender, household type/informal care, housing tenure and, for the disabled sub-sample, level of disability.

For non-disabled people, age was statistically significantly associated with the probability of receipt of home care, private help, district nursing, meals, and chiropody. Gender was associated with receipt of chiropody only, while household type/informal care was associated with receipt of private help only. Tenure was associated with receipt of home care, private help and day care. The following variables were associated with receipt of **any** service: age, household type/informal care, and household tenure.

For disabled people, age and degree of disability are associated with receipt of home care, private help, district nursing and chiropody. Household type/informal care and housing tenure are both associated with receipt of private help; household type/informal care also being associated with receipt of home care, private help and chiropody. Gender was associated with receipt of chiropody only. Housing tenure is associated with receipt of meals. In an analysis of receipt of **any** service, a significant association was found with age, household type/informal care and degree of disability.

Demand for non-residential 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, disability 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.

The estimated numbers of recipients of local authority home care, day care and meals were grossed to match Department of Health Referrals, Assessments and Packages of Care (RAP) data for 31 March 2003 for England (Department of Health, 2004a). The grossing factors estimated for 2002 were then applied for all projection years. Grossing was not possible for NHS community or day hospital services or for private services, as there are no official data on numbers of clients of these services.

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 disability was also obtained from the 2001/2 GHS. For local authority home care, day care and meals, the GHS data was grossed up to match the Department of Health data on average hours, sessions or meals per client week.

In summary, the numbers of recipients (*SERNO*) of each service (*j*) was estimated as:

$$SERNO_j = \sum_{i=1}^{960} p_{ij} \cdot n_i \, ,$$

where p_{ij} is the probability of a person in cell i (i=1 to 960) receiving service j (j=1 to 9) and n_i is the number of older people in cell i.

Assessment and care management

The number of assessments and the number of clients receiving care management are also included in the model. There were around 900,000 assessments of older people in 2002/3, according to Department of Health RAP data. The number of assessments is assumed to rise in line with the projected number of disabled older people. All recipients of local authority funded residential, day or home care are assumed to receive care management. This means that the number of clients receiving care management is assumed to rise in line with the projected number of recipients of these services.

Disability benefits

The model includes both Attendance Allowance (AA) and Disability Living Allowance (DLA) (care and mobility components). Department for Work and Pensions (DWP) data on receipt of disability benefits, by age, gender, and rate of benefit, are used for 2002. The numbers of recipients are expressed as age- and gender-specific rates through division by a weighted sum of the numbers of older people in each disability group. The weighting is included to reflect the finding that level of disability is positively associated with receipt of disability benefits. The weights are derived from the relative proportions of older people reporting receipt of disability benefits in the 2001/2 GHS.

Differences in eligibility for disability benefits between residential and home care meant that the total number of recipients of AA needed to be divided between those in care homes and those in private households. It was assumed that around 70% of privately funded care home residents receive AA, on the basis of a PSSRU survey of privately funded care home admissions (Netten et al, 2002) and that a negligible proportion of publicly funded residents receive AA, since disability benefits cease after 4 weeks of public funding. The percentage of private household residents receiving AA was estimated, by dividing the number of AA recipients excluding those in care homes by the number of individuals age 65 and over residing in private households.

This rate was compared to the rate of receipt of AA in the GHS 2001, to produce a scaling factor needed to scale up the number of AA recipients in the GHS 2001 to be

consistent with the DWP data. The scaled GHS data was then used to estimate the proportion of older people receiving AA by disability group.

Projected aggregate expenditure on long-term care services

The third part of the model projects total expenditure on the formal services demanded, applying unit costs of formal care to the volume of services projected in the second part of the model. For independent sector care homes, the unit costs are from the Laing & Buisson market survey for 2004 (Laing & Buisson, 2004). An assumption is incorporated, based broadly on Laing & Buisson findings, that privately funded residents meet higher fees than local authorities. For other services, unit costs are from the report, PSSRU Unit Costs of Health & Social Care 2004 (Curtis and Netten, 2004). All unit costs are deflated to 2002/3 prices, using Department of Health service specific deflators.

An assessment is assumed to cost £250 and care management to cost £600 per client year. Although these are estimates, total expenditure on assessment and care management calculated using these estimates matches official PSS EX1 expenditure data for expenditure on assessment and care management in 2002/3 (Department of Health, 2004b).

In summary, the model estimates total expenditure on long-term care (E_t), for each year (t), as the sum across all formal health and social services considered, j (j = 1 to 9) of the following: projected number of service recipients in year t ($serno_{jt}$) multiplied by the intensity of service receipt in terms of hours/visits per week (int_j) and multiplied by the unit cost of care inflated to the year to which the projection year relates (c_{jt}). This can be shown as:

$$E_t = \sum_{j=1}^{9} serno_{jt} \cdot int_j \cdot c_{jt}$$

Projected breakdown of expenditure between funders

The fourth part of the model breaks down projected aggregate expenditure on services by source of funding: NHS, social services and service users. The costs of the health services included are assigned to the NHS. The costs of social services are divided between personal social services and service users. As there are no national data on the quantities of privately funded care, the projections for privately funded care, especially on non-residential care, need to be treated with caution as it is not possible to verify that all privately funded care is captured by the model.

Residents of residential care and nursing homes are divided into privately and publicly funded residents. The breakdown for 2002 is based on Department of Health data for nursing homes, Laing & Buisson data (Laing & Buisson, 2004) for independent sector residential care homes and 1996 PSSRU survey data (Netten *et al*, 1998) for local authority homes. The proportion privately funded is assumed to rise in line with the proportion of care home residents who were owner occupiers living

alone prior to admission. Privately funded residents are assumed to meet their care home fees from their own funds (including disability benefits), except that the NHS meets nursing costs in nursing homes.

Expenditure on local authority funded residential care, home care, day care and meals is divided between local authority social services and users on the basis of Department of Health data (Department of Health, 2004b) on the proportion of gross costs of social services met by user charges. The proportion of costs met by users is held constant for future years. 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.

Estimated net and gross expenditure on local authority funded services plus expenditure on assessment and care management is grossed to match local authority PSS EX1 expenditure data for 2002/3 (Department of Health, 2004b). Estimated expenditure on NHS community services is grossed to match an estimate derived from the Department of Health programme budget. The grossing factors estimated for 2002/3 are applied to all projection years to 2041.

