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Abstract

One challenge presented by population aging is how to adjust public support for social care in a way that achieves desired quality of life outcomes without compromising budget sustainability. This study uses best-practice methods of economic analysis to explore projections for care and related public policy between 2020 and 2070 in the United Kingdom (UK). The UK is an interesting case study, as diverse social care provisions are adopted in the four constituent countries. Projections indicate that the number of people in need of care will approximately double over the prospective half century, with informal carers playing a key role in meeting the growing burden. Policy counterfactuals contrast the budgetary implications of closing the social care gap, particularly in England and Northern Ireland, and of easing poverty among informal carers.

Keywords: Social care, poverty, informal care, at-home care, welfare policy, microsimulation
JEL codes: J11, J13, D15

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1 Introduction

Public policies that assist provision and receipt of social care – including direct public transfers, tax credits, and publicly provided services – offer a measure of security to vulnerable population subgroups, mitigating inequality, poverty, and social exclusion. Despite widespread support for such policies, however, population aging will place increasing strain on publicly assisted social care throughout the 21st century. This study uses best-practice methods of economic analysis to explore the implications of selected policy alternatives for social care during the prospective half century in the UK, focussing on implications for people receiving or providing care, poverty, and the government budget.

Social care is the provision of personal care, social work, protection, or social support services to people in need or at risk, including older people with needs arising from illness, disability, or poverty. In practice, social care services are provided to help people who experience difficulties in undertaking a selected set of activities on their own. The set of selected tasks for which social care may be needed typically comprises basic self-care tasks necessary for survival and daily functioning (Activities of Daily Living, ADLs), or more complex tasks that support independent living (Instrumental Activities of Daily Living, IADLs). Social care services can be obtained from formal social care providers (often with public support), or from informal carers (usually from a recipient's social network).

The unsubsidised costs involved in obtaining social care from formal sector providers can be substantial. An recent cross-country analysis conducted by the OECD concluded that the unsubsidised costs of social care for people aged 65 and over "would be unaffordable in most countries" (OECD, 2024, p. 47).[1] Furthermore, there are generally few private options available for people to purchase insurance against the risks of incurring these costs, and limited capacity or willingness for people to self-insure.[2] Recognition of these factors underlies public support for policies that subsidise receipt of social care.

Nevertheless, substantial gaps remain in existing systems of publicly supported social care, which vary substantially both between countries and across forms of care provision. In an analysis of unmet needs for social care in southern European countries, for example, Albuquerque (2022) finds relatively strong reliance on informal care in Portugal and Greece, relative to Spain and Italy. In Portugal, however, the proportion of people aged 50 and over with an unmet social care needs is over twice that reported for Greece (15.45% c.f. 7.29%). Albequerque concludes by cautioning against treatment of southern European countries as a

[1] The OECD (2024, Figure 3.1) finds that the annual costs of long-term care for people aged 65 and over with severe needs exceed median disposable income in all but two countries Greece (for home care) and Slovenia (for institutional care).

[2] Most available statistical evidence concerning preferences for insurance against the risks of long-term care is reported for the United States; see e.g. Ameriks *et al*. (2020), De Nardi *et al.* (2021), Klimaviciute and Pestieau (2020), Goda (2011), and Cramer and Jensen (2006). For international evidence, see OECD (2020), Section 3.3.

cluster. Meanwhile, the National Audit Office in the UK reported in 2021 that one in four adults aged 65 and over in England had unmet care needs for at least one ADL (NAO, 2021).

Further evidence of international variation in the adequacy of public social care provisions is provided by OECD (2024), who report that the share of total care costs covered by public funding varies substantially across 32 considered countries. These provisions range from near universal coverage in Sweden, Finland, Denmark, Netherlands and Germany, to near zero in Poland, Greece, and Estonia. The OECD study also highlights the substantial variation in public provisions that can exist within countries, as Isreal is reported to provide zero public support for institutional care but near universal support for home care (see also statistics for the Slovak Republic and Slovenia).

Disparities of public coverage of social care needs are likely to widen in context of mounting pressures driven by population aging. The share of people aged 65 and over in OECD countries doubled between 1960 and 2021 to 18%, and is projected to rise to 27% by 2050 (OECD, 2023). Similarly, the share of people aged 80 and over is predicted to double on average across OECD countries between 2021 and 2050, from approximately 1 in 20 (4.8%) to 1 in 10 (9.8%).

A key factor underlying population aging is increased life expectancy; life expectancy at age 65 averaged across OECD countries increased by 6 years between 1970 and 2021. Unfortunately, not all of the increase in life expectancy is in good health. In 2021 approximately half of life expectancy from age 65 (52% for women and 46% for men) was subject to some activity limitation in 26 EU countries (OECD, 2023, p. 213).

These demographic trends put increased pressure on existing systems of public support for social care. Rising life expectancy implies increased demand for social care, at the same time as potential supply of care is depressed by the relative decline of the working-aged (healthy) population. OECD (2022), for example, projects that average public spending on long-term care across 27 EU countries will increase from 1.7% of GDP in 2019 to 2.8% in 2070. These projections vary widely by country, from near zero in Greece, Latvia and Bulgaria, up to 3.4% in Denmark. Similarly, the UK Office for Budget Responsibility projects that adult social care spending will rise from 1.5% of GDP in 2028/29 to 2.4% by 2073/74 (OBR, 2024).

This context has seen a heavy reliance placed upon informal carers to meet social care needs. In the European Union, for example, nearly one-third of inactive women aged 20-64 are not engaged in paid work due to family and care obligations (and 5% of inactive men).[3] Despite the social importance of their role, however, many informal carers suffer from low incomes.[4] Furthermore, the impact of carer responsibilities can have a profound bearing on

[3] Reported by the *European Institute for Gender Equality*: "Gender equality index 2019: work-life balance". Similarly, OECD (2023b) report that over 80% of informal carers are female, and earn on average 20% less than the economy-wide average wage.

[4] For evidence concerning the predominance of lower socioeconomic groups among informal social care providers, see e.g. Quashie *et al*. (2022) and OECD (2023b). Similarly, Aldridge and Hughes

the subsequent life course: it has been observed, for example, that informal carers who exit employment rarely return to employment after their period of care provision ends.[5] However, expanding public subsidies to off-set the costs incurred by informal carers will tend to exacerbate associated budgetary pressures.

A key challenge in the reform of social care policy is how to balance desirable quality of life outcomes against the need to ensure budget sustainability. In the UK, uncertainty over how to balance these competing objectives has resulted in political deadlock for more than two decades. This deadlock has persisted despite successive government reports acknowledging that the existing system of social care support is under "unsustainable strain", that it "is not fit to respond to the demographic trends of the future", and that the lack of government action in face of these facts represents a "national scandal".[6]

This study uses simulation techniques to explore the implications of alternative social care policy options during the prospective half century, focussing on the UK as a case study. Our analysis projects simulated panel data for the evolving population cross-section between 2020 and 2070, and forms a complement to a companion study that explores drivers underlying simulated projections, reported by van de Ven *et al*. (2025). Analysis reported here focusses upon five key simulation scenarios. All materials used for the study are fully-open source, and a step-by-step walkthrough to replicate reported results is provided in Appendix C.

The starting point for analysis is a 'baseline' scenario, designed to represent business-as-usual conditions for the UK. This scenario attempts to address the question of what can be anticipated if conditions currently observed in the UK and anticipated by official government forecasts hold into the future. Analysis focuses upon summary statistics for need, receipt and provision of social care, associated state provisions and incidence of poverty.

A 'high mortality' scenario considers sensitivity of projections to assumptions concerning future improvements in life expectancy. Similarly, a 'healthy life' scenario considers sensitivity of projections to assumptions concerning improvements in "healthy life expectancy". A 'reduced social care gap' scenario considers sensitivity of projections to policy reforms that reduce the projected gap between the incidence of needing and receiving social care assistance. Care is taken in this projection to account for differences between the four constituent nations of the UK (England, Scotland, Wales, Northern Ireland). The fourth and final scenario 'increased carer support' explores the implications of expanding carer related public support payments currently offered in the UK.

(2016) report that the poverty rate among all carers in the UK was 22%, rising to 37% among carers who supply 20 hours of care or more per week. This rise was partly attributed to the fact that 76% of those providing 20+ hours of care per week provide care to someone in their household who was also likely to have limited capacity to work.

[5] See the review by Lilly *et al*. (2007).

[6] HC (2018), HL (2019).

The remainder of this study is organised as follows. UK public support for social care is described in Section 2. Methods used to project the social care provisions through time and associated effects of counterfactual assumptions are described in Section **Error! Reference source not found.**. Results from the analysis are reported in Section 3 and section 4.3.1 concludes.

2 Policy Context

Social care in the current study refers to the provision of personal care, social work, protection, or social support services to people in need or at risk, including older people with needs arising from illness, disability, or poverty.

2.1 Policy overview

In a cluster analysis of the long-term care systems of OECD countries, Ariaans *et al*. (2021) identify the United Kingdom – together with France, Israel, Spain and the United States – as an "evolving private need-based system".[7] The authors note that these systems are oriented towards private financing, in which access to publicly subsidised services is restricted by means-testing and limited service choice.

Local Authorities provide social care services in England, Scotland and Wales supported by central grants, which are distinct from the National Health Service (NHS) that provides health services.[8] This is in common with EU systems of social care more generally (e.g. Spasova *et al.*, 2018). In contrast, provisions for health and social care in Northern Ireland are combined under the Health and Social Care system. Unlike health services provided by the NHS, social care services in the UK are not provided free of charge. Under the Care Act 2014[9], local authorities are required to assess people's eligibility for care and support with reference to nationally administered financial thresholds. This assessment takes into consideration any private assets or income an individual has.

Any private income above an assumed minimum threshold (the Minimum Income Guarantee) reduces financial support for social care £1 for £1. The value of an owner-occupied home is omitted from consideration[10], and assets held in a pension are evaluated as if they were used to purchase a life annuity. Any other capital a person owns above an "upper capital limit" must self-fund their social care costs. People with capital below a

[7] See also Anttonen and Sipila (1996).

[8] There are 152 local authorities in England, 32 in Scotland, and 22 in Wales.

[9] Although the Care Act 2014 applies only to residents in England, it has much in common with the Social Services and Wellbeing Act 2014 (Wales) and the Social Care Act 2013 (Scotland).

[10] This applies only to home care. Assessment of benefits to support residential care generally includes the value of the recipient's home.

"lower capital limit" need only fund social care out of their income. All other people with capital between the upper and lower limits are subject to a tariff rate.[11]

The Care Act 2014 states that an individual is eligible to social care support if: i) they have a need arising from a physical or mental impairment or illness; ii) they cannot achieve two or more activities (of daily living) listed by the act; and iii) the inability to achieve these activities has an impact on the individual's wellbeing. The subjective nature of these criteria gives local authorities a degree of autonomy in relation to the social care support that they provide. Data limitations prevent a detailed exploration of the practical relevance of this autonomy.

In contrast, variation of public provisions for social care between the four constituent nations of the UK are relatively transparent, being described by legislation.[12] It is consequently informative to discuss systematic differences observed between the UK nations.

As noted above, all four nations use means-testing to limit public provisions for social care, but Scotland and Wales apply thresholds that are higher (and therefore more generous) than England and Northern Ireland. Furthermore, each of the four nations differ in terms of services that are exempt from means-testing. In Scotland, personal and nursing care is free for anyone assessed with a tightly defined "eligible social care need"[13] and in Northern Ireland most home-based care is fully subsidised. In contrast, public subsidies for home care in excess of means-tested thresholds are capped in Wales, and are negligible in England.

Formal social care is generally supplied by private sector providers paid for by local authorities, which levy co-payments from recipients. This has resulted in adult social care comprising a sizeable share of total local authority expenditure.[14]

In 2007, the UK government introduced the concept of a *personal budget*, defined as "a sum of money allocated to an adult to meet their assessed social care needs, which can be given to the user as a direct payment or managed on behalf of the user by the local authority or a third party." Any care costs incurred above the personal budget are at an individual's own expense.

In addition to the support for social care provided by local authorities, the UK social welfare system includes a number of targeted benefits for people in need of and/or providing care.

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[11] Income from capital is imputed at the rate £1 per week for every £250 of capital in excess of the lower capital limit.

[12] See, e.g., Reed *et al.* (2021) and Atkins *et al*. (2021). These differences within the UK are relatively minor when considered from an international perspective; see, for example, Robertson *et al*. (2014) for a comparison between provisions in England and international comparators.

[13] Broadly limited to ADLs, available to people aged 65 or over since 2002 and to all adults from 2019.

[14] For example, NAO (2018) report that expenditure on adult social care accounted for approximately 40% of local authority expenditure in England in 2016/17.

Employment and Support Allowance (ESA) is a benefit for the sick and long-term incapacitated, conditional on the claimant's inability to do paid work. From 2008 this replaced Incapacity Benefit and the disability element of Income Support (IS). ESA involves an initial assessment phase of 13 weeks during which a basic allowance is paid. The assessment focuses on capability to work. If claimants are assessed as having a limited capability for work-related activity, they are moved on to the support component, which means receiving a higher rate with no additional conditions. If claimants are assessed to have a capability for work-related activity (WRAG), they receive the work-related activity supplement and must participate in regular work-focussed interviews. From 2012 contributions-based ESA for those on WRAG is limited to a period of 12 months.

Attendance Allowance (AA) is a flat-rate benefit and can be claimed by individuals who need care during the day, at night or both (higher rate) due to their illness or disability. It is taxable. In Scotland, from 2022 it was replaced by the Pension Age Disability Payment but has remained broadly in line with Attendance Allowance.

Disability Living Allowance (DLA) can be claimed by individuals if they become disabled before the age of 65 and have personal care and/or mobility needs. The care component is paid at one of three rates and the mobility component at one of two rates, depending on severity of need. DLA is not taxable. This allowance is being gradually replaced by the Personal Independence Payment (PIP) for working-age adults. In Scotland, from 2022 DLA Child payments were replaced by the Child Disability Payment.

Personal Independence Payment (PIP) has been gradually introduced across the country from summer 2013 for new claimants of DLA aged 16-64. It is very similar to DLA as it is not means-tested, non-contributory and non-taxable. It aims to help working-age adults with some of the extra costs caused by long-term disability or ill-health. As for DLA, PIP has two components, referred to as living and mobility components. Each component has two rates: a standard rate and an enhanced rate. In Scotland, from 2022 PIP was replaced by the Adult Disability Payment. Nevertheless, the Adult Disability Payment continues to share close similarities with PIP.

Industrial Injuries Disablement Benefit is a benefit for people who are long-term incapacitated due to injury at work. It is not taxable.

Carer's Allowance (CA) is a benefit for carers who provide at least 35 hours of care per week to severely disabled people who are themselves not earning more than a specific threshold (£151 per week in 2024). Severe disability is defined as someone getting either the DLA care component or AA. Although there is no upper age limit placed on receipt, payment of Carer's Allowance usually stops due to higher benefits payable from state retirement age. It is taxable and there are additions for dependents.

Carer's Credit provides accreditation for National Insurance contributions which affect contributory related benefits. Carer's credit is provided to people who provide at least 20 hours of care per week to someone receiving selected disability related payments, but who are not eligible for CA.

Carer Premium is an additional component to various means-tested benefits, including Income Support, Jobseeker's Allowance and Housing Benefit. Carer Premium is provided to people receiving (or entitled to) CA. Similar additional components are also provided under means-tested benefits provided by Universal Credit (carer element, working aged population) and Pension Credit (carer addition, retirement aged population).

Scottish Carer's Allowance Supplement is an extra payment for people in Scotland who get Carer's Allowance. It was first paid in December 2018.

Furthermore, various forms of assistance – ranging from help with emergency expenses or essential household to grants and discounts – are made available to carers by some local councils, charities and third-sector organisations in the UK.

2.2 Social care policy reform

Reforms to public support for social care in the UK have been a subject of intense public interest for over two decades, with little practical effect.[15] In 1997, a Royal Commission was established to examine sustainable funding options for long-term care. This commission published its findings in 1999, advocating a significantly more generous means-test and free personal care.[16] Both of these proposals were rejected as being too costly by the government. A subsequent commission was established in 2010 to re-consider funding of social care and support. This commission reported in 2011[17], echoing the 1999 report that advocated for more generous means-testing, and adding the concept of a lifetime cap on social care charges to protect against the risk of extreme costs. The Care Act 2014 legislated for the introduction of the lifetime cap, but this proposal was delayed and then subsequently cancelled due to funding difficulties.

In 2018, a government report concluded that the then existing system of social care support was under "unsustainable strain", adding that "in its present state, the system is not fit to respond to the demographic trends of the future" (HC, 2018, p. 13). Similarly, a 2019 report by the House of Lords concluded that sustained underfunding of the social care sector was a "national scandal" (HL, 2019). The 2019 report supported the proposition of the 2018 report that a government objective should be to provide universal access to free personal care in support of basic activities of daily living, with a target date set for 2025/26 (HL, 2019, p. 6). Subsequent government reports published in 2020 and 2022 reached similar conclusions, though no substantive policy reforms have emerged.[18] Most recently, a Commission was established in January 2025 to build cross-party consensus for the introduction of a National Care Service with the objective of centralising and standardising social care services across the country.

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[15] Harker and Jarrett (2019).
[16] Sutherland (1999).
[17] Dilnot *et al.* (2011).
[18] HC (2020), HC (2022)

The policy deadlock has resulted in deteriorating social care outcomes. The social care workforce is generally characterised by low pay and difficult work conditions, complicating worker engagement and retention.[19] As a result, there is a heavy reliance on informal carers; Banks *et al.* (2023), for example, estimate that the value of informal social care to people aged 65 and over in England in 2018 was between 1 and 3 times the size of formal social care costs. Furthermore, the National Audit Office reported in 2021 that approximately one quarter of adults aged 65 and over in England had unmet care needs for an activity of daily living (NAO, 2021).

There are two key themes underlying government inaction, despite cross-party appreciation of the need for reform to social care policy in the UK. The first is a general acceptance that existing public support for social care is insufficient to meet desired outcomes. The second militating feature is the limited capacity of public finances, both now and in the future.[20] Balancing these competing objectives is a challenge that is shared by many countries across the world. The OECD (2024) suggests three "non-mutually exclusive options" to address the challenge:

- Seek additional sources of funding.
- Improve targeting of public support for social care.
- Improve efficiency of public support for social care.

These themes form the backdrop to the analysis reported in Section 4.

3 Simulation Methods

As noted in the introduction, this study is based on simulated projections for the UK population during the half-century between 2020 and 2070. The projections are derived from an open-source dynamic microsimulation model parameterised to data observed for the UK called SimPaths. The principal source code and user documentation for SimPaths and the 'fork' of the SimPaths project considered for this study are both freely available for download from Github at:

- SimPaths: https://github.com/centreformicrosimulation/SimPaths
- Current study: https://github.com/centreformicrosimulation/WELLCARE/releases/tag/policy-analysis

A recent technical description of SimPaths is reported in Bronka *et al.* (2024) in addition to the dynamically updated documentation available from the SimPaths Github repository.

[19] HC (2020, p. 16), for example, reported that the adult social care workforce in England in 2020 was under "significant pressure, with 122,000 vacancies, a turnover rate of 30.8%, and a quarter of staff employed on zero hours contracts". See also HC (2024).

[20] See Oung (2023) for more detailed discussion.

This section starts with a brief overview of the SimPaths model, before providing a detailed description of the methods used to simulate social care.

3.1 Overview of SimPaths

SimPaths is an open-source structural dynamic microsimulation model of the life-course, coded in Java using the JAS-mine simulation libraries (Richiardi and Richardson, 2017). Individual people in the model are organised in benefit units (for fiscal purposes), and benefit units are organised in households. The model projects data for all simulated individuals at yearly intervals, which reflects the yearly frequency of the survey data used to parameterise the model.