Expenditure on disability benefits is estimated separately, by multiplying the numbers of recipients by the weekly average amounts. Projected expenditure on disability benefits can be added to projected public expenditure on services to produce projected public expenditure on services and cash benefits. It cannot, however, be added to total expenditure. That would involve double-counting since an (unknown) proportion of disability benefit expenditure is used to purchase services privately or meet user charges for local authority services

Social care workforce

A fifth part of the model has recently been added. It makes projections of the numbers of social care (but not NHS) staff required to provide the projected volume of social services, for different groups of social care staff. Department of Health estimates on whole-time equivalent staff numbers by category of staff and service have been used for 2002. For care staff, it is assumed that the ratio of staff to clients remains constant to 2041. For administrative and managerial staff, it is assumed that the ratio of such staff to care staff remains constant over the projection years.

3. Base case assumptions and projections

The PSSRU model produces projections on the basis of specific assumptions about future trends in the key drivers of demand for long-term care. The main assumptions used in the base case of the model are summarised in box 3 below. The base case projections take account of expected changes in factors exogenous to long-term care policy, such as demographic trends. The base case projections hold constant factors endogenous to long-term care policy, such as patterns of care and the funding system. The base case is used as a point of comparison when the assumptions of the model are subsequently varied in alternative scenarios.

The GAD 2004-based principal population projections for England project that between 2002 and 2041 the numbers of people aged 65 or over will rise by 80%. The numbers of those aged 85 or more are projected to rise faster during this period, by 190%, from more than 950,000 to around 2,770,000. Much of this increase is a result of a projected rise in male life expectancy. Between 2002 and 2041, the numbers of men aged 85 or more are projected to rise by 325%, compared to a 135% rise in the number of women in that age group.

Under the base case assumptions, the numbers of disabled older people, defined as those unable to perform at least one IADL or having problems with at least one ADL, would grow by 100% between 2002 and 2041, from 2,340,000 to 4,640,000. The number of older people with moderate or severe disability, that is needing help with 1 or more ADL tasks, would increase by 105% from 580,000 to 1,190,000.

Box 3

KEY ASSUMPTIONS OF THE BASE CASE OF THE PSSRU MODEL

- The number of people by age and gender changes in line with the Government Actuary's Department 2004-based population projections (GAD, 2005).

- Marital status changes in line with GAD 2003-based marital status and cohabitation projections (ONS, 2005): as these projections run to 2032, the 2031 marital status rates are applied to 2041.

- There is a constant ratio of single people living alone to single people living with their children or with others and of married people living with partner only to married people living with partner and others.

- Prevalence rates of disability by age and gender remain unchanged, as reported in the 2001/2 General Household Survey (GHS) for Great Britain.

- Home-ownership rates, as reported in the 2001/2 Family Resources Survey (FRS), change in line with projections produced by the University of Essex (Hancock, 2005).

- The proportions of older people receiving informal care, formal community care services, residential care services and disability benefits remain constant for each sub-group by age, disability and other needs-related characteristics.

- Health and social care unit costs rise by 2% per year in real terms (but non-revenue staff costs remain constant in real terms). Real Gross Domestic Product rises in line with HM Treasury assumptions (HM Treasury, 2005).

- The supply of formal care will adjust to match demand[1] and demand will be no more constrained by supply in the future than in the base year.

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[1] The model effectively assumes that the assumed real rise in care costs will be sufficient to ensure that supply will rise to meet projected demand.

The numbers of disabled older people in households receiving informal care are projected to increase by 95%, from approximately 1.7 million in 2002 to over 3.3 million in 2041. The numbers of disabled older people receiving care from a spouse or partner are projected to increase faster than the numbers receiving care from a child, under base case assumptions.

The numbers of users of non-residential formal services would need to rise by 95%, from 1.5 million to just under 3.0 million, to keep pace with demographic pressures; and the numbers of older people in institutions would need to rise by 114%, from 340,000 to nearly 730,000.

Projected long-term care expenditure would grow by 325%, from £13 billion in 2002 to over £55 billion in 2041 (figure 1). If Gross Domestic Product rose in line with HM Treasury assumptions, long-term care expenditure would grow from 1.43% of GDP in 2002 to 2.63% in 2041. Table 1 shows these base case projections in greater detail.

Figure 1: Projected expenditure (£m) by source of funding, England, 2002-2041, under base case assumptions.
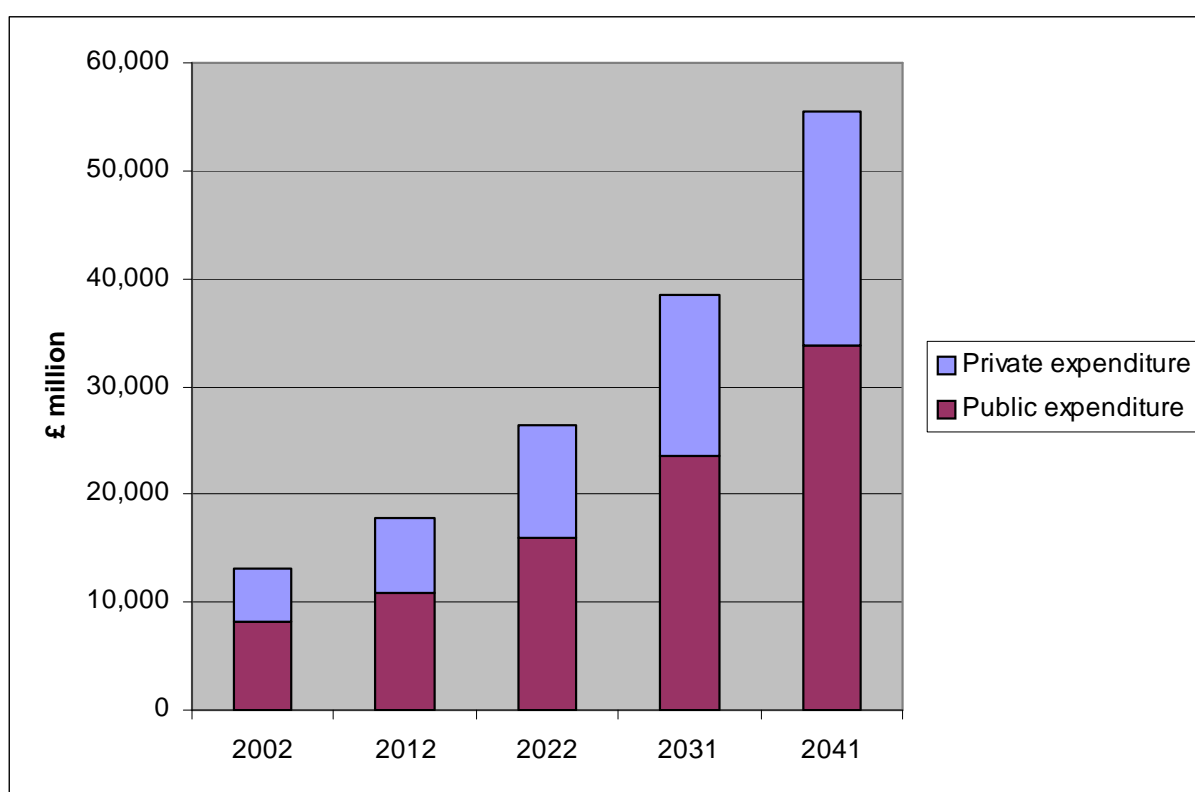
Source: PSSRU model

Table 1: Projected numbers of older people (thousands), service recipients (thousands) and expenditure (£ billion) under base case assumptions, 2002 to 2041

	2002	2012	2022	2031	2041	% growth 2002 to 2041
Numbers of older people (aged 65 or more)	7,890	9,040	10,790	12,790	14,160	80%
Numbers of people aged 85 or more	960	1,220	1,580	2,140	2,770	190%
Numbers of older people with some disability	2,340	2,670	3,270	3,990	4,640	100%
Number of older people severely disabled	580	670	830	1,020	1,190	105%
Numbers of disabled older people with informal care (in households)	1,710	1,950	2,380	2,900	3,340	95%
Numbers of disabled older people with informal care from spouse/partner (in households)	640	740	900	1,180	1,340	110%
Numbers of disabled older people with informal care from (adult) child (in households)	670	750	920	1,050	1,230	83%
Numbers of users of local authority home help services	340	380	470	580	680	100%
Numbers of users of community nursing services	430	490	600	760	890	110%
Numbers of users of private domestic help	820	960	1,180	1,420	1,630	100%
Numbers of users of any non-residential service[2]	1,520	1,730	2,130	2,550	2,960	95%
Numbers of people in residential care homes	200	230	280	360	440	115%
Numbers of people in nursing homes	120	140	170	220	260	115%
Numbers of people in institutions	340	390	480	600	730	115%
Public long-term care expenditure (£ billion)	8.2	10.9	15.9	23.5	33.7	310%
Private[3] long-term care expenditure (£ billion)	4.8	6.9	10.4	15.1	21.8	350%
Total long-term care expenditure (£ billion)	13.0	17.8	26.4	38.6	55.6	325%
Total long-term care expenditure as a % of GDP	1.4%	1.5%	1.8%	2.2%	2.6%	90%

Source: PSSRU model

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[2] Local authority home care, district nursing, day centre care, meals or private domestic help

[3] Includes user fees for local authority arranged services and out-of-pocket payments for privately purchased services.

4. Sensitivity analysis: the effect of changes in the key assumptions

This section investigates the sensitivity of the projections to changes in the base case assumptions, in particular to changes in the assumptions about life expectancy, disability rates, availability of informal care, patterns of formal care and the unit costs of care. Table 2 (at the end) summarises the projections obtained under different assumptions.

Assumptions about increases in life expectancy

Mortality rates in old age are the key factor affecting the projected number of older people (Murphy, 1995). The base case of this version of the model uses the Government Actuary's Department (GAD) 2004-based principal population projection (GAD, 2005). A number of variants have been tested to assess the effects of differing increases in life expectancy and hence differing increases in the future numbers of older people.

The GAD 2004 principal population projections assume that, between 2002 and 2041, male life expectancy will rise from 76.2 to 82.7 years and female life expectancy from 80.8 to 86.2 years (GAD, 2005). The GAD produces higher and lower life expectancy variants to their population projections. The high life expectancy projection assumes that life expectancy would rise from 76.2 in 2002 to 85.9 in 2041 for men and from 80.8 in 2002 to 88.6 in 2041 for women. The low life expectancy projection assumes a more moderate rise to 79.5 years for men and to 83.8 for women in 2041.

Results
Under the base case the future numbers of older people are projected to grow from 7.9 million in 2002 to 14.2 million in 2041, a 80% increase. Long-term care expenditure would grow by 326% between 2002 and 2041 on base case assumptions.

Using the GAD low life expectancy variant long-term care expenditure in England would rise by 275% between 2002 and 2041, compared to 380% using the GAD high life expectancy variant. As a percentage of GDP, the GAD low life expectancy variant projects long-term care expenditure to increase from 1.4% in 2002 to 2.4% in 2041. The GAD high expectancy variant projects expenditure to be just under 3.0% of GDP in 2041.

A third variant assumption allows the numbers of people aged 85 and over to rise by 1 per cent per year faster than the GAD 2004-based projections to 2041. This assumption has been chosen because it corresponds roughly to the extent of past under-estimation of the numbers of very elderly people (Shaw, 1994). It is debatable whether the most recent projections, based on a changed approach, will prove to be under-estimates. The variant is included, however, because 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). Moreover, as the proportion of older people receiving services rises sharply with age, the model projections are most sensitive to assumptions about the numbers of very elderly people.

Under this assumption, expenditure on long-term care is projected to increase to 3.3% of GDP in 2041 as compared to 2.6% under the base case. These findings, illustrated in figure 2, indicate the sensitivity of long-term care projections to assumptions about future increases in life expectancy.