The current analysis is based on a variant of SimPaths that is composed of ten modules: (i) Ageing, (ii) Education, (iii) Health, (iv) Family composition, (v) Social care, (vi) Investment income, (vii) Labour income, (viii) Disposable income, (ix) Consumption, and (x) Statistical display. Each module is composed of one or more processes; for example, the ageing module contains ageing, mortality, child maturation, and population alignment processes. The empirical specifications assumed for dynamic processes include extensive cross-module interaction of simulated characteristics (state variables).

The simulated modules and processes are organised in SimPaths as displayed in Figure 3.1. In each simulated year, agents are first subject to the ageing process, followed by population alignment. By default, the alignment process adjusts the simulated population to match official population projections distinguished by gender, age, and geographic region.

The education module simulates transitions into and out of student status. Students are assumed not to work and therefore do not enter the labour supply module. Individuals who leave education have their level of education re-evaluated and can become employed.

The health module projects an individual's health status, defined by a self-rated general health metric on a five point scale (poor, fair, good, very good, excellent). The health module also determines whether an individual is defined as sick or disabled. Sick and disabled people are not at risk of work and may receive social care.

The family composition module projects the formation and dissolution of cohabiting relationships and fertility. Where a relationship forms, then spouses are selected via a matching process that is designed to reflect correlations between partners' characteristics observed in survey data. The proportion of the population in a cohabiting relationship is, by default, aligned to year-specific population aggregates in the years for which observed data are available.

Females in couples can give birth to a (single) child in each simulated year, as determined by a process that depends on a range of characteristics including age and presence of children of different ages in the household. In case of divergence from the officially projected number of newborns, fertility rates are adapted by an alignment process to match population projections for new-born children distinguished by gender, region, and year. The existence of dependent children is associated with childcare responsibilities.

The social care module projects provision and receipt of social care activities for people in need of help due to poor health or advanced age. The module is designed to distinguish between formal and informal social care, and the social relationships with informal care providers. The social care module accounts for the time cost incurred by informal care providers, and the financial cost incurred by formal care receivers. These features of the model are central to the current report and are described in Section 3.2.

The investment income module projects income based on accrued asset values and exogenously projected rates of return. Similarly, the labour income module begins by projecting potential (hourly) wage rates for each simulated adult. Given these potential wage rates, the employment status of all adult members are projected. Finally, (gross) labour income is then determined by multiplying hours worked by the respective wage rate.

The disposable income module uses information concerning disability, relationship status and fertility, social care, investment income and labour income to evaluate taxes and benefits and disposable income for each projected benefit unit in each year. As discussed in the introduction, the current study considers counterfactuals for informal carers and care recipients. These aspects of the model are also returned to in Section 3.2.

Given disposable income and household demographics, the consumption module projects measures of benefit unit expenditure. Wealth is then projected through time as a accounting identity: wealth next year is equal to wealth this year plus disposable income less expenditure.

At the end of each simulated year, SimPaths generates a series of year specific summary statistics. All of these statistics are saved for post-simulation analysis, with a subset of results also reported graphically as the simulation proceeds.

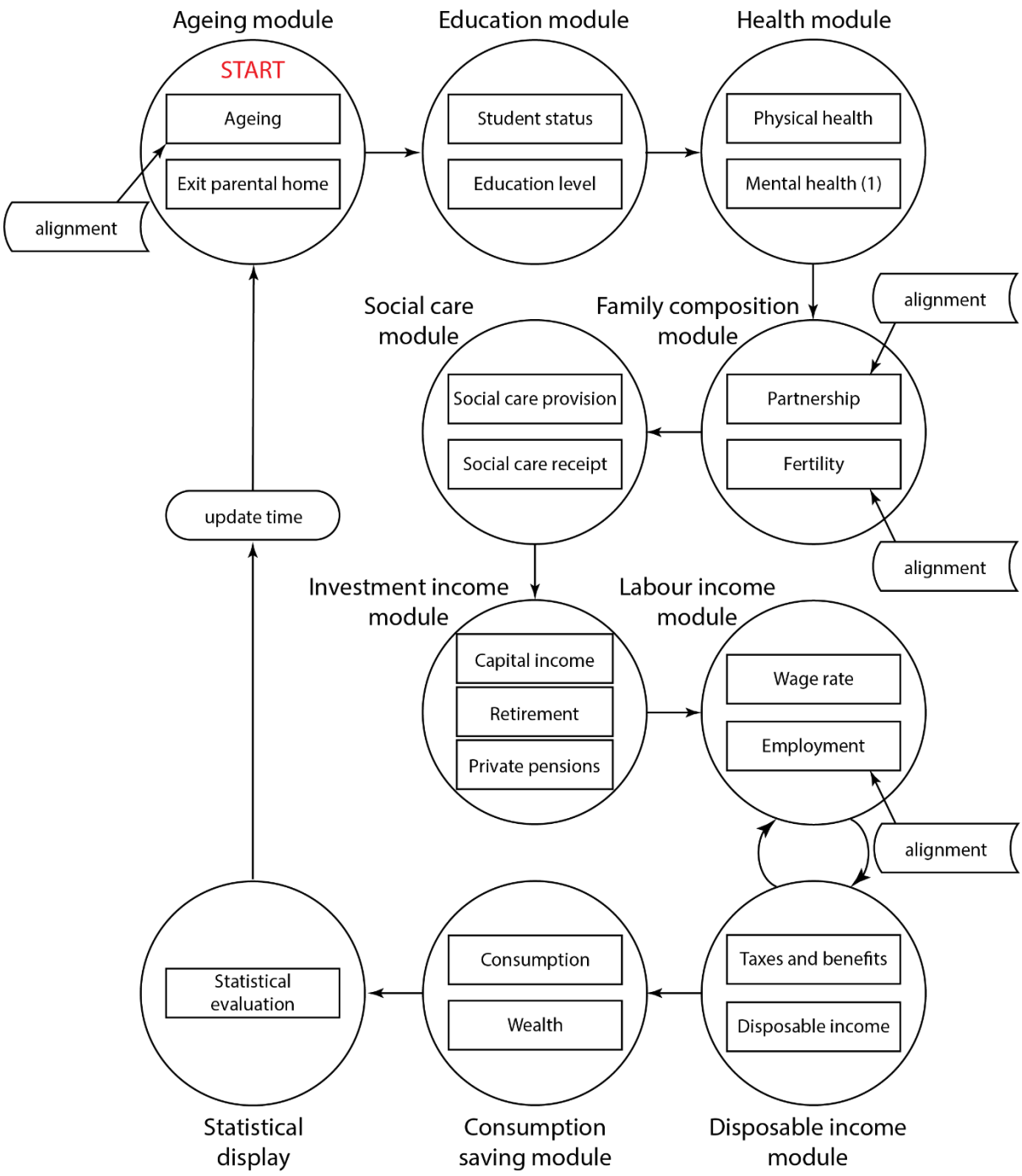


Figure 3.1: Module configuration of the SimPaths microsimulation model

3.2 Simulating social care

This subsection begins by describing the methods used to project need and receipt of social care, before describing projection of (informal) social care provision.

3.2.1 Need and receipt of social care for people aged 65 and over

SimPaths is designed to project social care receipt for the population aged 18 and over. Nevertheless, this study focusses on social care receipt projected for people aged 65 and over, motivated by two key considerations. First, population aging is a principal source of concern regarding sustainability of the public system of social care provision, and this bears primarily on social care among older people. Second, greater statistical detail is available in the UK for parameterising social care receipt for people aged 65 and over, relative to younger people (see Appendix A). This section consequently focuses exclusively on methods used to project social care receipt for people aged 65 and over, with details concerning the more stylised methods used to project receipt of care among younger people reported for completeness in Appendix B.

The current analysis focusses exclusively on home based social care, due to the limited data available for identifying transitions into residential care.[21] Most people currently in receipt of long term care receive care at home, following an EU wide prioritisation of home-based care (Spasova *et al.*, 2018). The OECD (2023), for example, reports that the proportion of long-term care recipients receiving care at home in OECD countries increased from 67% in 2011 to 69% in 2021. Similarly, Banks *et al.* (2023) report that 60% of recipients of public social care in England currently receive care at home.

Nevertheless, it is important to recognise that residential care remains a dominant component of formal social care expenditure in the UK. In 2022, for example, the ONS UK Health Accounts indicate that the value of health care expenditure on providers of home healthcare services was £14.2 billion (2022 prices, 0.57% of GDP), relative to £34.1 billion (1.36% of GDP) on providers of residential long-term care facilities.[22]

Social care provisions for individuals aged 65 and over are projected using the following process:

1. The incidence of needing care is modelled following probabilities described by a probit equation (Table 3.1, left panel).
2. The incidence of receipt of care is also modelled as a probit equation (Table 3.1, right panel).

[21] Transitions into formal care were included as a question in the forerunner to the UKHLS (British Household Panel Survey), but were discontinued due to very low response numbers.

[22] ONS Reference tables accompanying the 2022 UK Health Accounts and 2023 provisional estimates, Table 4a.

3. If in receipt of care (from 2), a multinomial logit equation (Table C.7) is used to determine if the individual receives: i) only informal care; ii) formal and informal care; or iii) only formal care.
4. If in receipt of informal care (from 3), a multi-level model is used to distinguish between alternative providers of informal care. The first level (Table C.8) considers whether a partner provides informal care, for individuals with partners and in receipt of some informal care. For individuals who receive social care from their partner, the second level uses a multinomial logit (Table C.9) to consider whether they also receive care from a daughter, a son, or someone else (other). For individuals in receipt of informal care who do not have a partner caring for them, another multinomial logit (Table C.10) considers six alternatives that allow for up to two carers from "daughter", "son", and "other".
5. For each carer (from 3 and 4), a log linear equation (Tables C.11 to C.15) is used to project number of hours of care provided.
6. Hours of formal care are converted into a cost, based on the year-specific mean hourly wages for all social care workers, as reported in.[23]

All of the regression specifications listed above were estimated on panel data reported by the "social care" module of the UK Household Longitudinal Study (UKHLS, see Appendix A.3). This is important because it permits lag dependent variables to be included for analysis, thereby capturing intertemporal persistence. The social care module is reported at two year intervals – waves "g", "i" and "k" – by the UKHLS and interpolation methods were used to reflect the annual periodicity of SimPaths (see Appendix A.3.1). The probit regressions used to identify incidence of need and receipt of social care are of particular relevance for this study and so are discussed at length here. Other regression specifications noted above are reported for completeness in Appendix B.2.

Table 3.1 reports regression statistics of probit regressions of needing and receiving social care for people aged 65 and over. Individuals were identified as "needing care" if they reported requiring help with at least two of the activities of daily living (ADL) or instrumental activities of daily living (IADL) reported by the UKHLS. The focus on ADLs to identify "need of care" is common in the associated literature and reflects conditions for public support set out (for example) by the Care Act 2014. Similarly, "receipt of care" was identified for any survey respondent who indicated that they needed and received help with at least one of the activities of daily living reported by the UKHLS in the week preceding the survey.

The same set of explanatory variables are considered for the probit equations governing need and receipt of social care. These variables include gender, education status,

[23] Where the simulated year lies outside the time-series reported in the table, the series is extended assuming a (geometric) growth rate of 3.1% per annum. This growth rate is the average reported between 2011 and 2022 in **Error! Reference source not found.**, and is greater than the rate assumed for inflation of 2.6% per annum.

relationship status, self-reported health status, age, and geographic region. Each regression also included a one-year lag of the dependent variable to reflect persistence. This set of covariates corresponds to pre-determined variables for social care in the schedule used by SimPaths to project data for any given year.

Coefficient estimates reported in Table 3.1 for need and receipt of social care share close similarities, alluding to the close correspondence between the respective states. The incidence of social care tends to be lower for men than for women, after controlling for the remaining set of covariates. Caution should be exercised in interpreting this result, which may reflect under-reporting of gender biases in informal care among partner couples later in life. It is nevertheless consistent with estimates reported elsewhere in the literature (e.g. Albuquerque, 2022).

Rates of social care tend to vary inversely with education level, which is also consistent with findings generally reported in the associated literature. This result may reflect a higher incidence of physically demanding work histories among lower educated survey respondents. Higher likelihoods of needing/receiving care are also associated with need/receipt of care in the preceding year, having a partner, poor health and advanced age. These relationships are generally as anticipated, with the possible exception of the positive relationship between need of care and partnership status. In this last respect, it is notable that partnership plays a key role in social care provision, and this may also have a positive impact on reported incidence of needing care among survey respondents.

Note that the reference group for the dummy variables by age reported in Table 3.1 is age 65 to 66, which has an (implicit) estimate of 0. This parameter departs with the other age parameters reported in the table, which tend to increase with age as noted above. In contrast, parameter estimates for age fall significantly from age group 65-66 to 67-68. The reason for the departure is the omission of observations under age 65, so that age 65 observations omit the lag variable on care need / receipt, which positively affect associated likelihoods.

The regression estimates reported in Table 3.1 for dummy variables identifying UK regions are mostly statistically insignificant at any reasonable confidence interval. The exceptions in this regard are of particular note. First, both need and receipt of social care are associated with significantly higher likelihoods in Northern Ireland, relative to the reference region (Yorkshire and Humber). Second, receipt of social care is also associated with significantly higher likelihoods in Wales and (marginally) Scotland. These last observations may reflect differences in public provisions for social care between UK constituent countries as discussed in Section 2.1. This issue is returned to in Section 3.3.

Summary measures of fit described in the notes to Table 3.1 indicate that the assumed regression specifications are associated with appreciable explanatory power. The Pseudo (McFadden's) R-squares of the respective regressions are 0.568 and 0.537, and correct predictions for of the estimated samples are (at 91% and 90%) are substantially higher than would be obtained by a models comprised only of regression intercepts (71% and 78%).

Table 3.1: Probit regression estimates for need and receipt of social care; people aged 65+

	need care			receive care		
	Coef.	s.e.	p>z	Coef.	s.e.	p>z
Gender (Ref = Women)						
Men	-0.040	0.0293	0.173	-0.100	0.0284	0.000
Education Level (Ref = High)						
Medium	0.074	0.0402	0.064	0.026	0.0388	0.498
Low	0.180	0.0420	0.000	0.082	0.0407	0.045
partner	0.216	0.0324	0.000	0.201	0.0312	0.000
need care (lag)	2.429	0.0342	0.000	2.296	0.0322	0.000
Self-rated health (Ref = Excellent)						
Very good	0.082	0.0818	0.313	0.124	0.1009	0.218
Good	0.395	0.0786	0.000	0.498	0.0986	0.000
Fair	0.836	0.0796	0.000	0.916	0.0993	0.000
Poor	1.404	0.0903	0.000	1.423	0.1069	0.000
Age group (Ref = 65-66)						
67-68	-0.322	0.0580	0.000	-0.250	0.0566	0.000
69-70	-0.241	0.0554	0.000	-0.121	0.0541	0.025
71-72	-0.177	0.0538	0.001	-0.128	0.0530	0.016
73-74	-0.084	0.0563	0.134	-0.070	0.0551	0.204
75-76	-0.036	0.0593	0.543	-0.030	0.0593	0.612
77-78	0.032	0.0621	0.603	0.059	0.0612	0.337
79-80	0.082	0.0662	0.215	0.141	0.0631	0.026
81-82	0.061	0.0681	0.374	0.205	0.0662	0.002
83-84	0.194	0.0683	0.005	0.289	0.0659	0.000
85+	0.532	0.0647	0.000	0.542	0.0634	0.000
Region (Ref = Yorkshire and Humber)						
North East	-0.010	0.0868	0.909	0.011	0.0841	0.897
North West	-0.022	0.0663	0.742	-0.008	0.0639	0.901
East Midlands	0.104	0.0719	0.147	0.007	0.0698	0.922
West Midlands	0.097	0.0696	0.162	0.093	0.0657	0.157
East of England	0.066	0.0664	0.320	0.044	0.0633	0.487
London	-0.086	0.0795	0.281	-0.030	0.0770	0.700
South East	0.063	0.0632	0.319	-0.031	0.0622	0.621
South West	0.038	0.0658	0.566	0.019	0.0630	0.765
Wales	0.113	0.0690	0.102	0.147	0.0672	0.028
Scotland	0.064	0.0667	0.337	0.105	0.0642	0.104
Northern Ireland	0.268	0.0680	0.000	0.238	0.0669	0.000
Constant	-2.356	0.1049	0.000	-2.346	0.1155	0.000

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.

Notes: Observations=20,464. Regression “need care”: proportion positive=0.291; correct predictions=0.910; pseudo R-square=0.568. Regression “receive care”: proportion positive=0.212; correct predictions=0.902; pseudo R-square=0.537. Positive predictions identified at 50% likelihood cut-off. Sample limited to individuals aged 65 and over without missing variables. Weighted estimates with robust standard errors. "lag" defined as preceding year.

The simulations reported in Section **Error! Reference source not found.** use Monte Carlo methods to project need and receipt of social care, based on probabilities described by the probit regression statistics reported in Table 3.1. Importantly, projections for need and receipt of care are based on the same random draw from a uniform [0,1] distribution. This implies that, where the probability of needing care exceeds the probability of receiving care, then care will only be simulated where it is needed. Hence, in the current context unmet care needs reflect the degree to which probabilities describing needs for care exceed those of receiving care.

3.2.2 Informal provision of social care

The model is adapted to project provision of social care by informal sector providers; the characteristics of formal sector providers of social care are beyond the scope of this study. Projections for receipt of social care described in Section 3.2.2 identify the incidence and hours of informal social care received, the relationship between those in receipt of informal social care and their informal care providers, and the persistence of those care relationships. These details potentially provide much of the information necessary to simulate provision of informal social care.

Use of the information outlined above for projecting supply of social care is complicated by limitations of the "social links" between individuals that are described by the input data from which model projections are made. Specifically, the input data do not include comprehensive information concerning links between adult children and their parents, or the wider social networks that often supply informal social care services. The method that is used to project informal provision of social care is designed to accommodate these limitations in a way that broadly reflects projection of social care receipt.

Specifically, the model distinguishes between four population subgroups with respect to provision of informal social care: (i) no provision; (ii) provision only to a partner; (iii) provision to a partner and someone else; and (iv) provision but only to non-partners. For people who are identified as supplying informal care to their partner via the process described in Section 3.2.1, a probit equation (Table B.12) is used to distinguish between alternatives (ii) and (iii). Similarly, for people with a partner to whom they do not supply care, another probit equation (Table B.13) is used to distinguish between alternatives (i) and (iv). The incidence of informal social care provision among single people is identified by another probit equation (Table B.14), and a subsequent multinomial logit regression is used to distinguish who single people provide care to (Table B.15). Finally, a log linear equation (Table B.16) is used to project number of hours of care provided, given the classification of who care is provided to.

3.2.3 Simulating public support for social care

The current analysis focuses on public support for social care recipients and informal carers.

Social care recipients

As discussed in Section 2, analysis of support to social care recipients in the UK is complicated by opacity of public interventions stemming from a decentralised administration. Nevertheless, important features of this support concerns the degree of means-testing, and the scope of interventions that are unconditionally provided by the public. SimPaths is designed to capture both of these features.

The probit equations discussed in Section 3.2.1 are designed to capture regional heterogeneity in the scope of interventions that are unconditionally provided. As noted above, little statistically significant variation in social care need is identified between regions of the UK, except for the significantly higher rates of need identified for Northern Ireland. In contrast, higher rates of social care receipt are associated with Scotland, Wales and Northern Ireland than in England. As discussed above, these cross-country differences reflect variation between the respective countries in terms of services that are exempt from means-testing. These features are consequently built into the model and are a focus of discussion in Section 4.