Figure 2: Projected expenditure as a % of GDP, England, 2041, under alternative assumptions about changes in life expectancy
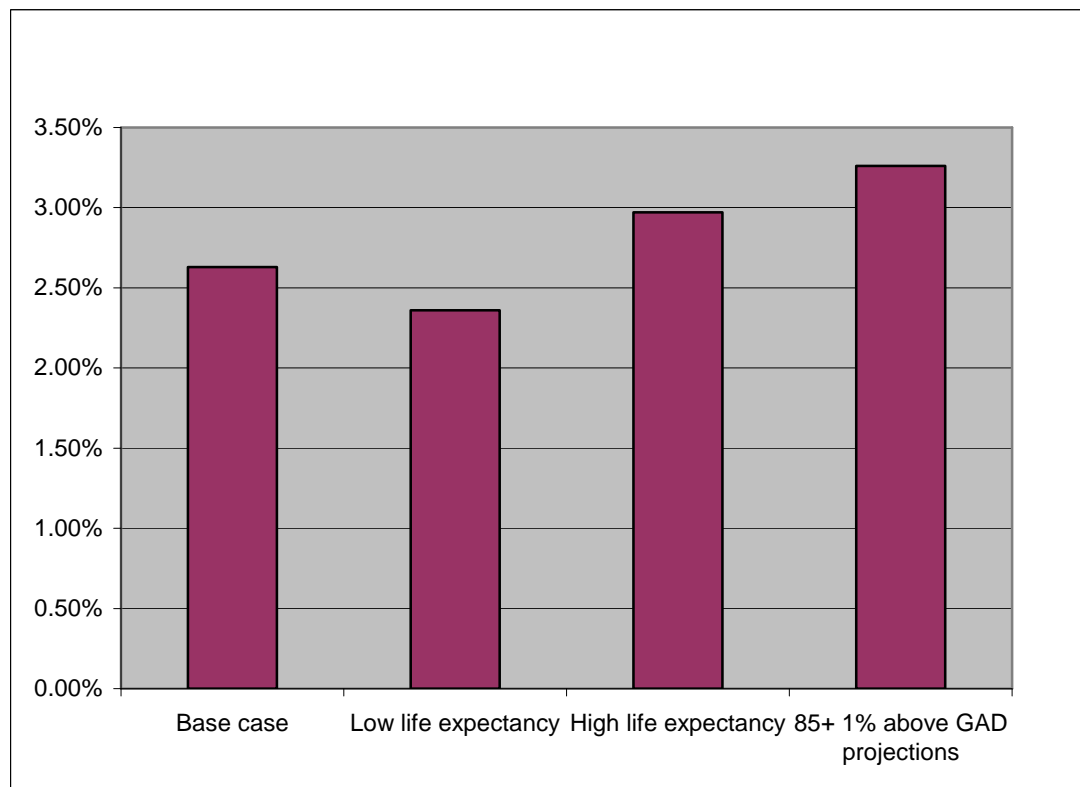
Source: PSSRU model

Assumptions about trends in functional disability

There are different views about whether age-specific disability rates can be expected to rise, fall or remain broadly constant in the future (Bone et al 1995 and Dunnell 1995). Constant age-specific disability rates may be regarded as a neutral assumption and this is our base case. Yet, if age-specific disability rates remain constant while life expectancy rises, the number of years with disability will rise as well as the number of years without disability. A less pessimistic assumption for future disability would be to assume that, as life expectancy rises, the number of years without disability rise by the same amount and the number of years with disability remains constant. An assumption on these lines was developed by Wiener et al. (1994). This assumption (referred to as the 'Brookings assumption') involves moving the age-specific disability rate upward by one year for each one year increase in life expectancy. The 'double-Brookings' scenario assumes that, for one-year increases in life expectancy, disability rates would shift to people two

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years older. The 'half-Brookings' scenario assumes that, for one-year increases in life expectancy, disability rates would shift to people half a year older.

Results

Table 2 presents the impact of three alternative assumptions about trends in age-specific disability rates: the 'Brookings', 'half-Brookings' and 'double-Brookings' scenarios. It shows that the numbers of disabled older people would increase by 50% under the Brookings assumption, by 75% under the half-Brookings assumption, and by 5% under the double-Brookings assumption, as compared to increasing by 100% if rates remained constant as in the base case. Overall expenditure is projected to increase by 210% between 2002 and 2041 under the Brookings assumption, by 265% under the half-Brookings assumption and by 90% under the double-Brookings assumption, compared to 325% with constant disability rates. As a percentage of GDP, long-term care expenditure is projected to increase by 2041 to 1.9% of GPD under the Brookings scenario, 2.3% of GDP under the half-Brookings scenario and 1.2% of GDP under the double-Brookings scenario, as compared with 2.6% of GDP under the base case.

These findings, illustrated in figure 3, show that projections of demand for long-term care are highly sensitive to assumptions about trends in disability rates. Falling disability rates would off-set part of the impact of the rise in numbers of older people. If falling mortality rates are accompanied by falling disability rates, the impact of demographic pressures on demand for long-term care would be mitigated.

Figure 3: Projected expenditure as a % of GDP, England, 2041, under alternative assumptions about disability trends
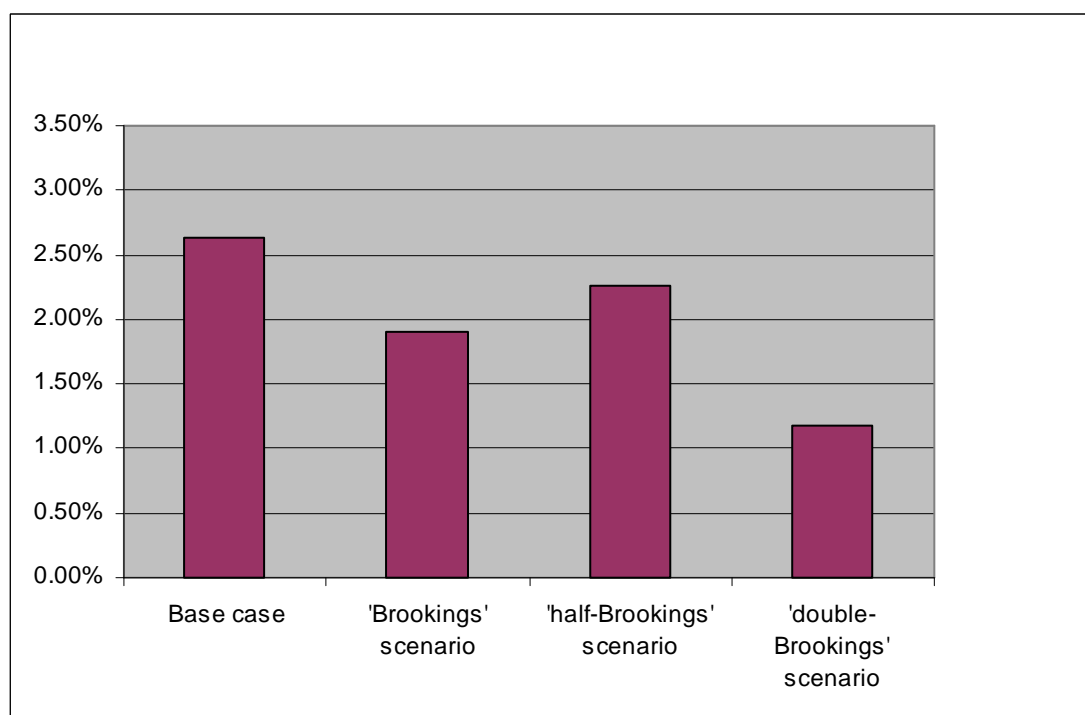
Source: PSSRU model

Assumptions about availability of informal care

The PSSRU model is a model of *demand* for long-term care and the informal care projections are essentially projections of the numbers of older people who would receive informal care if current patterns of care remained the same. In effect, the model projects 'demand' for informal care. With regard to the *supply* of informal care, the model includes a key aspect of supply, in that the marital status projections provide information on the numbers of older people who are likely to have a spouse or partner in the future. With regard to other aspects of the supply of informal care, these are explored by varying the assumptions used in the model.

The marital status projections used in the model show a marked increase in the numbers of married/cohabiting older people over the coming decades and the PSSRU model, in turn projects that there is likely to be a substantial increase in 'spouse care' in future years. The numbers of disabled older people receiving care from a spouse or partner are projected to more than double by 2041 (Table 1). Although not projected to increase as fast as married/cohabiting people, the numbers of single older people are also projected to rise. Single disabled older people rely particularly on their adult children for care, and the model projects that care by children will need to rise by over 80% by 2041, if the proportion of disabled older people (by age and marital status) receiving care from their children is to remain the same as today (Table 1). It is not clear, however, that the supply of informal care of older people will rise to meet this demand. Indeed, there is concern that informal care may decline in future, as a result of such factors as women's rising participation in the labour market. The future supply of informal care has been examined here through stylised scenarios allowing for a decline in receipt of informal care by disabled older people, which are described below.

1% decline in the proportion of disabled older people receiving informal care

Two new scenarios have been developed to test the sensitivity of the model to changes in assumptions about the availability of informal care for disabled older people. These are similar to scenarios developed as part of the European Commission financed study described at the beginning of this paper (Comas-Herrera *et al*, 2006). The first scenario allows for an annual 1% decline in the proportion of disabled older people receiving informal care, accompanied by a modest increase in community-based services. The second scenario allows for an annual 1% decline in the proportion of moderately/severely disabled[4] older people receiving informal care, accompanied by an increase in residential care.

Results
The impact of the first scenario, in which there is a 1% annual decline in the proportion of disabled older people receiving informal care accompanied by a modest increase in community-based services, is relatively small. Long-term care expenditure would rise by 340% between 2002 and 2041, compared to 325% under the base case. As a percentage of GDP, under this scenario, long-term care expenditure would rise to 2.7% as compared to 2.6% under the base case.

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[4] Moderate/severe disability is defined as an inability to perform one or more ADLs without help.

The impact of the second scenario is, however, greater, even though the reduction in numbers receiving informal care is lower. The second scenario assumes the same proportionate decline in receipt of informal care per annum as the first scenario, but the reduction applies only to disabled older people with a moderate/severe disability. Nevertheless, the impact on long-term care expenditure of the second scenario is greater because it is assumed that those no longer receiving informal care would enter residential care. Under this scenario, there would be over a million older people in institutions in 2041, compared to approximately 730,000 under the base case. Long-term care expenditure would grow by 400% between 2002 and 2041 under this scenario, compared to 325% under the base case. Long-term care expenditure would represent 3.1% of GDP in 2041, compared to 2.6% under the base case.

These projections suggest that a decline in the availability of informal care could have a substantial impact on future expenditure on long-term care. Much depends on the size of the decline in informal care and the extent to which informal care is substituted by residential care or by moderate packages of home care. Figure 4 illustrates the impact of these informal care scenarios on projected long-term care expenditure as a percentage of GDP.

Figure 4: Projected expenditure as a % of GDP, England, 2041, assuming a 1% decline in the proportion of disabled older people receiving informal care.
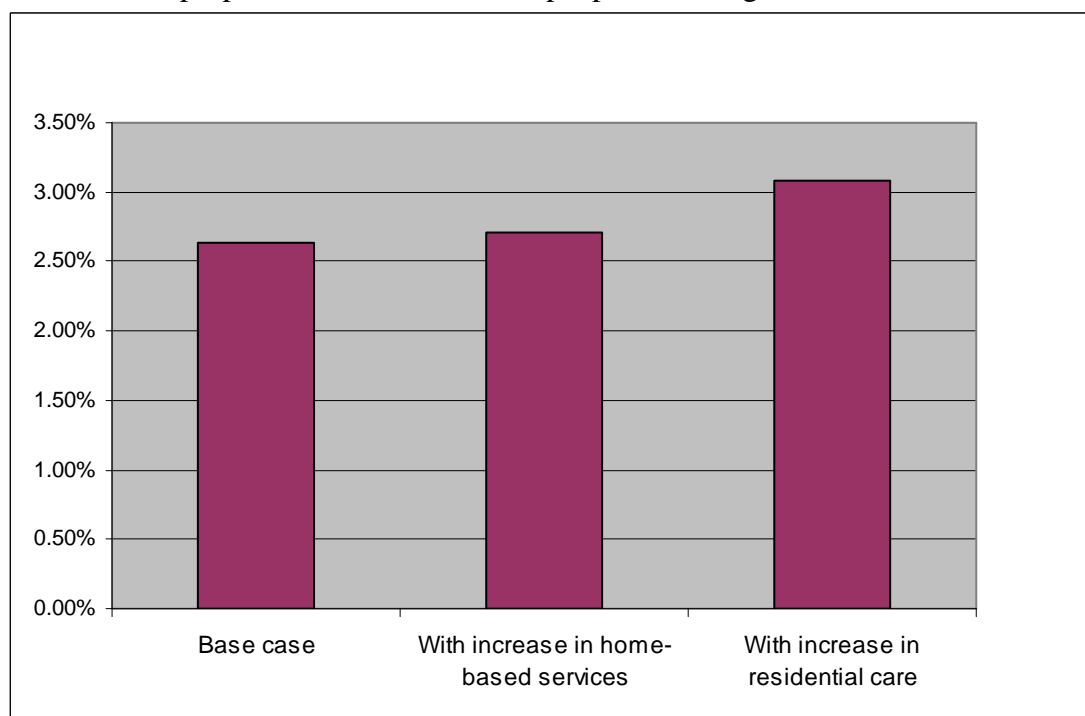
Source: PSSRU model

Assumptions about future patterns of care

The model can also be used as to explore the impact on projected long-term care expenditure of changes in the patterns of services. The assumptions explored here assume a shift in the balance of care from institutional to domiciliary care, a change in eligibility criteria for home care and an increase in support for informal carers.