In terms of means-testing, the model is designed to take into consideration the limitation of public support for formal care expenditure associated with the assets that a benefit unit holds. It is important to recognise, however, that the model is not well equipped to capture detail in this respect, as exempt assets including pensions and housing are not modelled separately from wealth subject to means-tests. The counterfactual scenarios considered for analysis, described in Section 3.3, are adapted to this limitation by focussing on innovations around the "care gap" (difference between social care need and receipt), rather than means-testing rates and thresholds.

Informal carers

Section 2.1 describes an array of benefit schemes that provide support to people affected by disability and their (informal) carers in the UK. SimPaths imputes tax and benefit payments from a database derived from a static tax-benefit calculator (UKMOD), following the approach described by van de Ven *et al*. (2025b).

The method used to impute tax and benefit payments involves matching simulated observations with "donors" described by a reference database. The reference database was evaluated by using UKMOD to simulate tax and benefit payments for the UK population cross-section observed in 2019 obtained from the Family Resources Survey. Importantly, the resulting database accounts for all of the welfare schemes of that are outlined in Section 2.1.

Donor selection is based on a matching algorithm that starts with coarsened exact matching over a selected set of features. These features include the number and age of benefit unit members, the incidence of formal childcare costs, carer responsibilities, employment and disability status of adult members, and income quintiles. Having identified a broad group of candidate donors, the matching algorithm uses nearest neighbour matching with respect to Mahalanobis distances evaluated for original (pre-tax and benefit / private) income and childcare costs.

Having matched a simulated observation to a database donor, disposable income is imputed for the simulated observation based on the ratio of disposable to private (pre-tax and benefit) income described by the database for the donor.

3.3 Scenarios for analysis

As noted in the introduction, the current study is based around five simulated scenarios: a baseline scenario as outlined by the sections above and four counterfactuals that explore sensitivity of the baseline scenario to selected changes in the simulated environment. Each of the counterfactual scenarios are described here in turn.

3.3.1 High mortality

SimPaths is designed to account for age, gender and year specific mortality rates underlying the 2020-based principal population projections reported by the ONS. A key concern regarding budget sustainability of the existing system of public social care provisions is due to increases in life-expectancy underlying official population projections. The 'high mortality' scenario considers sensitivity of simulated projections to assumed life-expectancy. This is done by addressing the question: what are the effects on simulated projections of holding all age and gender mortality rates fixed at their 2019 values?

An appreciation for the impact of this counterfactual might be obtained by considering Figure 3.2, which reports period life expectancies at age 65 for men and women implied by the mortality rates underlying the 2020-based principal population projections reported by the ONS. These life expectancies increase persistently over the period between 2019 and 2070, with the exception of a dip at 2020 due to the Covid-19 pandemic. For men, period life expectancy increases by 3.8 years over the reported period to 22.3 years in 2070, and 3.4 years for women to 24.2 years.

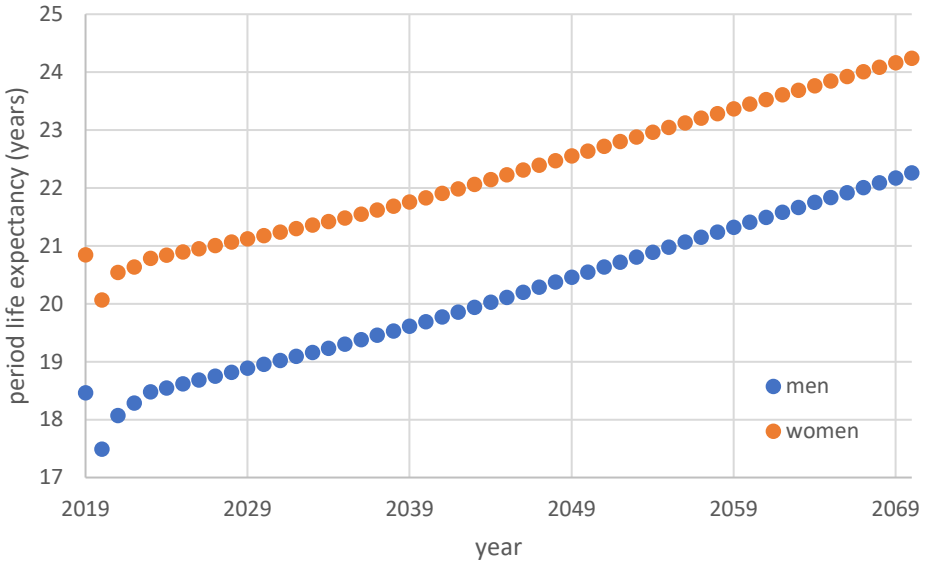


Figure 3.2: Period life expectancies at age 65 by gender and year

Source: Authors' calculations from age, gender and year specific mortality rates reported by the Office for National Statistics associated with the 2020-based principal population projections.
Notes: Period life expectancies are evaluated using mortality rates from a single year assuming that those rates continued to apply throughout the remainder of a person's life.

3.3.2 Healthy life

Improvements in healthy life could off-set the increase in social care demand associated with rising longevity. The 'healthy life' scenario consequently considers sensitivity of simulated projections to a shift in the relationship between age and social care need. This is done by addressing the question: what are the effects of discounting increases in age from 65 by 25% when evaluating probabilities for care need and receipt?

This scenario is implemented by discounting ages when evaluating probabilities implied by the probit regression coefficients for care need and receipt reported in Table 3.1. Hence a person aged 75 will be treated as though they were aged 73 (= 65 + (75-65)/1.25), so that they will be identified as belonging to the 73 to 74 age band under the healthy life scenario, rather than the 75 to 76 age band as under the baseline scenario.[24] For partial years a mid-point cut-off is considered. Hence, an individual aged 69 will have a discounted age of 68.2 (= 65 + (69-65)/1.25), placing them in the 67 to 68 age band under the healthy life scenario, rather than the 69 to 70 age band as in the baseline scenario. As coefficients describing the incidence of need and receipt of social care reported in Table 3.1 tend to increase with age band, the healthy life scenario will tend to depress the simulated demand for social care.[25]

[24] For anyone aged over 65 in the first simulated year, discounting is applied from their age in the first simulated year.

[25] As discussed in Section 3.2.1, the principal departure from monotonically increasing coefficients with age band is from the reference group (age 65 to 66) to the first identified age band (67 to 68). This departure does not influence comparisons between the healthy life and baseline scenarios, as each

3.3.3 Reduced social care gap

The above discussion tends to highlight differences in public support for social care recipients between the four constituent nations of the UK. Nevertheless, it is important to recognise that all four nations share a common set of aims that have guided contemporary policy reforms, and must cope with a common set of challenges looking forward.[26]

The 'reduced social care gap' scenario is designed to address the question: what would be the effects of converging the system of public support for social care recipients throughout the UK to those prevailing in Scotland? This scenario involves replacing all of the region-specific estimates reported in Table 3.1 with the parameter estimates reported for Scotland. The scenario is denoted the 'reduced social care gap' scenario because the estimates reported in Table 3.1 imply a smaller gap between the incidence of need and receipt in Scotland than in the remainder of the UK; this can be seen by taking the difference between region specific coefficient estimates in the right and left panels of the table.

3.3.4 Increased carer support

The 'increased carer support' scenario explores the effects of increasing the generosity of state benefits paid to informal carers. The increased carer support scenario is identical to the baseline scenario, except for the specification of the Scottish Carer's Allowance Supplement discussed in Section 2.1. In the counterfactual scenario, Scottish Carer's Allowance Supplement is extended to carers throughout the UK, and its generosity is increased. In 2024, Carer's Allowance was worth £81.90 per week and the Scottish Carer's Allowance Supplement was worth £577.20 per annum (£11.06 per week). The counterfactual considered here increases the value of the Carer's Allowance Supplement to £4577.20 per annum (£87.72 per week), giving a maximum benefit of £169.62 per week. This figure may be compared with the earnings cap of £151.00 per week imposed on eligibility for Carer's Allowance.

Note that the increased carer support scenario alters only the generosity of carer support payments in the UK, and does not alter the associated conditionality. This is important, as conditionality of carer support payments introduces a range of practical issues, some of which (e.g. limitations concerning the individuals receiving care) SimPaths is ill-equipped to deal.

4 Results

4.1 Baseline

Figure 4.1 displays the evolution of the number of people projected under the baseline scenario to require help with two or more activities of daily living (ADLs or IADLs) during

individual is treated as though they were between ages 65 and 66 for at most two years by both scenarios.

[26] See Atkins *et al*. (2021), p. 40.

the simulated time horizon. From 4.0 million in 2020, the number of people in need of social care is projected to more than double to 8.6 million by 2070. 2.5 million of this increase is projected to be among people aged 80 or over, with a further 1.1 million among people aged 65 to 79. These flows are driven by population aging, with the total population aged 80 and over projected to increase by 2.5 times (to 9.1 million) over the 50 year time horizon.

Not all of the people who need social care displayed in Figure 4.1 are simulated to also receive care. Figure 4.2 reports the proportion of the population in need of care who are simulated to not receive care – referred to here as the 'care gap' – distinguished by simulation year and UK country of residence. Note that this definition of the care gap focusses upon "incidence", rather than "intensity" in the sense that it is concerned only with identifiers for need and receipt, rather than a more general definition that focusses upon the extent to which people's needs are unmet.[27]

Figure 4.2 displays downward trends in the care gap for all four countries of the UK. From a (weighted) average of 16% in the UK in 2020, the simulated care gap falls to 8% in 2070. Note, however, that the trends reported in Figure 4.2 are implied by statistical relationships described by contemporary survey data, as discussed in Section 3.2.1 (see especially Table 3.1). Importantly, they do not reflect a balance between care needs and the supply of care providers. We return to discuss implications of this omission below.

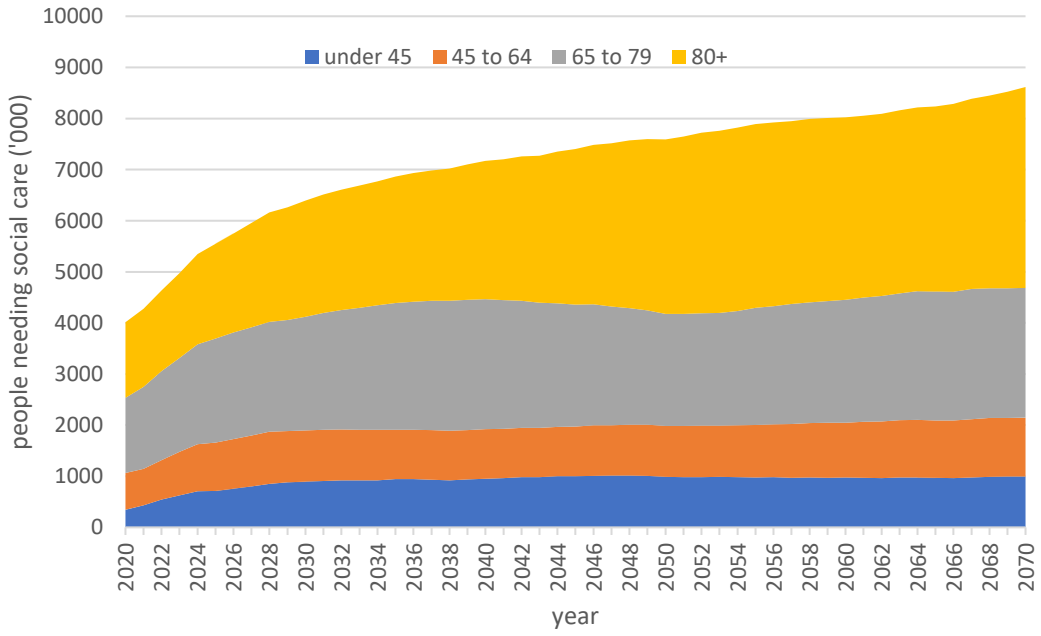


Figure 4.1: Number of people in need of social care, by age band and simulated year

Source: Authors' calculations on simulated data derived from the SimPaths microsimulation model.

[27] Broader definitions of the social care gap will tend to identify larger gaps. For example, the National Audit Office reported in 2021 that approximately one quarter of people aged 65 and over in England had unmet care needs for an activity of daily living (HC, 2021).

The cross-country variation displayed in Figure 4.2 is of particular interest. The figure indicates that projected care gaps are highest in England, declining slightly (by approximately 1 percentage point) for Northern Ireland, and by a wider margin (approximately 4.5 percentage points on average) for Scotland and Wales. These respective disparities are touched upon in Section 3.2.1, where differences between estimates for country specific dummy variables reported for the probit regressions that underly the current projections are attributed to differences in public support for social care, as discussed in Section 2.1. We return to explore the impact that closing these differences between UK countries would have on simulated projections in Section **Error! Reference source not found.**. A final point to note in relation to Figure 4.2 is that the relative volatility of the country specific series reported in the figure reflects respective sample sizes.[28]

Projections for total hours of social care received, distinguished by age band, are displayed in Figure 4.3.[29] Comparing Figures 4.1 and 4.3 reveals close similarities between projections for care need and hours of care received. These similarities are driven by the intertemporal stability of the care gap that is discussed above, and the omission of temporal trends from regressions used to project hours of care received, as reported in Appendix B.2. Total annual hours of social care receipt are projected to increase from approximately 3 billion in 2020 to just under 7 billion in 2070. Increases are projected for all age bands displayed in the figure, but especially those aged 80 and over, who are projected to receive an additional 1.8 billion hours per year of social care by 2070 (to 2.9 billion).

[28] In 2020, for example, the population for projections against which model projections were aligned are comprised of 56.3 million people for England, 3.1 million for Wales, 5.5 million for Scotland, and 1.9 million for Northern Ireland.

[29] Measures of financial value of care received implied by the hours of care reported here are displayed in Figure D.1.

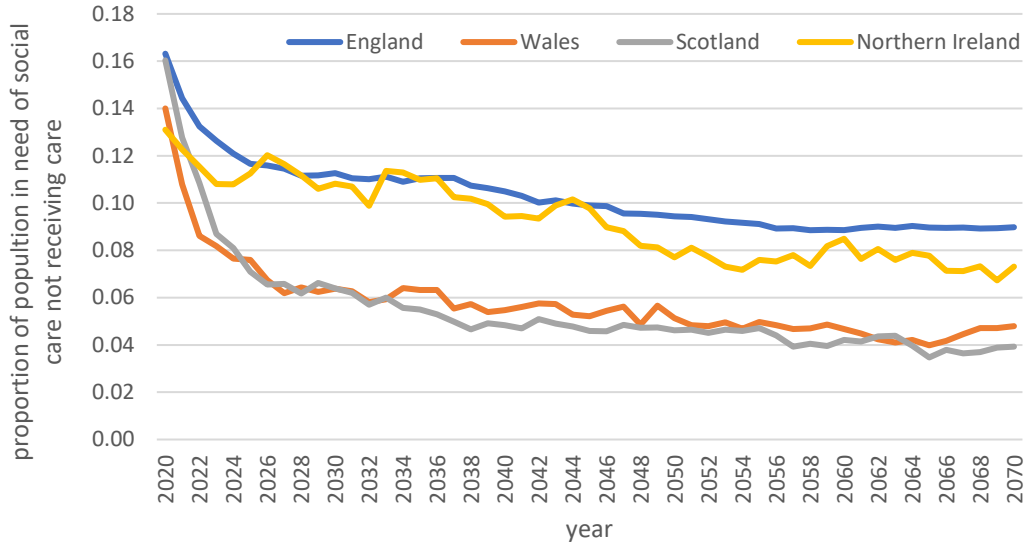


Figure 4.2: Evolution of social care gap for people aged 65 and over, by year and country

Source: Authors' calculations on simulated data derived from the SimPaths microsimulation model.
Notes: "Social care gap" defined here as the number of people in need of social care who do not receive care.

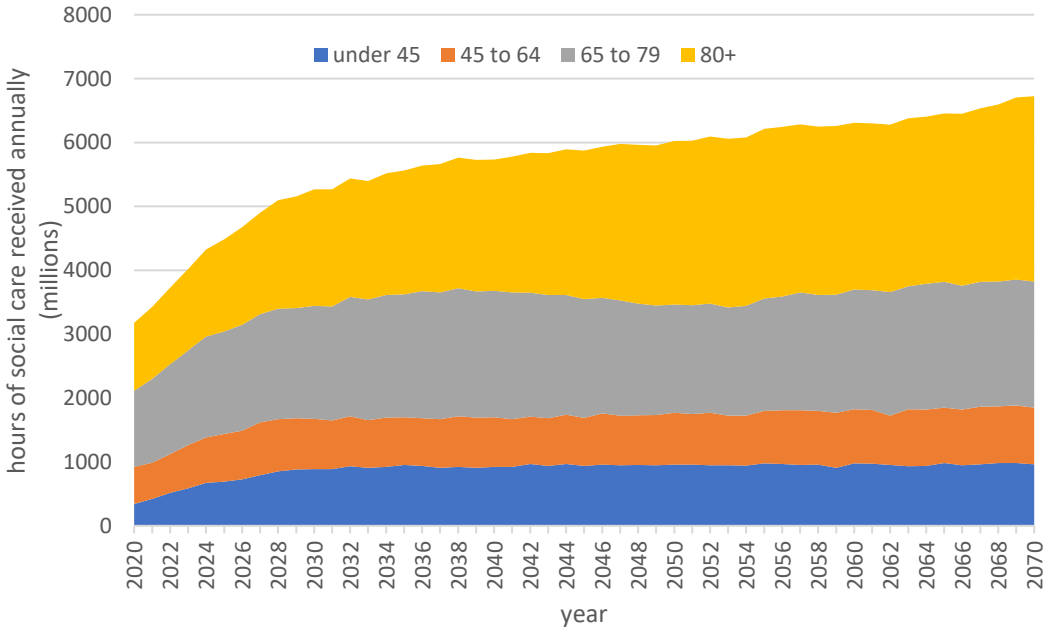


Figure 4.3: Hours of social care received by carer age band and simulated year

Source: Authors' calculations on simulated data derived from the SimPaths microsimulation model.

Informal carers are projected to provide between 86 and 90 percent of simulated care hours throughout the projected time period. Projections for the total number of hours of care provided by informal carers are displayed in Figure 4.4. This figure indicates a gradual increase in the number of simulated hours of informal care, from 6.4 billion in 2020 to 8.9 billion in 2070. The increase in hours of informal care per year rises from 390 million among carers aged under 65 to 870 million among carers aged 65 and over. Furthermore, the figure tends to understate the proportional increase in the number of informal carers aged 65 and over projected by the analysis, as older carers are each projected to supply a fewer number of hours of care than their younger counterparts. Hence, the projections suggest that the increase in social care needs associated with population aging can be partly met by increasing informal care provision among older people.

Nevertheless, Figure 4.4 highlights that people under age 65 are projected to account for a majority of informal care provision throughout the simulated time horizon. Specifically, the share of informal care provided by people under age 65 is projected to decline from 70% in 2020 to 59% in 2070.

Furthermore, comparing hours of care receipt reported in Figure 4.3 against hours of care provided in Figure 4.4 indicates stronger growth projected for the former than the latter. Specifically, whereas total hours of social care received are projected to increase by 4 billion hours per year between 2020 and 2070, total (informal) care provided is projected to rise by 2.5 billion hours.

As noted above, the simulations do not attempt to match care supply to care received. This omission is due to limitations of the data that are available for parameterisation.[30] One feature of the data used to parameterise the model is that care recipients tend to report providing a larger number of hours of informal social care than care recipients report receiving. This can be seen in figures reported here, where the hours of social care provision reported in Figure 4.4 systematically over-state projected hours of social care receipt reported in Figure 4.3.

Measurement error may help to explain differences in reported hours of care provided and received as described by survey data. Another possible explanation is if survey respondents included in their reports of the time they spent caring any associated travel time, or time in between specific care activities. Were such biases to apply, then it would be reasonable to anticipate that an increase in projected hours of care receipt ought to be associated with a *larger* increase in the hours of care provided, rather than the smaller number of hours as described above. These observations all imply a tightening of the market for informal social care.