Shift in the balance of care
The first assumption investigated replicates the assumptions used in the National Beds Inquiry (NBI) for England. The NBI assumed that the number of people in residential and nursing homes would rise in line with demographic pressures but that by 2019 there would be a shift of between 5% and 15% to non-residential care (Department of Health, 2000). The assumption considered here assumes that the projected numbers in residential and nursing care in 2031 would be 10% lower than under the base case. An equivalent number of people have been added to the projected number of home care recipients. Also, a number equivalent to a 10% reduction in nursing home residents has been added to the projected number of community nursing recipients. The expenditure implications of our scenario of the NBI assumptions would depend on the intensity of home care received by those diverted from residential and nursing homes. As a result, expenditure implications are not estimated for this scenario.

Entitlement to long-term care services
The next scenario was developed in the context of the European study of long-term care expenditure (Pickard et al, 2006). It investigates the potential impact of the provision of a national entitlement to formal care for all older people with moderate to severe disability (inability to perform one or more ADLs without help), independently of whether or not they receive informal care. The scenario is a policy option based on the German long-term care insurance scheme, which embodies the principle of an entitlement to long-term care benefits based on uniform national criteria. The scenario models this key principle of the German system in England, with respect to home care services.[5] It is assumed that all people with moderate disability (inability to perform 1 ADL without help) would receive the average number of hours of home care received by formal care recipients living in the community (10 hours per week), while those with severe disability (inability to perform 2 or more ADLs without help) would receive 15 hours per week of free home care. The scenario assumes one hundred percent take-up, that is, it assumes that these packages replace any means-tested home care and private home care received by older people in these two groups.

Increasing support for carers
The results of the PSSRU model, using the GAD marital status and cohabitation projections, presented earlier in this paper, suggest that there is likely to be an increase in spouse carers of disabled older people in the future (Pickard *et al* 2000). Many spouse carers are themselves elderly, many are in poor health and, as carers, many are themselves in need of support from formal services. An increase in spouse carers, therefore, raises issues about the need for support for carers. Current policies, in particular the National Strategy for Carers (1999) the principles of which were recently

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[5] In the German case the level of disability required to be entitled to care is more severe than the level of one or more ADLs used in this scenario. See, for example, Rothgang (2003).

endorsed (Department of Health 2006), are intended to increase the amount of service support received by carers. A scenario has, therefore, been developed which looks at the implications of increasing support for carers. The scenario focuses on providing more support to the most heavily burdened carers. These have been identified as carers providing personal care to older people living in the same household (Parker 1992). The scenario looks at the implications of increasing domiciliary services to older people with substantial disability needs (those unable to perform two or more ADLs without help) who share a household with others.

The way in which support to carers is increased in the scenario is by looking at the consequences if services were to become more 'carer-blind' in the future. The term 'carer-blind' was originally used by Twigg and Atkin in 1994 to describe a policy which involved "treating a disabled person with a carer in exactly the same way as a disabled person without" (Twigg and Atkin 1994: 150). The scenario explores the implications of making services more 'carer-blind' by allowing those living with others to receive the same level of domiciliary services as those living alone. The probability of receipt of each domiciliary service among the most disabled older people living with others rises linearly under this scenario to match by 2041 the probability for those living alone.

Results
Under the NBI-style assumption about a change in the balance between institutional and domiciliary care, the number of recipients of home care is projected to increase to over 740,000 as compared to approximately 680,000 under the base case. This would represent an 120% increase in home care recipients between 2041 and 2002 as against 100% under the base case. The number of older people receiving community nursing is projected to increase to 920,000 in 2041, an increase of 115% from 2002. Under the base case, approximately 890,000 older people would receive community nursing in 2041.

Because the NBI-style assumption envisages a shift in the balance of care from residential to non-residential care, the projected rate of increase of the number of older people in institutions under these assumptions would be lower than observed in the base case. The NBI-style assumption projects a 95% increase in the total number of older people in residential care between 2002 and 2041, as compared to a 115% increase estimated under the base case.

Introducing a national entitlement to an average package of home care for all older people who have problems with at least one ADL would benefit more than 800,000 moderately/severely disabled older people in England in 2041. This figure represents the projected additional number of disabled older people who would receive home care in 2041, compared to the numbers projected to receive home care if the present long-term care arrangements remained unchanged. An entitlement to home care of the type described here would have a considerable impact on projected long-term care expenditure. Long-term care expenditure in England would need to rise by 430% between 2002 and 2041, compared to 325% under the base case. Overall expenditure on long-term care would represent around 3.3% of GDP in 2041 under this scenario, compared with 2.6% under the base case.

Under the 'carer-blind' scenario, there would be nearly 770,000 recipients of home help services in 2041, compared to 680,000 under the base case. Expenditure on long-term care would rise by 340% under the 'carer blind' scenario between 2002 and 2041, compared to 325% under the base case. Overall expenditure on long-term care would represent around 2.7% of GDP in 2041 under the 'carer-blind' scenario, compared with 2.6% under the base case (Table 2 and figure 5).

Figure 5: Projected expenditure as a % of GDP, England, 2041, under alternative assumptions about patterns of care.
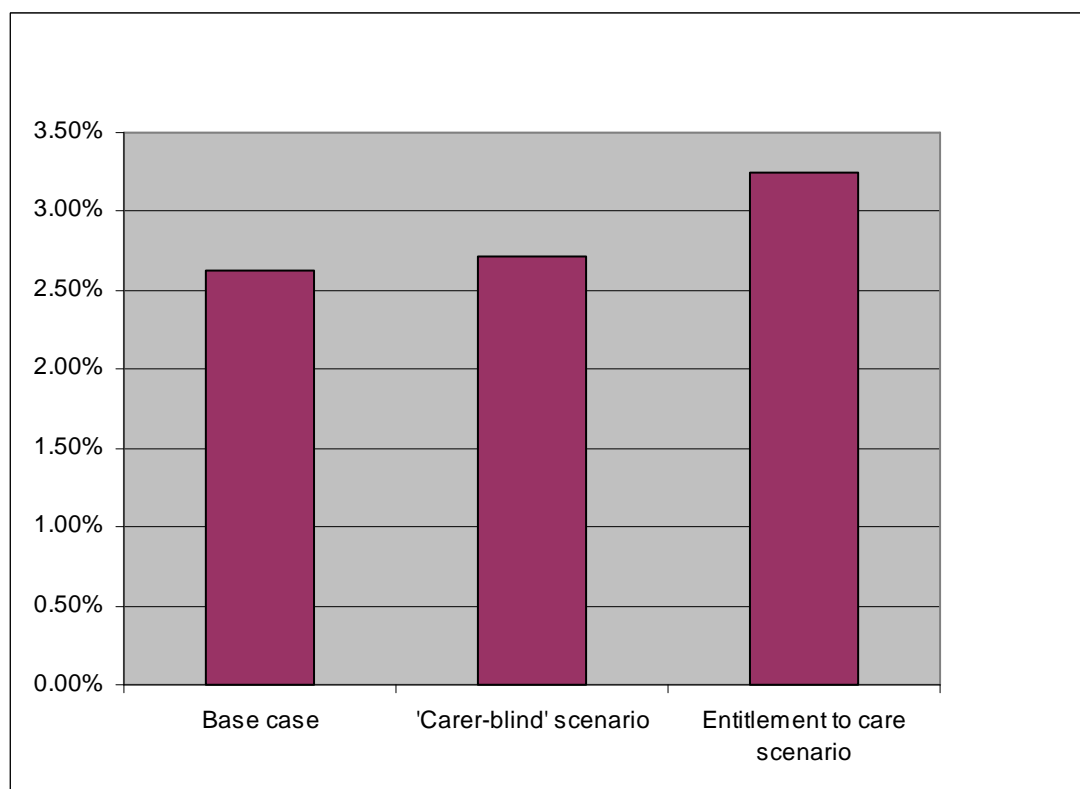
Source: PSSRU model

Assumptions about unit costs and economic growth

Previous reports have highlighted the sensitivity of future long-term care expenditure to relatively small changes in the future unit costs of long term care (Wittenberg et al, 1998, 2001 and 2002). The base case of the model assumes that the real unit costs of care, such as the cost of an hour's home care, will rise by 2% per year, in line with HM Treasury's assumption for average earnings. Gross Domestic Product (GDP) is also assumed to rise in line with the H M Treasury's assumption, which is also 2% per year in real terms over the long-term.

The key driver of rises in the unit costs of care is rises in the earnings of staff providing long-term care. Home care and day care are clearly highly labour-intensive. Residential care is also labour intensive, with staff costs accounting for the majority

of overall costs. For example, data from a UK study shows that, in public sector homes, staff costs accounted for 85% of the total unit cost (Netten et al., 1998). This suggests that it would be plausible to assume that the real unit costs of care will rise broadly in line with average earnings of care staff, or perhaps by somewhat less allowing for non-staff costs (Wittenberg and Comas-Herrera, 2003).

Two additional scenarios are examined here. The first assumes that there will be a 0.5% greater increase in unit costs than is modelled in the base case, that is, unit costs would rise by 2.5% per year in real terms. The second assumes that unit costs will rise by 1.5% per year in real terms, 0.5% less than the base case. Modelling moderate increases and decreases in unit costs around the base case demonstrates the sensitivity of the model to changes in this variable over time.

Results
Under the assumption that unit costs rise by 2.5%, long-term care expenditure would rise by 413% between 2002 and 2041, to nearly £67 billion, compared to £56 billion under the base case. Overall long-term care expenditure would represent 3.2% of GDP in 2041 under this variant assumption, compared to 2.6% under the base case (figure 6). Were unit costs to rise by 1.5%, long-term expenditure would rise by 256% to £46 billion in 2041. This would represent 2.2% of GDP in 2041. These variants illustrate how sensitive projections of long-term care expenditure are to assumptions about rises in the real unit costs of care.

Figure 6: Projected expenditure as a % of GDP, England, 2041, under alternative assumptions about future trends in the real unit costs of care

Source: PSSRU model

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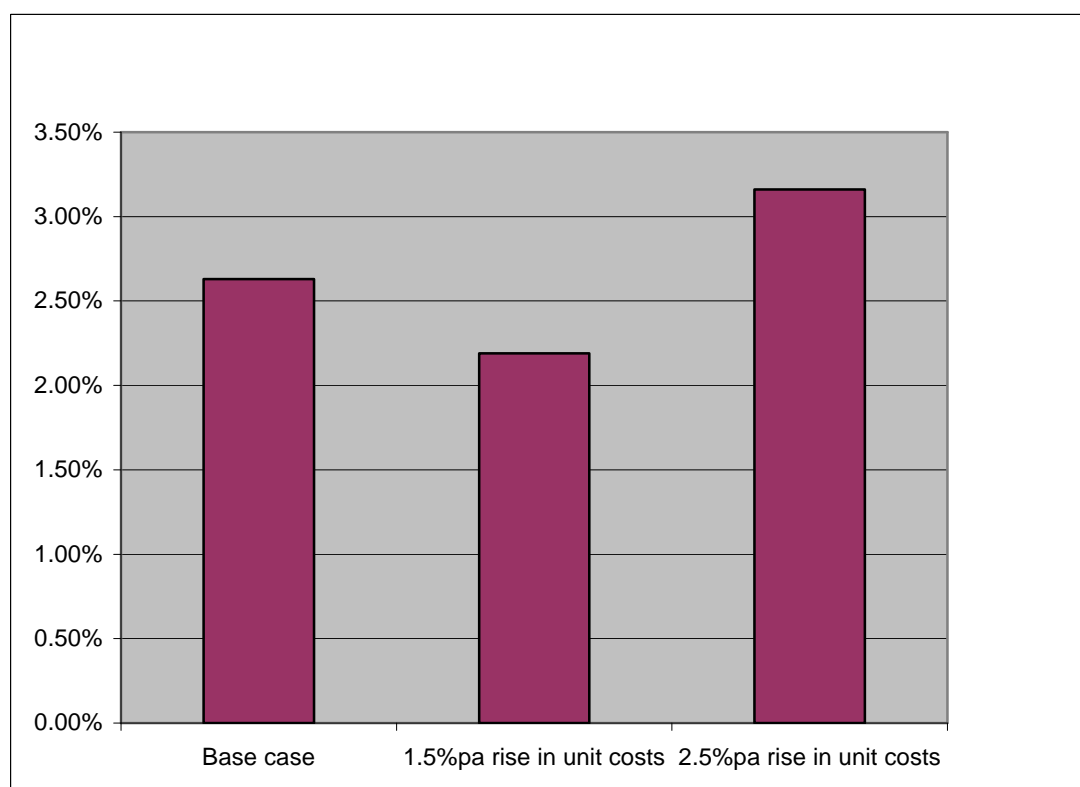
Table 2: Summary of sensitivity analysis

This table presents in summary form the projections obtained varying in turn some of the key base case assumptions. The figures relate to the projected numbers of older people, disabled older people and service recipients (in thousands) and to projected expenditure (in billions of pounds and % of GDP). The figures in brackets are the projected percentage increase between 2002 and 2041. Cells are left empty where the projections are the same as the base case.