[30] See our van de Ven *et al*. (2025) for detailed discussion of this issue.

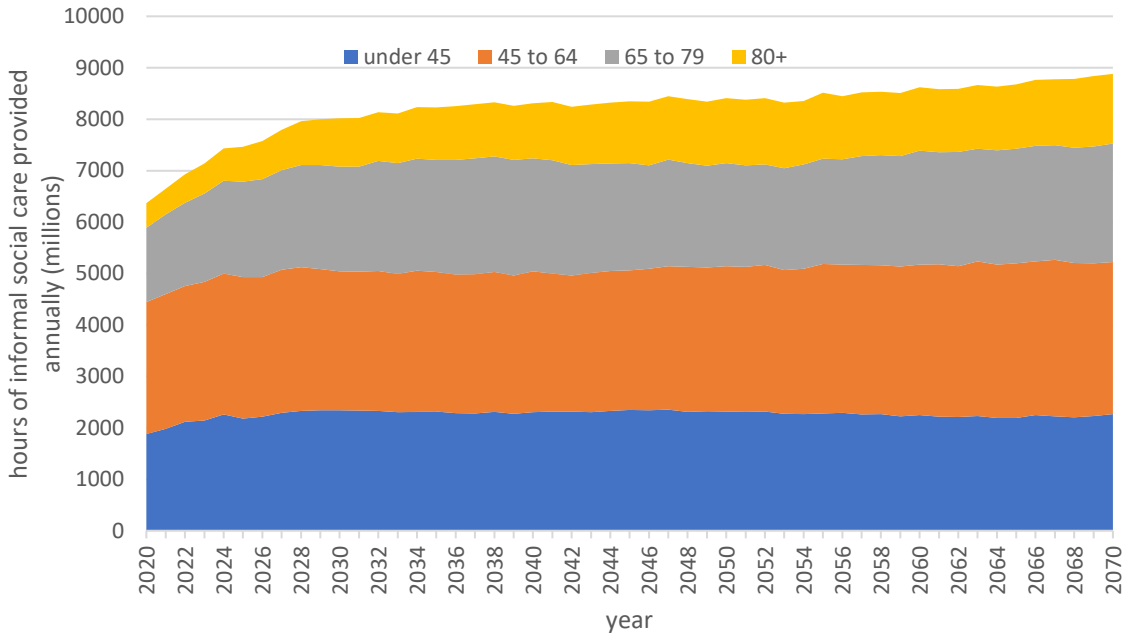


Figure 4.4: Hours of informal social care provided per year, by age band and year

Source: Authors' calculations on simulated data derived from the SimPaths microsimulation model.

The above discussion highlights the increasing social value associated with informal carers implied by the simulations, and carers under age 65 in particular. It is consequently interesting to consider how informal carers are projected to fare in the simulations.

Between 47 and 51 per cent of carers under age 45 are projected to receive benefits as a result of their caring activity. This share falls to between 43 and 45 per cent for carers between age 45 and 64, and is negligible at higher ages. These projected rates of benefit receipt among carers reflect the incidence of carer benefits in the Family Resources Survey used for imputing transfer payments in the model (see Section 3.2.3). They are influenced by the conditionality of benefits eligibility (discussed in Section 2.1) in addition to considerations like imperfect benefits take-up. Furthermore, the value of carer benefits per recipient projected by the model is projected to remain broadly stable in real-terms, at approximately £530 per month for carers under age 45, rising to approximately £600 per month for carers aged 45 to 64.[31]

Hence, projections are broadly stable for the number of carers under age 65, the proportions of carers receiving state support, and the value of benefits per recipient. These three features imply that the total value of state subsidies to carers is also projected to remain stable – at approximately £19Bn (2024 prices) – over the simulated time horizon. This stability contrasts with the projected rise in (informal) social care receipt discussed above.

[31] These benefit values denote the surplus of simulated benefits paid to carers, relative to the benefits that individuals would receive if they did not provide care.

The projected value of carer state subsidies can be compared against the projected informal social care received by pricing the hours of social care reported in Figure 4.3 by carer hourly wage rates. Figure 4.5 reports the ratio of aggregate welfare payments to carers to the value of informal care received. This figure indicates that simulated welfare benefits to carers are projected to cost the state just over half (55%) the value of all informal social care received in 2020. Thereafter, while the aggregate cost of carer benefits remains broadly constant, informal social care increases, so that the ratio reported in Figure 4.5 falls throughout the simulated time horizon, finishing at 13% in 2070. These observations argue in favour of increasing public support payments for informal carers in the future.

Further evidence concerning carer welfare is displayed in Figure 4.6, which reports selected poverty statistics implied by the simulation baseline scenario. Poverty rates for the full population (reported in blue) display a gradual upward drift over the simulated time horizon, from 24% in 2020 to 31% in 2070. Poverty rates for all carers also displayed in the figure (reported in grey) slightly understate the population averages, by an average of 3.4 percentage points over the simulated time horizon.[32] The lower average poverty rates reported for all carers, however, mask high rates of poverty particularly among younger carers.

Poverty statistics for all carers under age 45 (reported in red in Figure 4.6) are substantially higher, commencing at 36% and rising to 53% by 2070. The steeper rise with time projected for younger carers is attributable in part to the fact that welfare benefits are assumed to be indexed to prices, whereas wage rates exhibit real growth.

As discussed above, approximately half (47 to 51%) of carers under age 45 are simulated to receive carer support payments. While carer support payments are found to reduce poverty among carers under age 45 (the yellow relative to the red series), the effect is limited to approximately 5 percentage points early in the simulated period, rising to 10 percentage points late in the period. The reason for the limited influence of carer welfare benefits on projected poverty rates is clarified by the associated poverty gap (reported in cyan, right axis). This varies between £3,000 and £5,500 per annum during the sample period, which is in a similar range to the average benefits projected for carers over the simulated period, as discussed above. As discussed in Section 2.1, higher benefits are payable to Scottish residents in the simulation than the remainder of the UK. The influence of extending these benefits to the rest of the UK in the simulations is explored in Section **Error! Reference source not found.** below.

[32] The projected poverty rates among all carers reflects measures reported in the associated literature; see, e.g., Aldridge and Hughes (2016).

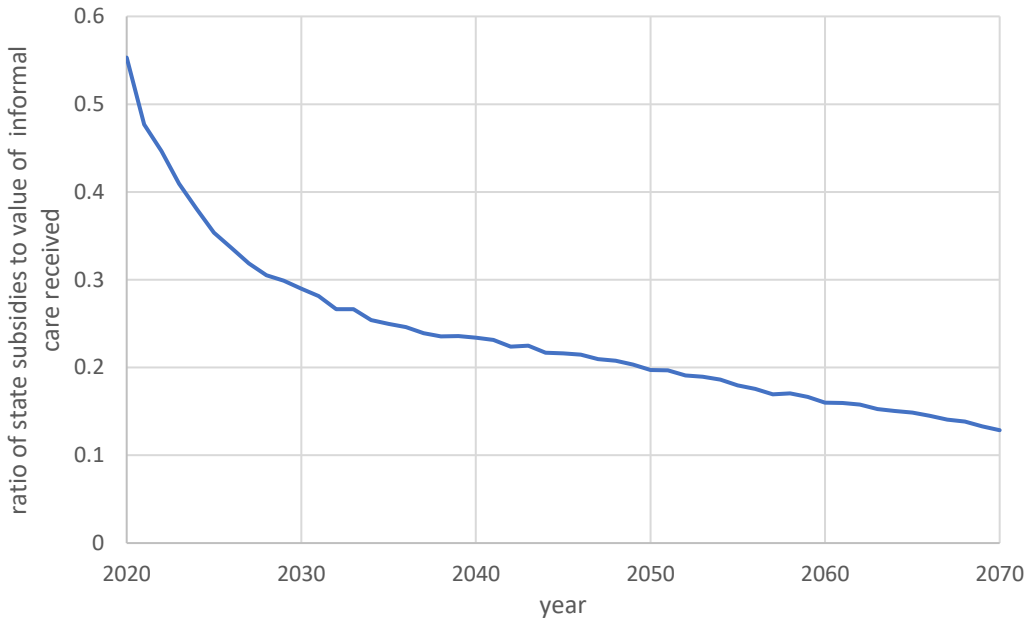


Figure 4.5: Total annual state subsidies to carers divided by value of annual hours of informal care received

Source: Authors' calculations on simulated data

Notes: Projections for value of social care received obtained by interacting hours of social care received by year-specific projections for hourly wages of care workers. Hourly wages of care workers reported for 2020 to 2023 by ONS Earnings and hours worked, care workers: ASHE Table 26. Projections for hourly wages based on median reported wages, adjusted to reflect wage growth and adjusted to 2024 prices based on the CPI reported by the OBR in its baseline projections reported 16 May 2024. See Figure D.2 for projected value of informal care received.

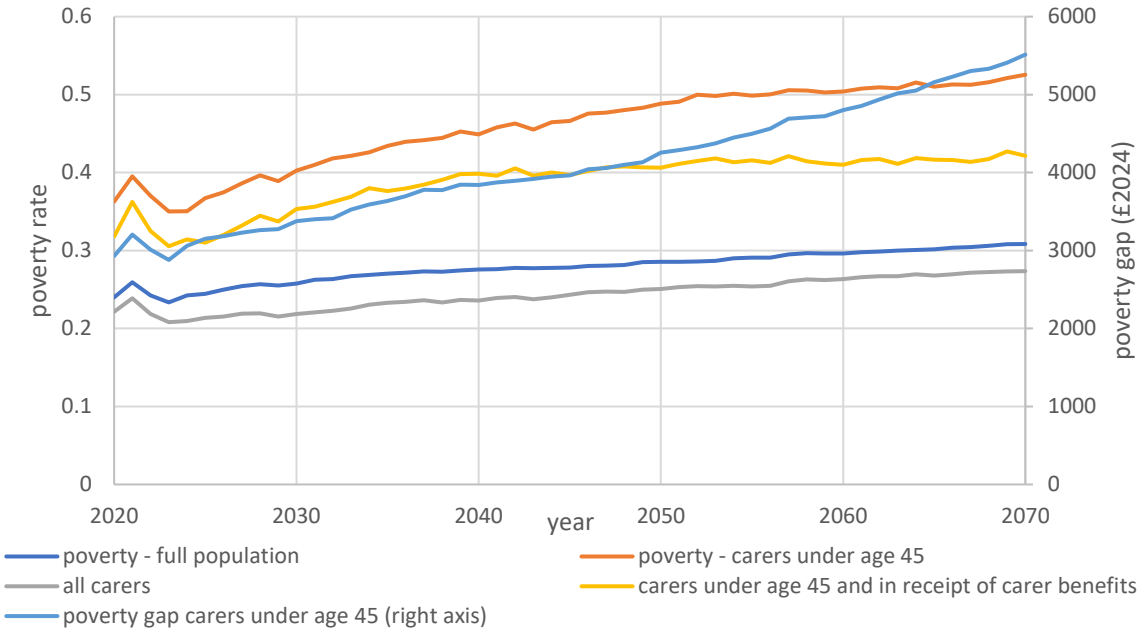


Figure 4.6: Poverty metrics by carer status and age band

Source: Authors' calculations on simulated data

Notes: Incidence of poverty identified as any individual in a benefit unit with equivalised income less than 60% of the population median, using the revised OECD equivalence scale. Poverty gap defined as the additional (annual) equivalised benefit unit income needed to bring an individual's benefit unit up to the considered poverty line.

4.2 Health scenarios

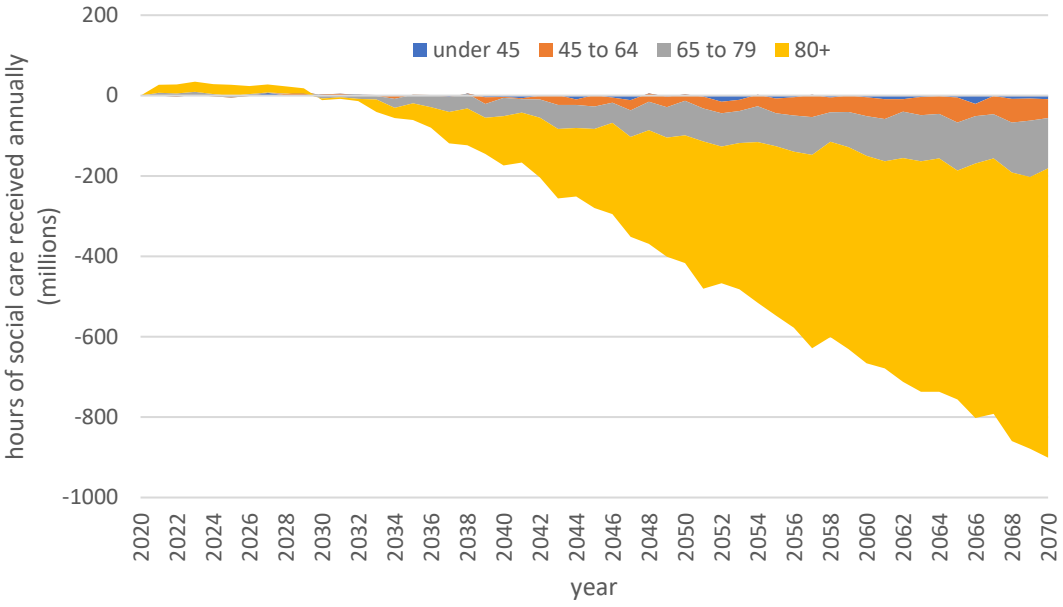
4.2.1 High mortality

This section reports sensitivity to the assumed mortality rates that underly simulated projections, with reference to the "high mortality scenario" described in Section 3.3.1. Analysis focusses on the "effects" of assuming high mortality rates. This is done by reporting summary statistics generated under the high mortality scenario, less the same statistics generated under the baseline scenario. Importantly, as discussed in Section 3.3.1, the two simulation scenarios are designed to be identical, with the exception that the high mortality scenario omits improvements in age and gender specific mortality rates from 2019 that are assumed by the ONS to obtain the 2020-based principal population projections for the UK.

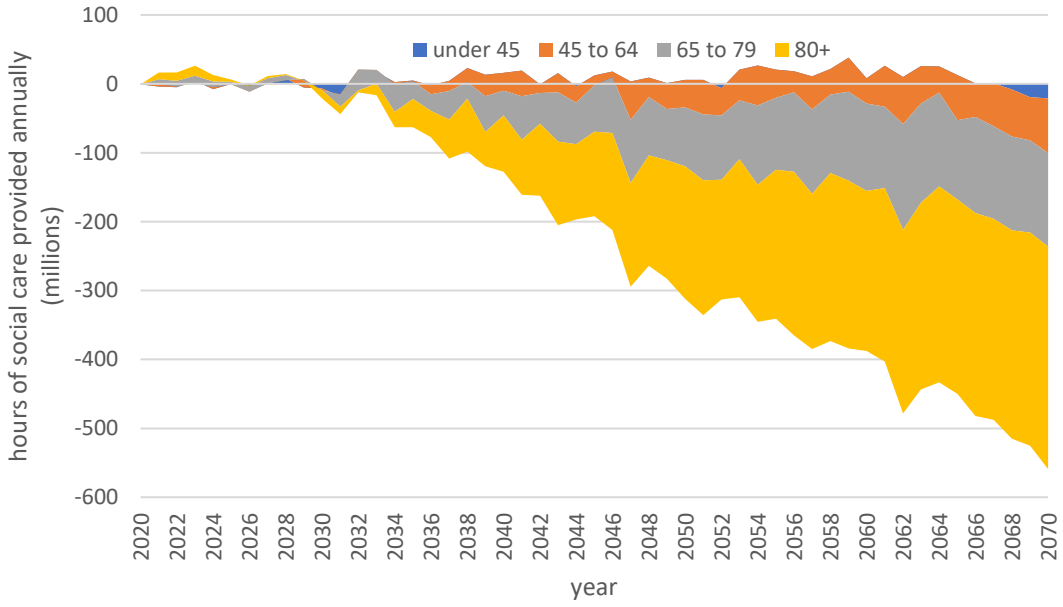
Key summary statistics for social care provision and receipt are reported in Figure 4.7. The two panels of Figure 4.7 display similar profiles for annual hours of care received and provided varying primarily over the respective scale of effects. This observation also carries over to projections for the total simulated population size and the number of people needing care (reported in Appendix D.2). All four of these series rise slightly to 2024, primarily driven by lower mortality rates among people aged 65 and over during the Covid-19 pandemic. Thereafter, higher mortality rates result in declining profiles, particularly among people aged 80 and over.

In terms of scale, whereas the simulated annual hours of care received is projected to fall by approximately 900 million by 2070 under the high mortality scenario relative to the baseline, hours of care provided fall by 550 million. At the same time the simulated population size under the high mortality scenario falls by just over 3 million people by 2070 relative to the baseline, while the number of people requiring care falls by 1.2 million.

Approximately two-thirds of the projected population decline by 2070 under the higher mortality scenario is for people aged 80 and over. This effect translates to reduced care need, and then to reduced care receipt and care provided as reported in Figure 4.7. Importantly, care receipt is projected to fall by a wider margin than care provision. This works to partly reverse the rise in demand for social care, relative to supply that is projected under the baseline scenario discussed in Section 4.1. It is notable, however, that this reversal is only partial, reducing the decline in the ratio of hours of care provided to hours of care received by approximately 15%. The reason why the off-set is partial is that much of the projected rise in demand for social care is among older people is met by partners who are also increasingly prevalent among older people when mortality rates are permitted to fall.



Panel A: Hours of social care received



Panel B: Hours of social care provided

Figure 4.7: Effects on projected annual hours of social care received and provided of replacing the baseline scenario with the 'high mortality' scenario, by age band and year

Source: Authors' calculations on simulated data

Notes: 'Baseline' and 'high mortality' scenarios described in Section 3.3. Relative to the simulated baseline scenario, the high mortality scenario holds age and gender specific mortality rates fixed at values representative of 2019. In contrast, the baseline scenario allows mortality rates to decline as assumed in the 2020-based principal population projections reported by the ONS. Results for baseline scenario reported in Section 4.1.

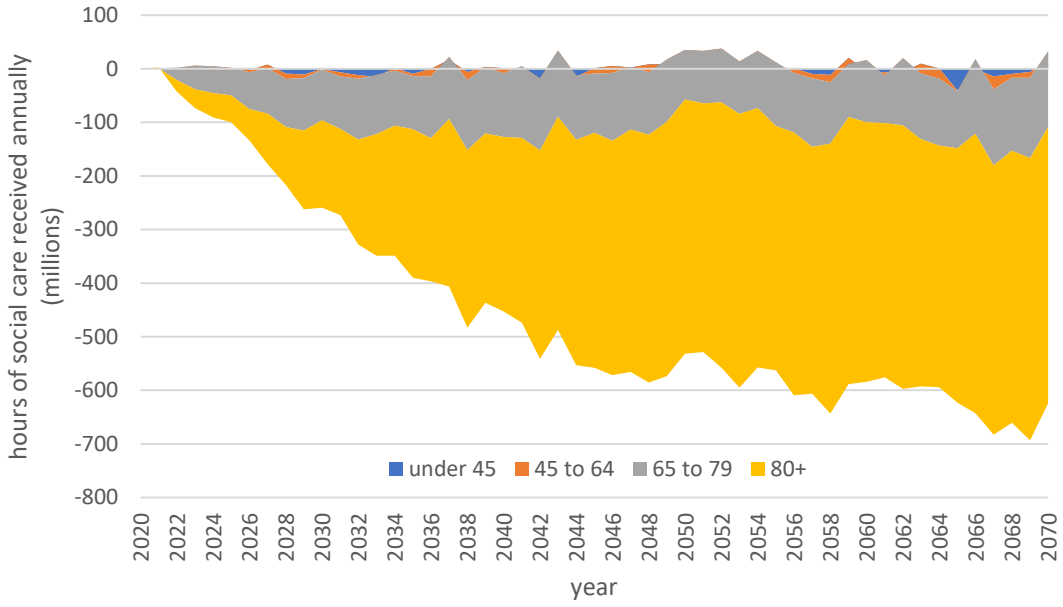
4.2.2 Healthy life

Following discussion in Section 4.2.1, this section explores the effects of the "healthy life scenario" described in Section 3.3.2 relative to the baseline scenario. As noted previously, the healthy life scenario involves discounting increases in age above 65 by 25% when evaluating probabilities for need and receipt of social care. Hence, someone aged 80 in the healthy life scenario is treated in the same way as someone aged 77 in the baseline scenario when evaluating whether they need and receive social care (based on estimates for probit regressions reported in Table 3.1).