	Projected numbers of older people	Projected numbers with disability	Projected number of recipients of home care	Projected numbers of people in institutional care	Projected total expenditure (£billion)	Projected total expenditure (% of GDP)
2002 estimates	7,890	2,340	340	340	13.0	1.4
Base case projection for 2041	14,160 (80%)	4,640 (100%)	680 (100%)	730 (145%)	55.6 (325%)	2.6
Life expectancy assumptions						
Low life expectancy population projection	13,360 (70%)	4,260 (80%)	620 (85%)	640 (90%)	50.0 (285%)	2.4
High life expectancy population projection	15,190 (95%)	5,130 (120%)	760 (125%)	830 (145%)	62.8 (380%)	3.0
85+ group grow 1% faster than base case	15,430 (95%)	5,430 (130%)	820 (140%)	940 (175%)	69.0 (430%)	3.3
Disability assumptions						
Brookings compression of morbidity assumption		3,530 (50%)	560 (65%)	460 (35%)	40.2 (210%)	1.9
Half-Brookings assumption		4,070 (75%)	620 (80%)	600 (75%)	47.9 (270%)	2.3
Double-Brookings assumption		2,450 (5%)	440 (30%)	190 (-45%)	24.8 (90%)	1.2
Informal care assumptions						
1% pa decline in informal care: shift to home care			720 (115%)		57.3 (340%)	2.7
1% pa decline in informal care: shift to residential care			590 (75%)	1,070 (215%)	65.1 (400%)	3.1
Patterns of care assumptions						
National Beds Inquiry			740 (120%)	660 (95%)	Not estimated	Not estimated
Carer blind			770 (130%)		57.6 (340%)	2.7
Entitlement to care			1,500 (345%)		68.8 (430%)	3.3
Unit costs assumptions						
2.5%pa rise in unit costs					66.9 (415%)	3.2
1.5%pa rise in unit costs					46.3 (255%)	2.2

Source: PSSRU model

5. Findings and future developments of the model

BOX 4

MAIN FINDINGS

- The numbers of disabled older people in England are projected to grow from around 2.3 million in 2002 to around 4.6 million in 2041, an increase of 100%.

- To keep pace with demographic pressures over the next thirty years, residential and nursing home places would need to expand by around 115% and numbers of hours of home care by around 100%, assuming unchanged disability rates.

- Long-term care expenditure would need to rise by around 325% in real terms between 2002 and 2041 to meet demographic pressures and allow for real rises in care costs of 2% per year for health and social care.

- Long-term care expenditure would need to increase from 1.43% of GDP in 2002 to 2.63% of GDP in 2041 to meet demographic pressures, assuming GDP rises in line with HM Treasury assumptions.

- Future long-term care demand is sensitive to the projected numbers of older people: under variant GAD population projections projected expenditure would be around 0.3% of GDP above or below the base case projection for 2041.

- Future demand is also sensitive to trends in disability rates: under a compression of morbidity scenario projected expenditure would be 1.90% of GDP in 2041, compared with 2.63% under constant disability rates.

- Future long-term care expenditure is highly sensitive to assumed rises in unit costs of care: under a variant that assumes that there will be a 0.5% greater increase in unit costs than the HM Treasury assumes will be the rise in average earnings, projected expenditure would be 3.16% of GDP in 2041.

- A decline in the availability of informal care could have a substantial impact on demand for formal services depending on the size of the decline and the extent to which residential care was required to substitute for informal care.

- A policy of increasing support to the most heavily burdened carers by providing domiciliary services on a 'carer-blind' basis would result in projected expenditure 0.1% of GDP above that estimated for the base case.

- A policy of providing an entitlement to an average package of home care for all moderately/severely disabled older people would benefit considerable numbers of disabled older people but would have substantial financial consequences. Expenditure would increase to 3.25% of GDP in 2041 as compared to 2.63% under the base case.

6. Conclusions

The model produces projections of future long-term care expenditure based on a specified set of base case assumptions. This set of assumptions seems plausible but is clearly not the only possible set. As the sensitivity analysis demonstrates, the projections are sensitive to changes in those assumptions. This means that the projections should not be regarded as forecasts of the future.

The sensitivity analysis shows that projected future demand for long-term care services for older people is sensitive to assumptions about future numbers of older people and about future prevalence rates of disability. It is also sensitive to assumptions about the future availability of informal care. Projected future expenditure on long-term care for older people is also sensitive to assumptions about future rises in the real unit costs of services, such as the cost of an hour's home care.

The expenditure projections do not constitute the total costs of long-term care to society. That would require inclusion of the costs of a wider range of services to a wider range of public agencies and service users and the opportunity costs of informal care. It should also be stressed that no allowance has been made here for changes in public expectations about the quality, range or level of care.

Notwithstanding these limitations, the projections have some clear implications for policy. The key implication is that policy-makers need to plan for uncertainty in future demand for long-term care for disabled older people. Future mortality and prevalence rates and rises in unit care costs, which are inevitably uncertain, have substantial implications for future demand for long-term care and associated expenditure. As there is no certainty about future trends in these variables, there is inevitable uncertainty about future long-term care expenditures, even under current policies and patterns of care.

The model projections show that, unless prevalence rates of disability decline, the numbers of disabled older people requiring long-term care will rise significantly over the next decades. They also show that, if improved health care or other measures were to have the effect of reducing disability rates, this would at least partially offset expected demographic pressures from rising numbers of older people. The implication is that there is a need to promote measures that are likely to reduce disability in old age and to promote healthy ageing.

Families and other informal carers provide much of the care for disabled older people living at home. Projections suggest that a decline in the supply of informal care provided to older people, resulting in increased admissions to residential care, could have considerable financial consequences. This highlights the importance of developing services to meet the needs of informal carers, as well the needs of older people in need of care.

The projections show that substantial rises in formal services will be required to keep pace with demographic pressures, even before consideration of potentially rising expectations. The development of non-residential services, such as home care and day care, will be especially important. Older people generally prefer to remain in their own homes as long as possible. If this preference is to be recognised, a substantial expansion of non-residential services will be required.

The model projects that the proportion of GDP required to fund long-term care services will rise significantly over the next decades under base case assumptions. This is not to suggest that there is a looming demographic 'time-bomb' or crisis of sustainability of long-term care expenditure. It does suggest, however, that the promotion of efficiency will be important to limit to some extent real rises in unit costs, though the scope for this may be limited. It also suggests that the achievement of improved cost-effectiveness will be important, such that better outcomes are achieved from long-term care for similar service inputs.

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