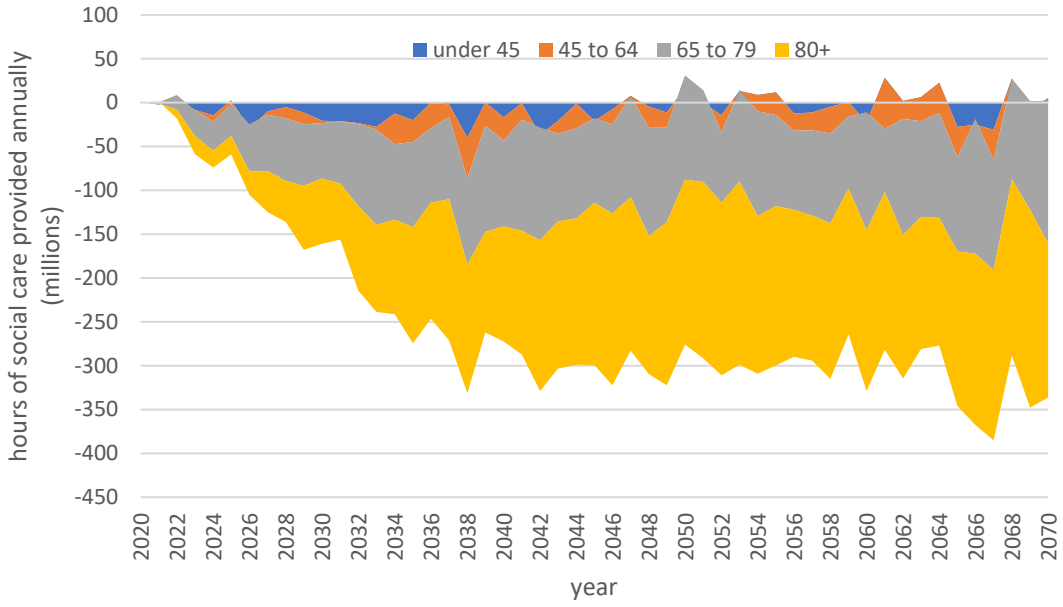
Effects of the healthy life scenario on projected hours per year of social care received and provided are reported in Figure 4.8. The top panel of the figure indicates that hours of social care received are projected to fall substantially for people aged 65 and over, with negligible results projected for younger people. The projected declines are particularly pronounced among people aged 80 and over, for whom annual hours of social care received in 2070 fall by 520 million relative to the baseline scenario. Similar statistics to those reported here were obtained for the numbers of people in need of care, which are reported for completeness in Appendix D.2.

As noted above, people aged 80 are treated as though they were aged 77 when evaluating the likelihoods of needing and receiving care under the healthy life scenario, and people aged 90 are treated as though they were aged 85. Hence, the pronounced effects on care receipt projected for people aged 80 and over under the healthy life scenario are driven by strong positive gradients in age specific dummy variables between ages 77 and 85 reported in Table 3.1, exaggerated by strong intertemporal persistence.

The bottom panel of Figure 4.8 broadly reflects the top panel, indicating substantial falls in annual hours of social care provided under the healthy life scenario relative to the simulation baseline. This is despite the fact that identical routines are used to project provision of social care in both the baseline and healthy life scenarios. The reduced social care provided under the healthy life scenario, which reach 330 million hours of care by 2070, reflect the importance of partners as informal social care providers in the simulations. In this regard, the healthy life scenario exhibits similar variation to that reported above for the high mortality scenario, off-setting the projected tightening of the market for social care implied by the model projections.



Panel A: Hours of social care received



Panel B: Hours of social care provided

Figure 4.8: Effects on projected annual hours of social care received and provided of replacing the baseline scenario with the 'healthy life' scenario, by age band and year

Source: Authors' calculations on simulated data

Notes: 'Baseline' and 'healthy life' scenarios described in Section 3.3. Relative to the simulated baseline scenario, the healthy life scenario discounts increments in age beyond age 65 by 25% when evaluating the likelihood of needing and receiving care. Results for baseline scenario reported in Section 4.1.

4.3 Public policy scenarios

4.3.1 Reduced social care gap

As discussed in Section 3.3.3, the "reduced social care gap" scenario explores projected effects if social care policy throughout the UK was implemented as applied in Scotland. Scotland is of interest here because it does not apply means-tests to public provision of in-home care services that support a tightly defined set of activities of daily living. In contrast, public support for all forms of in-home care are subject to means-testing. This reform scenario is implemented by assuming that the region specific coefficients estimated for Scotland for care need and receipt apply in all regions of the UK (see Table 3.1).

Relative to the simulated baseline scenario reported in Section 4.1, the reduced social care gap scenario implies a slight increase in the projected numbers of people in need of care, as reported in Figure 4.9. The volatile series reported in Figure 4.9 averages 44,000 additional people in need of care over the simulated period, approximately 0.6 percentage points of the numbers in need of care reported for the simulated baseline in Figure 4.1.

In contrast, the reduced care gap scenario has a pronounced impact on the simulated disparity between care need and receipt in England and Northern Ireland, as displayed in Figure 4.10. Comparing Figures 4.2 and 4.10 reveals that the reduced social care gap approximately halves the care gap projected for England and Northern Ireland relative to the baseline scenario, from approximately 10% of all people in need of care, to 5%. As a consequence, approximately the same care gap is projected for all countries of the UK under the reduced social care gap scenario, as displayed in Figure D.6 of Appendix D.2. Such a transition could be anticipated to appreciably improve quality of life of people needing care in England and Northern Ireland.

Effects on the annual hours of care are reported in Figure 4.11. This figure indicates that total annual hours of care are projected to increase throughout the simulated time horizon, rising to an additional 400 million hours by 2070. The vast majority of the additional hours of care are projected to be received in England, followed by Northern Ireland; effects are negligible for Scotland and Wales.

A premise underlying the projections reported here is that the additional hours of care would be publicly provided free of means-testing. Lower bounds to the implied costs of the policy reform considered here can be obtained by pricing the additional hours of care by projections for median hourly wage rates for care workers. These projections present lower bounds because: a) mean hourly wage rates typically exceed median hourly wage rates; and b) such projections omit substitution from informal social care into (un-means-tested) publicly subsidised care. Associated projections are reported in Figure 4.12.

Figure 4.12 indicates that closing the social care gap as discussed above would impose an increasing burden on the public purse throughout the simulated time horizon. From an additional £1bn in 2020 (2024 prices), costs are projected to increase to £11.7bn by 2070. The vast majority of these costs are projected due to additional care received in England, driven

by the relatively large social care gap that is projected for that country under the simulated baseline, exaggerated by the relatively large population.

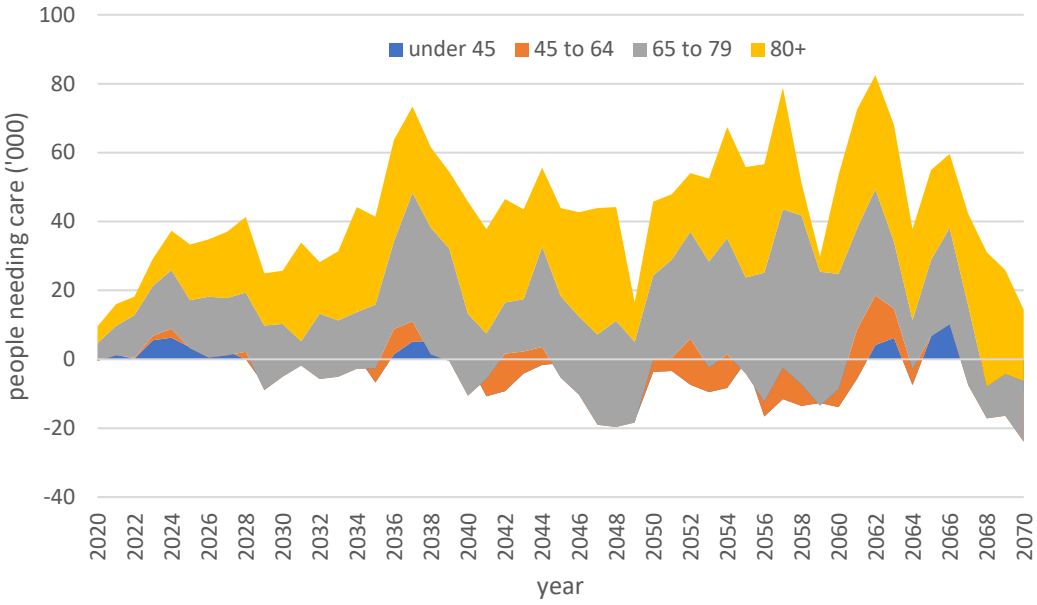


Figure 4.9: Effects on projected number of people needing care of replacing the simulated baseline scenario with the 'reduced social care gap' scenario, by age band and year

Source: Authors' calculations on simulated data
Notes: 'Baseline' and 'reduced social care gap' scenarios described in Section 3.3. Relative to the simulated baseline scenario, the reduced social care gap projects need and receipt of care as though all people were resident in Scotland. Results for baseline scenario reported in Section 4.1.

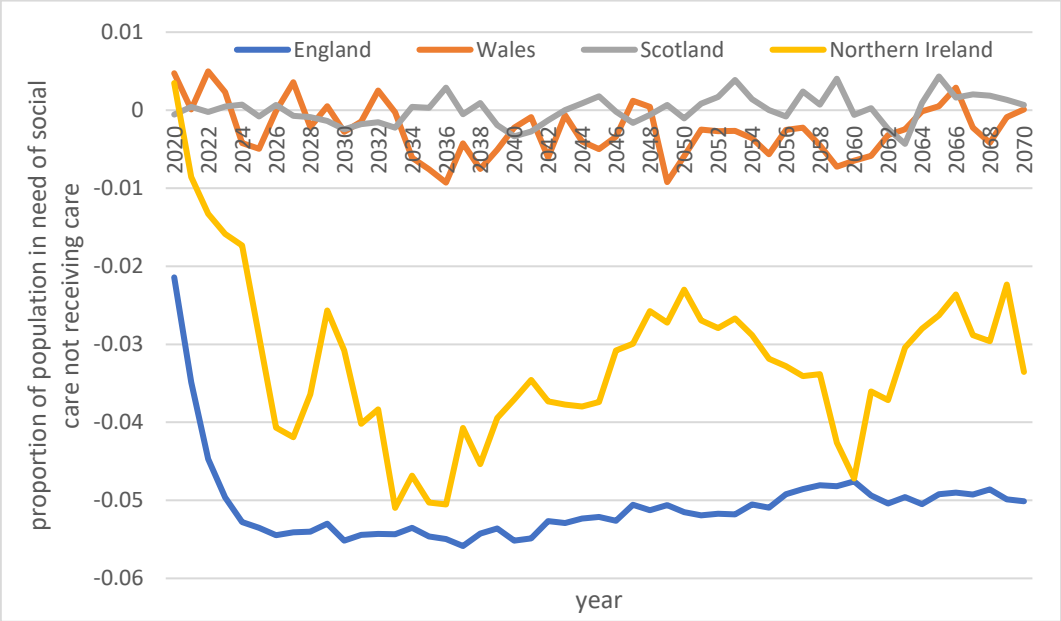


Figure 4.10: Effects on projected social care gap for people aged 65 and over of replacing the baseline scenario with the 'reduced social care gap' scenario, by year and country

Source: Authors' calculations on simulated data derived from the SimPaths microsimulation model.
Notes: See Figure 4.9. "Social care gap" defined here as the number of people in need of social care who do not receive care.

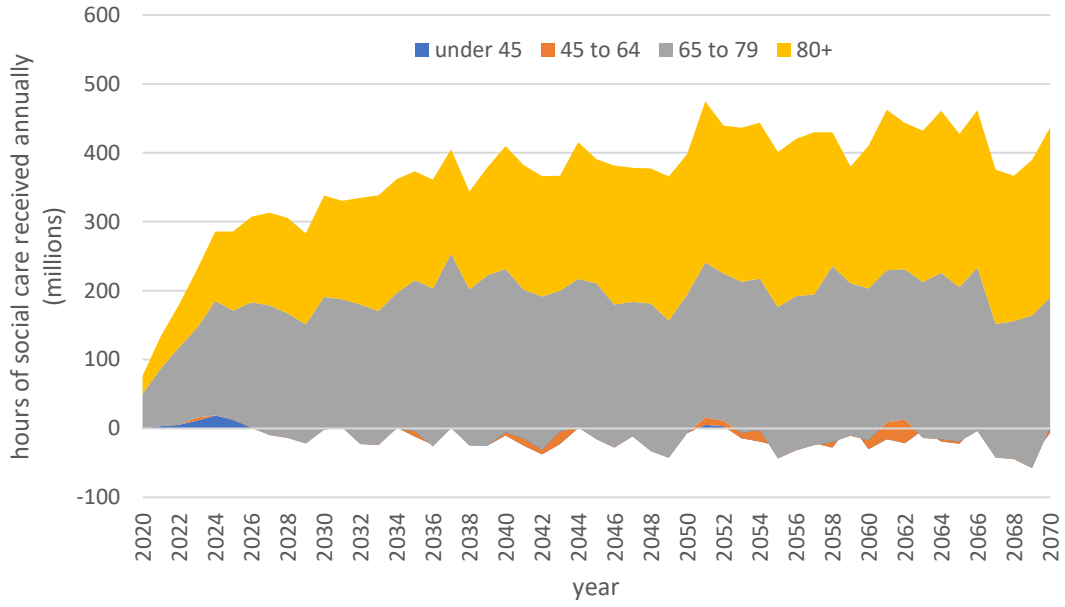


Figure 4.11: Effects on projected annual hours of social care received by people aged 65 and over of replacing the baseline scenario with the 'reduced social care gap' scenario, by year and country

Notes: See Figure 4.9.

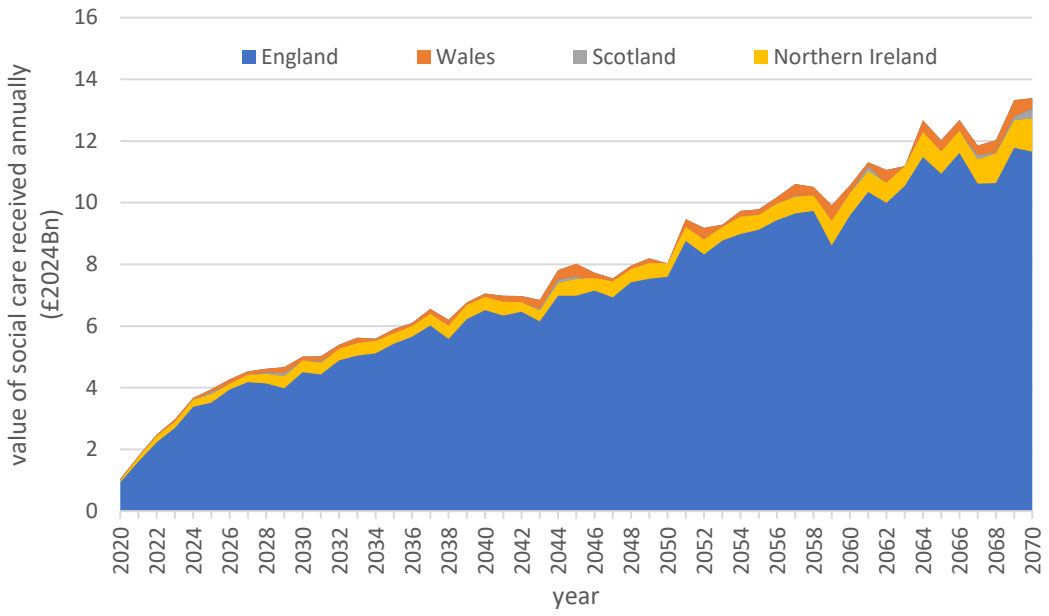


Figure 4.12: Effects on projected costs of social care received by people aged 65 and over of replacing the baseline scenario with the 'reduced social care gap' scenario, by year and country

Notes: See Figures and 4.5 and 4.9.

4.3.2 Increased carer support

This section explores the effects of increasing the value of benefits payable to qualifying informal carers. As discussed in Section 3.3.4, recipients of the amended benefits in Scotland are assumed to see their maximum support payments increase by 82%, and by 107% for carers in the rest of the UK.

As discussed in Section 2.1, eligibility for carer support payments in the UK requires a minimum number of hours of care to be supplied to a qualifying care recipient and is limited to people earning less than an upper threshold. Otherwise, associated benefits are free from means-testing. These conditions are not altered by the policy counterfactual considered here. Hence, in the absence of behavioural responses to the reform, the number of carers in receipt of carer benefits would be unaffected.

Nevertheless, model projections suggest that the share of carers in receipt of carer benefits would rise under the policy counterfactual considered here, by approximately 9 percentage points (to approximately 57%) for carers under age 45, and by 6 percentage points (to 50%) for carers aged 45 to 64.[33] These increases in the incidence of receipt of support payments under the counterfactual reflect associated reductions in labour market activity: employment falls by approximately 1.8 hours per week per carer under age 45, and by 0.6 hours per week per carer aged 45 to 64.[34] These transitions out of employment in

[33] See Figure D.7 in Appendix D.2.
[34] See Figure D.8 in Appendix D.2.

response to the increased generosity of state benefits for carers reflect the relatively low wages that carers typically earned, and highlights the potential unintended consequences of associated policy reforms.[35]

Disposable income is projected to increase among carers by an average of £37 per month (2024 prices) among carers under age 45, and by an average of £88 per month among carers aged 45 to 64 (Figure D.9). The muted increase in disposable incomes, relative to the increased value of carer benefits is observed because many carers do not receive benefits, and among those carers who do receive benefits some earn lower income from labour under the counterfactual considered here.

Effects of increasing welfare payment rates on poverty rates for informal carers are reported in Figure 4.13. This figure indicates that the higher benefit payment rates reduce simulated poverty rates among all carers by 1.1 percentage points on average over the simulated time horizon. Although the series displayed in Figure 4.13 exhibit some noise, there is some evidence that larger reductions in poverty are projected early in the simulated time period. This reflects the fact that the benefits are held fixed in real terms, whereas wages (and therefore poverty lines) exhibit real growth.

Figure 4.13 indicates that larger reductions in poverty are simulated among carers aged 45 to 64 than among younger carers. This reflects the fact that the poverty gap (difference between the poverty line and disposable income) under the baseline scenario is 13% smaller on average among carers aged 45 to 64 than among younger carers.

As noted in Section 4.1, total value of state subsidies to informal carers projected under the baseline scenario are broadly stable at approximately £19Bn (2024 prices). Figure 4.14 reports the impact that the increased carer support scenario has on these projected costs to the state. The figure indicates that the more generous payment rates considered here cost between £4Bn and £7Bn over the simulated time horizon, equivalent to approximately 30% of the annual cost on average under the simulated baseline. Carers aged 45 to 64 account for just over half (55%) of this increase, with most of the remainder due to younger carers. As discussed above, these costs are partly due to the higher benefits payable and partly due to the reduced labour market activity projected for carers under the counterfactual scenario.

[35] The wider literature emphasises the nuanced nature of support to informal carers. The meta-analysis reported by Gemito *et al*. (2024), for example, highlights the importance of non-pecuniary support for carers, while Costa-Font *et al*. (2016) report that subsidies to informal carers in Spain increased the incidence of informal caring and reduced net non-public transfers received by carers (reflecting altered intergenerational transfers).

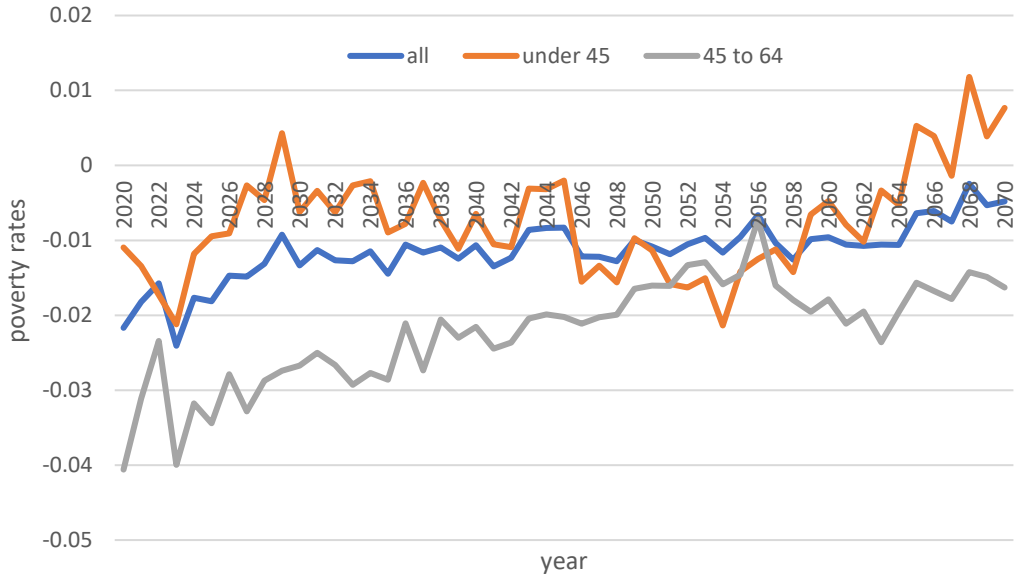


Figure 4.13: Effects on projected poverty rates among informal carers of replacing the simulated baseline with the 'increased carer support' scenario, by age band and year

Source: Authors' calculations on simulated data

Notes: 'Baseline' and 'increased carer support' scenarios described in Section 3.3. Relative to the simulated baseline scenario, the increased carer support scenario increases the generosity of carer welfare support payments. Results for baseline scenario reported in Section 4.1.

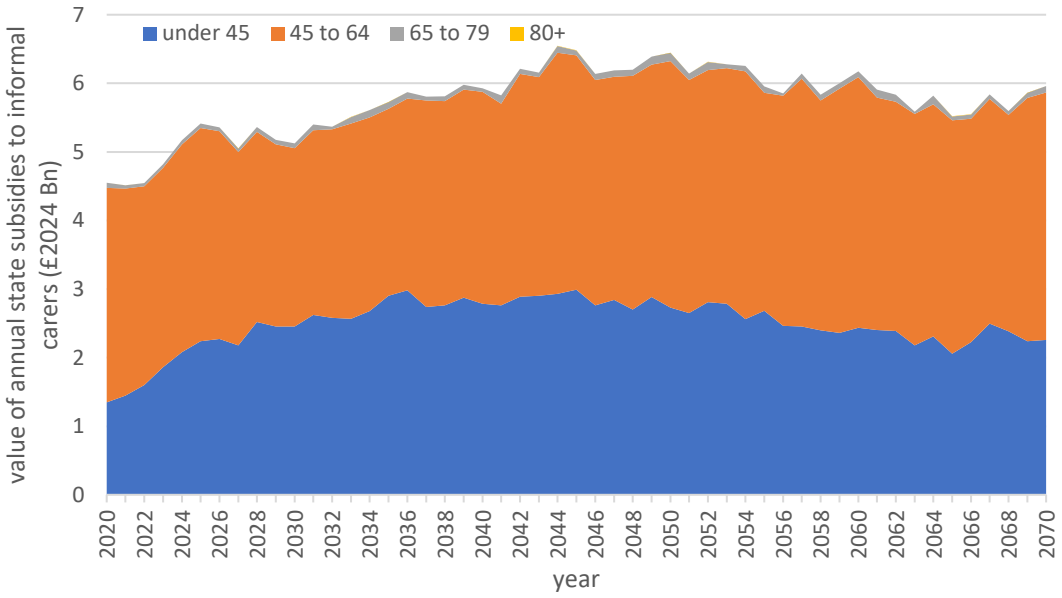


Figure 4.14: Effects on annual value of state subsidies to informal carers of replacing the baseline scenario with the 'increased carer support' scenario, by age band and year

Notes: See Figure 4.13. The values reported here denote the surplus of simulated benefits paid to carers, relative to the benefits that individuals would receive if they did not provide care.

5 Conclusions

Population aging throughout OECD countries complicates the problem of adapting public support of social care in a way that balances desirable quality of life outcomes against evolving budgetary pressures. The United Kingdom presents an interesting case-study in this context, as a diverse set of policy responses have been adopted by the four constituent nations.

Concerning home-based social care, all four nations employ some form of wealth-based means-testing to target associated public subsidies, but differ in terms of the degree of targeting. In Scotland, personal and nursing care is free for anyone assessed with tightly defined needs based on a set of Activities of Daily Living. In Wales, public support is capped for anyone with wealth in excess of means-tested thresholds. Although most home-based care is ostensibly fully subsidised in Northern Ireland, resource limitations have limited practical application. England currently employs the most tightly target system of public support, subject to relatively low thresholds on wealth, beyond which state benefits are negligible. The English context is of particular interest, following more than two decades of political inaction.

Concerning public support for informal carers, all four nations of the UK employ a common system that is centrally administered. This system of support imposes tight constraints on the minimum hours of informal care that can be supplied, who the care is provided to, and the income that a carer can earn. Carers who reside in Scotland also benefit from augmented support payments.

This study explores how social care provisions might evolve over the next half century in context of projected population aging for the UK, and the sensitivity of projections to alternative assumptions concerning health and public policy. Analysis is based on panel data generated by an open-source structural dynamic microsimulation model designed to reflect the evolving population cross-section. Five simulation scenarios are considered; a baseline scenario designed to reflect business-as-usual conditions, two counterfactuals that explore sensitivity to alternative assumptions concerning evolution of health, and two further scenarios that explore increased generosity of benefits to social care recipients and informal care providers respectively.

The analysis suggests that the number of people who require help with two or more activities of daily living (ADLs or IADLs) will grow from 4 million in 2020 to 8.6 million by 2070, driven by population aging. This increase falls by 1.2 million (to 7.4 million) if improvements in longevity underlying ONS 2020-based principal population projections are omitted from 2019. Similarly, allowing for improvements in “healthy life” by applying a 25% discount to age increments beyond 65 years reduces the projected increase in the number needing care by 0.9 million. Over half of the projected increase in the number of people in need of care (55%) is among people aged 80 and over.

Projections based on statistical relationships estimated on contemporary survey data indicate pronounced differences between the four constituent countries of the UK for the

incidence of unmet care needs. The simulations indicate unmet care needs are highest in England, falling slightly (by approximately 1 percentage point) in Northern Ireland, and by a wider margin (approximately 4.5 percentage points) in Scotland and Wales. These disparities are related to differences in state provisions for at-home care, as discussed above.

Attributing disparities between countries in unmet care needs to differences in state provisions for at-home care, a counterfactual projection considers the effects of adopting Scottish policy throughout the UK. Analysis suggests that this would approximately halve the care gap in England and Northern Ireland, to 5% of people in need of care. Budgetary estimates that are designed to be conservative suggest that the policy change would increase the burden on the public purse by £1Bn in 2020, rising to £11.7Bn by 2070.

Total at-home hours of social care received are projected to increase from 3 billion in 2020 to just under 7 billion in 2070, driven primarily by increasing care to people aged 80 and over. This increase falls by just under one billion hours if improvements in longevity are ignored, and by half a billion hours if improvements in healthy life are assumed. The vast majority of this time is projected to be provided by informal carers. Interestingly, the projections suggest that the increase in social care needs associated with population aging will be partly met by increasing informal care provision among older people. The projections also indicate growth of social care receipt relative to social care provision, suggesting a tightening of the market for social care services.

Projected poverty rates among all informal social care providers are slightly lower than among the population more generally, rising from just over 21% in 2023 (following the Covid-19 pandemic), to 27% in 2070. These rates, however, mask relatively high poverty rates among informal carers under age 45, for whom poverty projected rates are projected to rise from 36% in 2020 to 53% in 2070. Although approximately half (47 to 51%) of informal carers under age 45 are simulated to receive carer benefits, the scale of these benefits is insufficient to substantially suppress poverty rates.

Extending Scottish supplements for informal carers to the rest of the UK, and increasing the value of these benefits by £4,000 per annum is projected to reduce poverty rates among informal carers by 1.1 percentage points at an annual cost of between £4Bn and £7Bn (2024 prices) over the simulated time horizon. The simulations underscore the potential of carer benefits to discourage labour market participation, which off-sets the projected impact on carer poverty.

The analysis summarised above highlights the challenges posed by population aging to systems of public support for social care. Each of the four alternative counterfactual scenarios considered for analysis imply trade-offs that depend crucially on the value judgements of decision makers. Quantifying such trade-offs ought to help improve the decision making process, and the analysis reported in this study provides some useful detail in that regard.

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Appendix A Data Sources

A.1 Living Costs and Food Survey (LCF)

The LCF was introduced in 2008 when it replaced the Expenditure and Food Survey (EFS), which had been introduced in 2001 following amalgamation of the Family Expenditure Survey (FES, introduced in 1957) and the National Food Survey. The structure of the survey through these three iterations has remained broadly unchanged since 1971, reporting detailed information regarding demographics, income, and expenditure for a sample of approximately 5,500 households in the United Kingdom. The three surveys are consequently referred to collectively throughout this report as the LCF.

The basic unit in the survey is the household, with households being selected at random from the Royal Mail's small users Postcode Address File (PAF) in Great Britain (excluding the Scottish Isles and the Isles of Scilly). The small users PAF is limited to addresses which receive, on average, fewer than 50 items of post per day and which are not flagged with Royal Mail's "organisation code". Northern Ireland is sampled through the Valuations and Lands Agency list. Participation in the LCF is voluntary. The LCF defines a household as: "a group of people living at the same address with common housekeeping that is sharing household expenses such as food and bills, or sharing a living room."

All individuals aged 16 and over in participating households are asked to complete a computer-assisted income questionnaire and to keep a diary of expenditure covering a two-week period, with children aged 7 to 15 also being asked to keep a simplified diary since 1998. Regular expenditure, demographic, and income data are recorded at a household interview, and retrospective information is collected on expenditure of selected large and infrequent purchases. The survey is collected on a continuous basis and reported at annual intervals.

The representative nature of the LCF for the UK population is affected by a number of factors. Firstly, people in institutions — such as retirement homes, the military, or prison — are omitted from the survey. Also, people with no fixed address (the homeless) are not surveyed. Furthermore, the voluntary nature of the survey typically obtains a response rate of those initially approached in the region of 50-60 per cent and has been found in the past to be not uniformly distributed across the population.

A.2 Family Resources Survey (FRS)

The FRS was introduced by the Department for Work and Pensions (DWP) in October 1992, in response to the perceived limitations of the Living Costs and Food Survey (LCF) and the General Lifestyle Survey for analysing household incomes in the UK. The FRS reports detailed information regarding household demographics and income for a cross-section of households in the United Kingdom. Although the FRS omits detail concerning household

expenditure that is reported by the LCF, it includes finer detail concerning income sources, for samples that are typically more than three times those reported by the LCF.

Like the LCF, the FRS sample is drawn from the Royal Mail's small users Postcode Address File (PAF) in Great Britain. The sampling frame used by the FRS for Northern Ireland is the NISRA Address Register (NAR). The NAR is primarily based on the Land and Property Services (LPS) Pointer database, the most comprehensive and authoritative address database in Northern Ireland, with approximately 745,000 address records available for selection.

The current study reports results from pooled data reported at annual intervals from 2015/16 to 2019/20 and for 2021/22. The 2019/20 data are from interviews conducted between April 2019 and March 2020. Interviews were suspended in mid-March 2020 in line with the national lockdown. At this point, nearly a full year's worth of FRS interviews had already taken place and there is no material impact of COVID-19 upon these results, with the overall response rate for 2019/20 being 49%. Data reported by the FRS for 2020/21 are omitted from the study due to concerns regarding representativeness of the sample due to the effects of the COVID-19 pandemic.

A.2.1 Measurement of social care

FRS respondents are asked if they receive care from anyone. This includes both professional help – paid-for care from the local authority, health professionals or domestic staff – but it also includes informal care. This is any care where their carer is not doing it as a paid job; it can be for many, or only a few hours a week, and can take several different forms. The survey is intentionally not prescriptive about what counts as care; it could, for example, include going shopping for someone, or helping them with paperwork.[36]

Where respondents are receiving care at least once a week, they are further asked about the nature and frequency of that care. No information is collected concerning the cost of formal care services received or how those services are paid for.

FRS respondents are also asked if they provide care to someone else, on an informal basis. That person could be living with them, in their household, or they could live somewhere else (outside the household).

A.3 UK Household Longitudinal Survey (Understanding Society, UKHLS)

The UKHLS is a longitudinal household panel study. The Study started in 2009 and follows on from the British Household Panel Study which ran from 1991-2008. Taken together the two studies currently provide researchers with data on households in the UK spanning 30 years.

[36] A "showcard" is used, which lists a range of activities, including assisted mobility, personal care, administrative tasks, housework, and other general social support.

The General Population Sample (GPS) is comprised of a clustered and stratified, probability sample of approximately 24,000 households living in Great Britain in 2009-10, augmented by a simple random sample of approximately 2,000 households living in Northern Ireland in 2009 (selected with twice the selection probability as the Great Britain part). All household members of the households selected at the first wave and their descendants constitute the core sample and are followed wherever they move within the UK to see how things have changed over time and over their life course. Sample members are interviewed at approximately annual intervals as long as they continue to live in the UK and can be located, contacted and agree to participate.[37] The survey achieved a response rate of 57% in wave 1. Wave 11 (the last for which the social care module is reported – see below) was collected in fieldwork conducted between January 2019 and May 2021, and reported a response rate of 87%.

Although field work for wave 11 was affected by COVID-19 restrictions from March 2020, the overall response rate for the wave compares favourably with 82% achieved for wave 10 (unaffected by COVID-19). All results reported here were consequently calculated including data for 2020, subject to associated checks for robustness.

A.3.1 Measurement of social care

The UKHLS includes two principal modules that describe social care for adults.[38] A "caring module" has been asked in all survey waves, which reports information about informal caring activities provided by survey respondents to "sick, disabled, or elderly" people. Waves 7 (2015 and 2016), 9 (2017 and 2018) and 11 (2019 and 2020) also include a "social care module" that reports metrics describing the receipt of social care services for survey respondents aged 65 and over.

Caring module

The caring module administered by the UKHLS elicits information about the incidence and hours of informal care provision, including information about who care is provided to. Note that although this module provides links permitting identification of people in the same household that an individual provides help to, it does not permit identification more generally. Furthermore, the survey does not report a separate indicator permitting identification of eligibility for carer related benefits maintained in the UK.

Social care module

The social care module administered by the UKHLS elicits information about the following types of tasks for which assistance is needed and/or received:

- getting in and out of bed
- washing your face and hands

[37] The English Longitudinal Study of Aging (ELSA) is another panel survey that reports measures of social care. Unlike the UKHLS, however, ELSA reports data at biannual (intervals and only for a sample resident in England.

[38] A separate module also asks questions about care for children.

- cutting toenails
- having a bath or a shower, including getting in and out of the bath or shower
- dressing or undressing, including putting on shoes and socks
- using the toilet
- eating, including cutting up food
- taking the right amount medicine at the right times
- getting around the house
- getting up and down stairs
- walking down the road
- shopping for food including getting to the shops, choosing the items, carrying the items home and then unpacking and putting the items away
- doing routine housework or laundry
- doing paperwork or paying bills

The first ten activities listed above (to "up and down stairs") are categorised as "activities of daily living" by the survey (ADL). Basic or physical ADLs are commonly recognised as skills required to manage basic physical needs. The remainder of the activities (from "walking down the road") are categorised as "instrumental activities of daily living" (IADL). IADLs are generally considered to include more complex activities than basic ADLs, related to the ability to live independently in the community.

The survey asks each responded if they "manage" the tasks listed above on their own and what extent of difficulty they encounter if doing so. It also asks "In the last month, who has helped you with" each of the tasks listed above, distinguishing between a detailed list of formal and informal providers.[39] Furthermore, respondents are asked "in the last week, how many hours have" each of the care providers given their assistance and a range of details concerning costs incurred.

In principle, the UKHLS can track transitions into residential care. In practice, the incidence of such transitions is very rare and has been omitted for the most recent waves of the survey.[40] In contrast, the British Household Panel Survey (BHPS, the forerunner of the UKHLS) reported information concerning transitions into institutions in all waves. In this case, the proportion of the survey population identified as transitioning into an institution – including prisons and residential care – was typically less approximately 0.05 percentage points.

[39] Informal providers distinguished by the survey: partner, son, daughter, grandchild, sibling, niece or nephew, parent, other family, friend, neighbour. Formal providers: home care worker, intermediate care staff, occupational therapist, voluntary, sheltered housing, cleaner, council handyman.

[40] The same issue affects the English Longitudinal Study of Aging (ELSA), a related panel data source reporting health dynamics of the English population aged 50 and over.

Addressing data observed at two-year intervals

The regression estimates used to parameterise the simulation procedure described above were estimated on UKHLS data reported for the social care module in waves "g", "i" and "k". Lagged dependent variables appear in some of the functions used to project social care receipt, which helps to accommodate persistence in care arrangements. The fact that the UKHLS only provides social care data for every other year, however, raises procedural complications given the annual periodicity of the SimPaths model.[41]

Interpolation methods were used to impute data in year *t+1* for any individual with social care data reported in years *t* and *t+2*, and these data were used to estimate transition equations underlying the simulation. Where a social care statistic was observed to be the same in years *t* and *t+2*, then the same value was assumed to apply in year *t+1*. Alternatively, where a social care statistic was observed to vary from years *t* to *t+2*, then the observation was replicated, with each replication assigned half the respective survey weight. One of these replicated observations was assigned the value observed in year *t* for year *t+1*, while the other was assigned the value observed in year *t+2*.

The former of these imputation assumptions (no-change where values are the same in years *t* and *t+2*) will dampen projected volatility of simulated social care receipt, to the extent that it fails to capture (unobserved) variation. The latter assumption (replication where values are different in years *t* and *t+2*) will dampen (unobserved) temporal biases of social care transitions, including biases associated with age.

A.3.2 Population representativeness

Many challenges associated with obtaining a representative description of the underlying population of interest are exaggerated for panel surveys like the UKHLS, relative to purely cross-sectional surveys. One particular focus of concern is how to adapt survey weights in a way that accounts for panel attrition and associated population distortion. An appreciation for this issue may be obtained from Figure A.1, which reports the UK population age distribution for three years described by alternative data sources.[42]

Statistics reported for 2011 show a close correspondence between the age distribution described by (cross-sectionally weighted) UKHLS data and the ONS population estimates. This was two years after introduction of the UKHLS, which included a new population sample designed to reflect the UK population cross-section.

Ten years later, the statistics reported for 2021 (the most recently available wave at the time of writing) indicate appreciable differences between the age distributions described by ONS population estimates and the (weighted) UKHLS data. Relative to the ONS estimates, the UKHLS data tend to understate people under 10 years of age and between ages 25 and

[41] For example, a probit equation governing receipt of care that includes as a regressor receipt of care with a two-year lag would treat a person who first received care in the preceding year identically to one who did not receive care. This could result in undesirable oscillations in projected care states.

[42] The FRS covers Great Britain only (omits Northern Ireland).

40 (peak child-rearing ages), and overstate people aged 50 and over. In contrast, the FRS (a large cross-sectional survey, see Appendix A.2) display a close correspondence with the ONS population estimates. Finally, data for 2019 (Panel B of Figure A.1) suggest that the differences between the ONS population estimates and UKHLS weighted data have been widening with time.

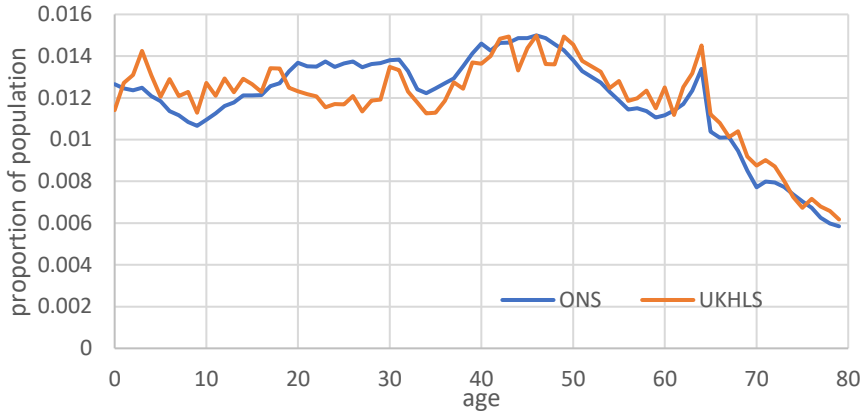
Strategies to address non-representativeness of UKHLS

The disparities between ONS population estimates and UKHLS data discussed above are clearly important for the current study. The modelling framework considered for this study employs three methods to mitigate these risks.

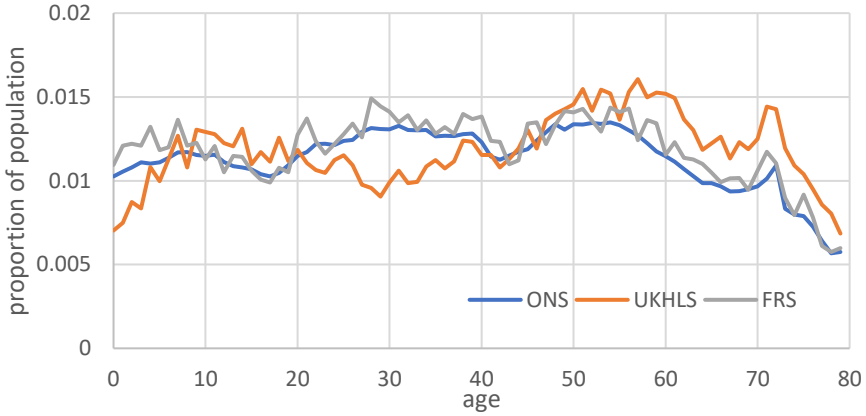
First, a re-sampling routine is used to ensure that the **starting data for analysis** match to ONS population estimates distinguished by single year of age (0 to 100), gender (male/female), and Government Office Region (12 geographic regions). Briefly, the routine involves taking the cross-sectionally weighted data described by the UKHLS for 2019 and randomly sampling households from these data with replacement until the targets described by the ONS population estimates are satisfied. The efficacy of this routine is supported by stratifying the UKHLS population between households with and without children. Child targets are matched first, followed by adult targets.[43]

Second, alignment methods are used to adjust the probit functions governing **fertility and cohabitation** to match model projections to year-specific population targets reported by the ONS. Specifically, the probit functions governing fertility and cohabitation were estimated on UKHLS data, and so may be affected by the same population biases as discussed above. The intercepts of the respective probit functions were consequently adjusted to match population averages for (period) fertility and the incidence of cohabitation.

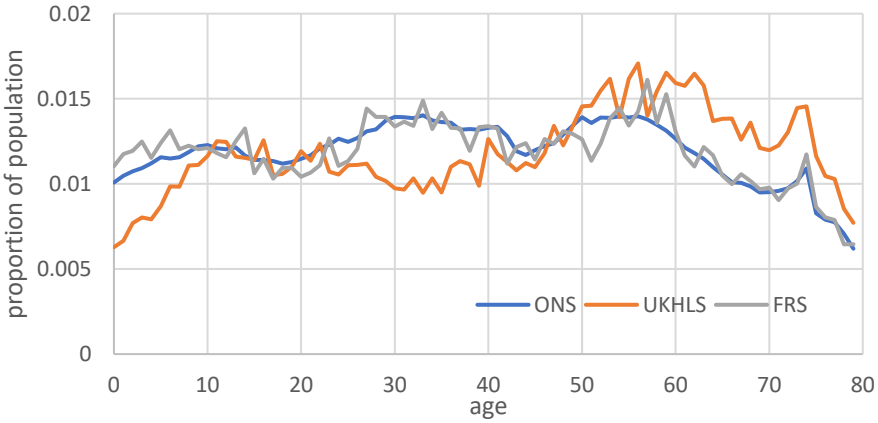
[43] This is important because all households with children include adults, so that matching child targets is only possible if there is adequate flexibility over the number of age specific adults.



Panel A: 2011



Panel B: 2019



Panel C: 2021

Figure A.1: Population distribution by age, year and data source

Source: Office for National Statistics (ONS) mid-year population estimates published June 2021. Family Resources Survey (FRS), 2019 and 2021 waves (series starts 1993). UK Household Longitudinal Survey (UKHLS). FRS and UKHLS series (cross-sectionally) weighted.

Third, **population projections in each simulated year** were aligned to ONS projections distinguishing the same age, gender and region subgroups as targeted for the input data.[44] Briefly, the population alignment routine is structured around the youngest member of each benefit unit. Starting with people aged 0, benefit units are moved between geographic regions to match to ONS population targets, for so long as there exist some regions that are deficient and others that exceed their respective targets. These transitions are considered to represent implicit internal migration. Any residual deficiency is met by cloning existing simulated benefit units, implicitly reflecting international immigration. Any residual excess is met by randomly selecting benefit units for remove, implicitly reflecting international emigration.

[44] To clarify, population estimates and projections reported by the ONS were obtained for single year of age between 0 and 100, for males and females, and for the 12 UK Government Office Regions, for each year between 2019 and 2070.

Appendix B Modelling Social Care

B.1 Social care receipt under age 65

Any individual under age 65 who is identified as long-term sick and disabled is assumed to have a potential need for social care. Disability is parameterised in the model using an employment status identifier (FRS variable *empstati*). This precludes disabled people from also being employed in the model, and omits consideration of disability status (and so need for social care) for children[45]. Hence, the "social care" considered for analysis is shorthand for "adult social care", in common with popular discussion.

Any individual under age 65 in need of social care is assumed to receive care, implying the absence of any "social care gap". This stylisation is also due to limitations of the data considered for parameterisation, in contrast to the analysis for people age 65 and over discussed in Section 3.2.1. Receipt of social care among individuals under age 65 focusses exclusively on informal social care. At the time an individual under age 65 is projected to enter a disabled state, a probit equation is used to identify whether the individual receives informal social care. In the absence of longitudinal data to parameterise persistence, this projection is assumed to continue for as long as the person remains ill or disabled. Estimates for the probit equation used to project the incidence of social care receipt among people under age 65 are reported in Table B.1.

If an individual under age 65 is identified as receiving social care, then care is assumed to be provided by a single person, with the time of care described by a linear equation (Table B.2). The (informal) carer is identified deterministically, using a hierarchical approach falling first to a spouse under age 75 (if one exists), then to parents under age 75, and finally to "other" adults aged between 25 and 74 years.

[45] Children's social care includes support for children with disabilities, requiring protection from harm, or being looked after by local authorities.

Table B.1: Probit regression estimates for receipt of informal social care services among people aged 16 to 64 with a long-term illness or disability.

	Coef.	s.e.	p>z
Education Level (Ref = High)			
Medium	0.0018	0.0009	0.036
Low	-0.0231	0.0013	0.000
Gender (Ref = Women)			
Men	0.0937	0.0008	0.000
under age 25	0.3368	0.0013	0.000
Region (Ref = London)			
North East	0.2579	0.0022	0.000
North West	0.2259	0.0017	0.000
Yorkshire and the Humber	0.1577	0.0019	0.000
East Midlands	0.2917	0.0020	0.000
West Midlands	0.1143	0.0019	0.000
East of England	0.1945	0.0020	0.000
South East	0.1999	0.0019	0.000
South West	0.2308	0.0019	0.000
Wales	-0.0191	0.0021	0.000
Scotland	0.1728	0.0018	0.000
Northern Ireland	0.2750	0.0024	0.000
Constant	-0.7291	0.0015	0.000
Number of observations	7248		
Pseudo R2	0.0098		

Source: Authors' calculations on pooled data reported by FRS at annual intervals between 2015/16 and 2019/20, and 2021/22.
Notes: Sample limited to individuals between age 16 and 64 with a long-term illness or disability. Robust standard errors reported. Long term illness or disability identified as code 9 of variable empstati.

Table B.2: Linear least squares regression estimates for hours of informal care per week received by people aged 16 to 64 years, with a long-term illness or disability, and in receipt of some informal social care

	Coef.	s.e.	p>z
Education Level (Ref = High)			
Medium	0.064	0.0014	0.000
Low	0.077	0.0020	0.000
Gender (Ref = Women)			
Men	-0.039	0.0013	0.000
Age (Ref = under age 25)			
25 to 39	-0.308	0.0022	0.000
40+	-0.568	0.0018	0.000
Region (Ref = London)			
North East	-0.008	0.0032	0.010
North West	0.046	0.0027	0.000
Yorkshire and the Humber	0.066	0.0030	0.000
East Midlands	-0.202	0.0031	0.000
West Midlands	0.022	0.0030	0.000
East of England	-0.148	0.0032	0.000
South East	-0.154	0.0030	0.000
South West	-0.251	0.0031	0.000
Wales	-0.033	0.0033	0.000
Scotland	-0.001	0.0029	0.724
Northern Ireland	-0.086	0.0035	0.000
Constant	4.213	0.0028	0.000
Number of obs	2265		
RMSE	1.1671		
R-squared	0.0359		

Source: Authors' calculations on pooled data reported by FRS at annual intervals between 2015/16 and 2019/20, and 2021/22.
Notes: Sample limited to individuals between age 16 and 64 with a long-term illness or disability. Robust standard errors reported. Long term illness or disability identified as code 9 of variable empstati.

B.2 Social care receipt age 65 and over – supplementary statistics

Table B.3 reports multinomial regression coefficients for the split between informal and formal social care for the population aged 65 and over in receipt of some care. The covariates included in this equation were selected after noting that coefficient estimates were insignificant for gender, self-reported health, and age under 85. The coefficient estimates reported in Table B.3 indicate that individuals receiving social care via the formal market tend to be higher educated, without a partner, or at an advanced age.

Table B.4 indicates that, for individuals aged 65 and over, who receive some social care and have a partner, men are more likely than women to receive informal care from their partner. This is notable, as estimates reported in Table 3.1 indicate that men are generally less likely to report receiving care. Table B.4 also highlights the persistence of care arrangements, and that care from partners is less prevalent toward the end of the life course.

Tables B.5 and B.6 report multinomial logit regression estimates for the set of informal carers where an individual is identified as receiving some informal care. In this case, covariates are limited to the lagged dependent variable (and a constant) to facilitate reflection of persistence in caring arrangements, subject to the limited data available for estimation.

Tables B.7 to B.13 report linear regression estimates for hours of care received, distinguished by type of provider. Inspection of these tables indicates that the most precise estimates were evaluated for informal care hours provided by partners, for which the largest survey sample is available. The estimated statistics for care provided by partners indicate that hours of care tend to be higher for men, who are lower educated, in poor health, and who also have daughters that care for them. Other regression estimates reveal substantial uncertainty concerning coefficient estimates, with the positive relationship between hours of care and poor health being a notable exception.

Table B.3: Multinomial logit regression estimates for formal and informal social care of population aged 65 and over in receipt of some care (reference group: only informal care)

	Coef.	s.e.	p>z	Coef.	s.e.	p>z
	formal and informal care			*only formal care*		
Population share	0.2057			0.1227		
Education Level (Ref = High)						
Medium	-0.292	0.1570	0.063	-0.387	0.1950	0.047
Low	-0.416	0.1533	0.007	-1.145	0.1938	0.000
partner	-0.576	0.1050	0.000	-1.687	0.1460	0.000
care market (lag, ref = none)						
informal only	-1.244	0.1160	0.000	-2.543	0.2109	0.000
formal and informal	2.987	0.1364	0.000	0.777	0.2076	0.000
only formal	1.607	0.2781	0.000	4.191	0.2431	0.000
aged 85 and over	0.258	0.1295	0.046	-0.006	0.1761	0.974
Region (Ref = London)						
North East	-0.020	0.3503	0.955	-1.156	0.5184	0.026
North West	0.021	0.2964	0.944	-0.197	0.3457	0.569
Yorkshire and the Humber	0.456	0.2991	0.128	-0.118	0.3707	0.750
East Midlands	0.081	0.3118	0.796	0.345	0.3586	0.336
West Midlands	0.124	0.3065	0.686	0.044	0.3583	0.901
East of England	0.769	0.2929	0.009	0.359	0.3368	0.286
South East	0.493	0.2940	0.093	0.094	0.3353	0.779
South West	0.445	0.2892	0.124	0.143	0.3363	0.671
Wales	0.093	0.2918	0.751	-0.272	0.3481	0.434
Scotland	0.321	0.2875	0.264	-0.310	0.3440	0.368
Northern Ireland	0.534	0.2881	0.064	0.017	0.3273	0.960
Constant	-1.128	0.2862	0.000	-0.267	0.3131	0.394
Number of observations	5726					
Share of “only informal care”	0.6716					
Pseudo R2	0.4481					

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.
Notes: Sample limited to individuals aged 65 and over receiving social care without missing variables. Weighted regression with robust standard errors reported. "lag" refers to preceding year.

Table B.4: Probit regression estimates describing incidence of partners providing social care for people aged 65 and over receiving care and with a partner

	Coef.	s.e.	p>z
Gender (Ref = Women)			
Men	0.254	0.0864	0.003
care from partner (lag)	1.446	0.0971	0.000
formal care received	-0.301	0.1025	0.003
aged 85 and over	-0.548	0.1142	0.000
Region (Ref = London)			
North East	0.190	0.3080	0.538
North West	-0.047	0.2286	0.837
Yorkshire and the Humber	-0.154	0.2354	0.514
East Midlands	-0.106	0.2416	0.661
West Midlands	-0.303	0.2281	0.184
East of England	-0.043	0.2497	0.862
South East	0.235	0.2435	0.334
South West	0.121	0.2535	0.633
Wales	-0.251	0.2330	0.282
Scotland	0.108	0.2485	0.665
Northern Ireland	-0.329	0.2318	0.156
Constant	0.825	0.2017	0.000
Number of observations	3176		
Proportion positive	0.9186		
Pseudo R2	0.2505		

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.

Notes: Sample limited to individuals aged 65 and over receiving social care, with a partner, and without missing variables. Weighted estimates with robust standard errors reported. Explanatory variables describe characteristics of person in receipt of care. "lag" is defined as preceding year.

Table B.5: Multinomial logit regression estimates for receipt of supplementary care for population aged 65 and over who receive care from their partner (reference group: none)

	Coef.	s.e.	p>z
Daughter			
Population share		0.1048	
Supplementary carer (lag, ref = none)			
Daughter	5.253	0.2482	0.000
Son	2.345	0.6135	0.000
Other	2.479	0.6058	0.000
Care from partner (lag)	1.087	0.7086	0.125
Constant	-4.752	0.7263	0.000
Son			
Population share		0.0406	
Supplementary carer (lag, ref = none)			
Daughter	2.305	0.5646	0.000
Son	5.988	0.3731	0.000
Other	3.424	0.6542	0.000
Care from partner (lag)	1.419	0.8477	0.094
Constant	-5.889	0.8788	0.000
Other			
Population share		0.0238	
Supplementary carer (lag, ref = none)			
Daughter	1.332	1.0583	0.208
Son	2.999	0.7267	0.000
Other	6.108	0.4798	0.000
Care from partner (lag)	16.038	0.5285	0.000
Constant	-20.810	0.6080	0.000
Number of observations	1998		
Share of "none"	0.8309		
Pseudo R2	0.5285		

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.
Notes: Sample limited to individuals aged 65 and over receiving social care from their partner and without missing variables. Regression considers four alternatives for supplementary carers: none (reference), daughter, son, and other. Weighted regression with robust standard errors reported. "lag" defined as preceding year.

Table B.6: Multinomial logit regression estimates for informal carer(s) for population aged 65 and over who receive care but not from a partner (reference group: daughter only)

	Coef.	s.e.	p>z	Coef.	s.e.	p>z
	Daughter and son			*Daughter and other*		
Population share	0.0822			0.0924		
Carer(s) (lag, ref: none)						
Daughter only	-2.279	0.3566	0.000	-1.701	0.3164	0.000
Daughter and son	3.415	0.3473	0.000	-2.708	1.0562	0.010
Daughter and other	-0.955	0.6524	0.143	3.162	0.3449	0.000
Son only	2.537	0.5140	0.000	-0.147	0.6953	0.833
Son and other	2.944	1.4254	0.039	1.149	1.4277	0.421
Other only	-0.285	1.0008	0.776	0.757	0.6439	0.240
Constant	-1.533	0.1756	0.000	-1.586	0.1931	0.000
	Son only			*Son and other*		
Population share	0.1640			0.0513		
Carer(s) (lag, ref: none)						
Daughter only	-4.261	0.5518	0.000	-2.628	0.6440	0.000
Daughter and son	-0.152	0.4764	0.750	0.488	0.8075	0.545
Daughter and other	-3.164	1.0421	0.002	-1.710	1.0677	0.109
Son only	4.475	0.4313	0.000	2.982	0.5800	0.000
Son and other	4.226	1.0790	0.000	7.554	1.0474	0.000
Other only	0.400	0.5718	0.484	1.446	0.7086	0.041
Constant	-0.784	0.1372	0.000	-2.216	0.2696	0.000
	Other only					
Population share	0.2492					
Carer(s) (lag, ref: none)						
Daughter only	-4.145	0.4039	0.000			
Daughter and son	-1.396	0.7752	0.072			
Daughter and other	-1.607	0.6581	0.015			
Son only	-0.606	0.7058	0.391			
Son and other	1.213	1.3403	0.365			
Other only	3.771	0.4380	0.000			
Constant	-0.264	0.1181	0.025			
Number of observations	2232					
Share of "daughter only"	0.3609					
Pseudo R2	0.5311					

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.
Notes: Sample limited to individuals aged 65 and receiving social care but not from a partner and without missing variables. Regression considers six possible alternatives: none daughter only (reference), daughter and son, daughter and other, son only, son and other, and other only. Weighted estimates with robust standard errors reported. "lag" refers to preceding year.

Table B.7: Linear least squares regression estimates for log hours of informal care per week provided by partner to people aged 65 and over

	Coef.	s.e.	p>z
Gender (ref = Women)			
Men	0.144	0.070	0.041
Education Level (ref = High)			
Medium	0.056	0.109	0.606
Low	0.288	0.109	0.009
Supplementary carer (ref = none)			
Daughter	0.355	0.127	0.005
Son	0.280	0.153	0.067
Other	0.522	0.161	0.001
Formal market	0.264	0.096	0.006
Self-rated health poor	0.659	0.085	0.000
Region (Ref = London)			
North East	0.314	0.254	0.217
North West	0.024	0.193	0.901
Yorkshire and the Humber	0.131	0.200	0.513
East Midlands	-0.053	0.198	0.791
West Midlands	-0.267	0.194	0.168
East of England	-0.014	0.187	0.940
South East	-0.128	0.197	0.516
South West	-0.177	0.189	0.348
Wales	-0.012	0.187	0.950
Scotland	-0.090	0.191	0.637
Northern Ireland	-0.026	0.199	0.897
Constant	1.641	0.189	0.000
Number of obs	1626		
RMSE	1.2093		
R-squared	0.1179		

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.

Notes: Sample limited to individuals aged 65 and receiving social care from a partner and without missing variables. Robust standard errors reported. Explanatory variables describe characteristics of person in receipt of care.

Table B.8: Linear least squares regression estimates for log hours of informal care per week provided by daughter to people aged 65 and over

	Coef.	s.e.	p>z
Gender (ref = Women)			
Men	-0.053	0.088	0.549
Education Level (ref = High)			
Medium	-0.236	0.193	0.224
Low	-0.198	0.186	0.286
Supplementary carer (ref = none)			
Partner	-0.282	0.095	0.003
Son	-0.002	0.094	0.985
Other	-0.124	0.089	0.166
Formal market	0.176	0.091	0.055
Self-rated health poor	0.305	0.091	0.001
Region (Ref = London)			
North East	-0.389	0.233	0.094
North West	0.012	0.225	0.959
Yorkshire and the Humber	-0.075	0.243	0.759
East Midlands	-0.204	0.219	0.353
West Midlands	0.013	0.199	0.948
East of England	-0.361	0.201	0.073
South East	-0.329	0.202	0.104
South West	-0.084	0.209	0.688
Wales	0.061	0.206	0.766
Scotland	-0.057	0.202	0.777
Northern Ireland	0.023	0.203	0.909
Constant	1.982	0.234	0.000
Number of obs	894		
RMSE	0.9889		
R-squared	0.0570		

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.

Notes: Sample limited to individuals aged 65 and receiving social care from a partner and without missing variables. Explanatory variables describe characteristics of person in receipt of care. Robust standard errors reported.

Table B.9: Linear least squares regression estimates for log hours of informal care per week provided by son to people aged 65 and over

	Coef.	s.e.	p>z
Gender (ref = Women)			
Men	-0.039	0.109	0.723
Education Level (ref = High)			
Medium	-0.293	0.244	0.232
Low	-0.080	0.228	0.727
Supplementary carer (ref = none)			
Partner	-0.255	0.124	0.039
Daughter	-0.070	0.097	0.470
Other	-0.145	0.098	0.141
Formal market	-0.045	0.110	0.681
Self-rated health poor	0.340	0.116	0.004
Region (Ref = London)			
North East	0.245	0.453	0.589
North West	0.031	0.207	0.882
Yorkshire and the Humber	-0.017	0.220	0.937
East Midlands	-0.056	0.257	0.828
West Midlands	-0.146	0.205	0.476
East of England	-0.255	0.210	0.225
South East	-0.291	0.192	0.130
South West	-0.230	0.226	0.309
Wales	-0.207	0.211	0.327
Scotland	0.177	0.254	0.487
Northern Ireland	0.191	0.203	0.349
Constant	1.892	0.283	0.000
Number of obs	547		
RMSE	0.9513		
R-squared	0.0760		

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.
Notes: Sample limited to individuals aged 65 and receiving social care from a partner and without missing variables. Explanatory variables describe characteristics of person in receipt of care. Robust standard errors reported.

Table B.10: Linear least squares regression estimates for log hours of informal care per week provided by others to people aged 65 and over

	Coef.	s.e.	p>z
Gender (ref = Women)			
Men	0.076	0.086	0.378
Education Level (ref = High)			
Medium	0.072	0.147	0.626
Low	0.239	0.147	0.105
Supplementary carer (ref = none)			
Partner	-0.186	0.093	0.047
Daughter	0.006	0.086	0.944
Son	-0.088	0.098	0.366
Formal market	0.113	0.094	0.234
Self-rated health poor	0.285	0.089	0.001
Region (Ref = London)			
North East	-0.604	0.310	0.052
North West	-0.717	0.281	0.011
Yorkshire and the Humber	-0.536	0.279	0.056
East Midlands	-0.418	0.300	0.164
West Midlands	-0.572	0.293	0.051
East of England	-0.859	0.295	0.004
South East	-0.642	0.281	0.023
South West	-0.536	0.313	0.087
Wales	-0.401	0.277	0.149
Scotland	-0.276	0.285	0.334
Northern Ireland	-0.432	0.296	0.145
Constant	1.760	0.261	0.000
Number of obs	585		
RMSE	0.8472		
R-squared	0.0934		

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.

Notes: Sample limited to individuals aged 65 and receiving social care from a partner and without missing variables. Explanatory variables describe characteristics of person in receipt of care. Robust standard errors reported.

Table B.11: Linear least squares regression estimates for log hours of formal care per week provided to people aged 65 and over

	Coef.	s.e.	p>z
Gender (ref = Women)			
Men	0.234	0.078	0.003
Education Level (ref = High)			
Medium	-0.015	0.108	0.890
Low	0.183	0.109	0.093
Informal carer	0.196	0.071	0.005
Self-rated health poor	0.306	0.087	0.000
Region (Ref = London)			
North East	0.016	0.272	0.954
North West	-0.010	0.199	0.961
Yorkshire and the Humber	-0.141	0.211	0.504
East Midlands	0.168	0.224	0.453
West Midlands	0.048	0.210	0.820
East of England	-0.062	0.199	0.754
South East	-0.159	0.190	0.402
South West	-0.044	0.194	0.822
Wales	-0.240	0.187	0.199
Scotland	-0.009	0.190	0.964
Northern Ireland	0.094	0.189	0.617
Constant	1.293	0.179	0.000
Number of obs	1026		
RMSE	0.9433		
R-squared	0.0681		

Source: Authors' calculations on pooled data reported by waves "g", "i", and "k" of UKHLS.
Notes: Sample limited to individuals aged 65 and receiving social care from a partner and without missing variables. Robust standard errors reported.

B.3 Informal Social Care Provision – supplementary statistics

Table B.12: Probit regression estimates for the incidence of providing informal care to non-partners among people aged 18 and over who supply informal care to their partners

	Coef.	s.e.	p>z
Gender (Ref = Women)			
Men	-0.100	0.0463	0.031
Education Level (Ref = High)			
Medium	0.006	0.0641	0.922
Low	-0.118	0.0715	0.100
care for partner (lag, Ref = no care)			
care only for partner	-0.135	0.0566	0.017
care for partner and non-partner	1.236	0.0688	0.000
care only for non-partner	1.253	0.0897	0.000
Self-rated health (Ref = Excellent)			
Very good	0.001	0.1030	0.995
Good	-0.005	0.0991	0.956
Fair	-0.033	0.1009	0.746
Poor	-0.007	0.1146	0.953
Age group (Ref = 18-19)			
20-24	0.472	0.4815	0.327
25-29	0.344	0.2273	0.130
30-34	0.592	0.1996	0.003
35-39	0.781	0.1789	0.000
40-44	0.641	0.1701	0.000
45-49	0.775	0.1502	0.000
50-54	0.741	0.1434	0.000
55-59	0.590	0.1422	0.000
60-64	0.436	0.1384	0.002
65-69	0.275	0.1370	0.045
70-74	0.181	0.1346	0.180
75-59	0.164	0.1402	0.243
80-84	-0.031	0.1475	0.832
85+		(omitted)	
Constant	-1.373	0.1868	0.000
Number of observations	6355		
Proportion positive	0.2057		
Pseudo R2	0.2115		

Source: Authors' calculations on pooled data reported between 2015 and 2020 by waves "f" to "l" of the UKHLS.
Notes: Sample limited to individuals aged 18 and over with partners to whom they provide informal care and without missing variables. Weighted estimates with robust standard errors. "lag" defined as preceding year. Regional dummy variables generally not significant, and omitted from table for brevity (available from authors upon request).

Table B.13: Probit estimates for the incidence of providing informal care to non-partners among people aged 18 and over who do not supply informal care to a partner

	Coef.	s.e.	p>z
Gender (Ref = Women)			
Men	-0.139	0.0112	0.000
Education Level (Ref = High)			
Medium	0.099	0.0128	0.000
Low	0.007	0.0181	0.714
Care for partner (lag, Ref = no care)			
care only for partner	0.259	0.0561	0.000
care for partner and non-partner	1.514	0.0744	0.000
care only for non-partner	1.806	0.0119	0.000
Self-rated health (Ref = Excellent)			
Very good	0.043	0.0193	0.024
Good	0.063	0.0195	0.001
Fair	0.082	0.0223	0.000
Poor	-0.007	0.0293	0.815
Partner	-0.107	0.0123	0.000
Age group (Ref = 18-19)			
20-24	0.106	0.0476	0.026
25-29	0.173	0.0482	0.000
30-34	0.216	0.0475	0.000
35-39	0.320	0.0459	0.000
40-44	0.342	0.0447	0.000
45-49	0.434	0.0437	0.000
50-54	0.534	0.0433	0.000
55-59	0.526	0.0431	0.000
60-64	0.483	0.0437	0.000
65-69	0.395	0.0439	0.000
70-74	0.255	0.0448	0.000
75-59	0.106	0.0482	0.028
80-84	0.005	0.0537	0.927
85+	-0.188	0.0639	0.003
Constant	-1.902	0.0473	0.000
Number of observations	167458		
Proportion positive	0.1355		
Pseudo R2	0.3021		

Source: Authors' calculations on pooled data reported between 2015 and 2020 by waves "f" to "l" of the UKHLS.
Notes: Sample limited to individuals aged 18 and over who do not provide informal care to a partner and without missing variables. Weighted estimates with robust standard errors. "lag" defined as preceding year. Regional dummy variables generally not significant, and omitted from table for brevity (available from authors upon request).

Table B.14: Probit regression estimates for the incidence of providing informal care among people aged 18 and over who do not have a partner

	Coef.	s.e.	p>z
Gender (Ref = Women)			
Men	-0.093	0.0193	0.000
Education Level (Ref = High)			
Medium	0.109	0.0233	0.000
Low	0.025	0.0308	0.421
Care for partner (lag, Ref = no care)			
care only for partner	0.400	0.1061	0.000
care for partner and non-partner	1.198	0.1898	0.000
care only for non-partner	1.778	0.0202	0.000
Self-rated health (Ref = Excellent)			
Very good	-0.008	0.0333	0.807
Good	0.038	0.0333	0.260
Fair	0.076	0.0369	0.040
Poor	-0.012	0.0442	0.788
Age group (Ref = 18-19)			
20-24	0.110	0.0483	0.023
25-29	0.191	0.0537	0.000
30-34	0.261	0.0581	0.000
35-39	0.351	0.0578	0.000
40-44	0.423	0.0556	0.000
45-49	0.472	0.0517	0.000
50-54	0.499	0.0503	0.000
55-59	0.446	0.0491	0.000
60-64	0.453	0.0510	0.000
65-69	0.361	0.0515	0.000
70-74	0.291	0.0522	0.000
75-59	0.156	0.0563	0.005
80-84	0.025	0.0609	0.681
85+	-0.160	0.0689	0.021
Constant	-1.922	0.0581	0.000
Number of observations	61235		
Proportion positive	0.1353		
Pseudo R2	0.2956		

Source: Authors' calculations on pooled data reported between 2015 and 2020 by waves "f" to "l" of the UKHLS.
Notes: Sample limited to individuals aged 18 and over who do not have a partner and without missing variables.

Table B.15: Multinomial logit regression estimates for the incidence of providing informal care among people aged 18 and over with a partner

	only care for partner (4.9%)			care for partner and other (1.3%)			only care for other (13.0%)		
	Coef.	s.e.	p>z	Coef.	s.e.	p>z	Coef.	s.e.	p>z
Gender (Ref = Women)									
Men	-0.028	0.046	0.550	-0.194	0.075	0.010	-0.336	0.026	0.000
Education Level (Ref = High)									
Medium	0.366	0.057	0.000	0.410	0.096	0.000	0.157	0.029	0.000
Low	0.632	0.069	0.000	0.415	0.118	0.000	-0.059	0.042	0.160
Care for partner (lag, Ref = no care)									
care only for partner	4.707	0.055	0.000	4.601	0.110	0.000	0.317	0.133	0.018
care for partner and non-partner	4.549	0.120	0.000	6.771	0.134	0.000	2.742	0.129	0.000
care only for non-partner	0.404	0.099	0.000	2.561	0.113	0.000	3.198	0.026	0.000
Self-rated health (Ref = Excellent)									
Very good	0.045	0.094	0.632	0.094	0.157	0.550	0.155	0.045	0.001
Good	0.191	0.092	0.038	0.218	0.152	0.152	0.157	0.045	0.001
Fair	0.522	0.099	0.000	0.611	0.159	0.000	0.140	0.052	0.007
Poor	0.606	0.122	0.000	0.722	0.190	0.000	-0.026	0.075	0.732
Age group (Ref = under 35)									
35-44	0.069	0.123	0.574	0.292	0.213	0.171	0.296	0.055	0.000
45-54	0.251	0.116	0.030	0.572	0.192	0.003	0.626	0.052	0.000
55-64	0.651	0.112	0.000	0.554	0.192	0.004	0.701	0.052	0.000
65+	1.203	0.108	0.000	0.472	0.191	0.013	0.199	0.053	0.000
Constant	-5.068	0.162	0.000	-6.623	0.257	0.000	-3.274	0.076	0.000

Source: Authors' calculations on pooled data reported between 2015 and 2020 by waves "f" to "l" of the UKHLS.
Notes: Sample limited to individuals aged 18 and over who have a partner and without missing variables comprising 112,579 observations. Pseudo R2 equals 0.3560. Reference group is people not providing social care. Population shares reported in brackets. Weighted estimates with robust standard errors. "lag" defined as preceding year. Regional dummy variables generally not significant, and omitted from table for brevity.

Table B.16: Linear least squares regression estimates for log hours of informal care per week provided by people aged 18 and over

	Coef.	s.e.	p>z
Gender (Ref = Women)			
Men	-0.260	0.0179	0.000
Education Level (Ref = High)			
Medium	0.250	0.0208	0.000
Low	0.523	0.0285	0.000
Self-rated health (Ref = Excellent)			
Very good	0.011	0.0328	0.739
Good	0.172	0.0331	0.000
Fair	0.329	0.0367	0.000
Poor	0.553	0.0477	0.000
Social care provided (Ref = care only for partner)			
care for partner and non-partner	-0.205	0.0502	0.000
care only for non-partner	-1.272	0.0278	0.000
Partner	-0.234	0.0219	0.000
Age group (Ref = 18-19)			
20-24	0.165	0.0913	0.070
25-29	0.279	0.0936	0.003
30-34	0.526	0.0926	0.000
35-39	0.597	0.0888	0.000
40-44	0.564	0.0864	0.000
45-49	0.309	0.0837	0.000
50-54	0.223	0.0818	0.006
55-59	0.196	0.0811	0.016
60-64	0.152	0.0812	0.062
65-69	0.065	0.0820	0.427
70-74	0.068	0.0833	0.414
75-79	0.071	0.0874	0.415
80-84	0.068	0.0946	0.474
85+	-0.072	0.1086	0.506
Constant	2.704	0.0933	0.000
Number of observations	31490		
RSME	1.2789		
R2	0.1783		

Source: Authors' calculations on pooled data reported by waves "f" to "l" of UKHLS.
Notes: Sample limited to individuals aged 18 and over supplying some social care and without missing variables. See table A.17 for further details.

Appendix C Walk-through of analysis

This appendix provides a step-by-step walk through to facilitate replication of projections that are the focus of this study. Directions concerning the SimPaths model can be found on the Github wiki at: https://github.com/centreformicrosimulation/SimPaths/wiki. Directions concerning UKMOD can be found at: https://www.microsimulation.ac.uk/ukmod. All simulations were evaluated on personal workstations using Windows operating systems. Any further queries concerning the analysis should be directed to the authors.

1. Download the SimPaths model from the public Github repository at: https://github.com/centreformicrosimulation/WELLCARE/releases/tag/policy-analysis
2. Download survey data sources used for model input. The survey data sources were obtained from the UK data service at https://ukdataservice.ac.uk
    a. Understanding Society survey, Serial Number 6614.
    b. Wealth and Assets Survey, Serial Number 7215.
3. Compile the model input data:
    a. Using the Stata statistical program, open file found in the SimPaths directory: `input\InitialPopulations\compile\00_master.do`
    b. Amend working directories as necessary.
    c. Run the Stata file.
4. Compile the input data used to impute taxes and benefits:
    a. Obtain UKMOD, version B2024.14 from the public Github repository at https://github.com/centreformicrosimulation/UKMOD-PUBLIC
    b. Request UKMOD input dataset "UK_2019_b1" via the on-line application form at: https://www.microsimulation.ac.uk/ukmod/access
    c. Run UKMOD for UK system years 2011 to 2027, using the input data from (4b)
    d. Copy and paste output data from (4c) to SimPaths directory: `input\EUROMODoutput\database1`
    e. Copy and paste output data from (4c) again, this time to SimPaths directory: `input\EUROMODoutput`
5. Create model input database:
    a. Open SimPaths file: `src\main\java\simpaths\experiment\SimPathsMultiRun.java`
    b. Change the name of configFile at line 53 to "create database.yml"
    c. Run SimPathsMultiRun
6. Extend the tax database:
    a. Open SimPaths file: `src\main\java\simpaths\experiment\SimPathsMultiRun.java`
    b. Change the name of configFile at line 53 to "sc analysis0.yml"

    c. Open SimPaths file: `src\main\java\simpaths\model\taxes\database\DatabaseExtension.java`
    d. Change the file directory at line 31 to UKMOD's input folder
    e. Run SimPathsMultiRun
    f. When simulation is complete navigate to UKMOD's input folder
    g. Rename "UK_2019_b1.txt" to "UK_2019_b1 – database1.txt"
    h. Rename "UK_2019_b1 – augmented.txt" to "UK_2019_b1.txt"
    i. Copy "UK_2019_b1.txt" and rename as "UK_2019_b1 – database2.txt"
    j. Run UKMOD for system years 2011 to 2027, using the input data from (6h)
    k. Copy and paste output data from (6j) to SimPaths directory: `input\EUROMODoutput\database2`
    l. Copy and paste output data from (6j) to SimPaths directory: `input\EUROMODoutput`
    m. Run SimPathsStart
    n. Select option "Load new input data for tax and benefit systems" and click "next"
    o. Exit when "Start-up Options" are complete
7. Run simulated baseline scenario.
    a. Open SimPaths file: `src\main\java\simpaths\experiment\SimPathsMultiRun.java`
    b. Change the name of configFile at line 53 to "sc analysis1.yml"
    c. Run SimPathsMultiRun
    d. When the simulation is done, rename the newly created directory that has saved simulated output (located in `output\`) to `output\sc_analysis1`
8. Run simulated baseline scenario omitting population alignment.
    a. Open SimPaths file: `src\main\java\simpaths\experiment\SimPathsMultiRun.java`
    b. Change the name of configFile at line 53 to "sc analysis1b.yml"
    c. Run SimPathsMultiRun
    d. When the simulation is done, rename the newly created directory that has saved simulated output (located in `output\`) to `output\sc_analysis1b`
9. Run simulated high mortality scenario.
    a. Replace excel file `input\projections_mortality.xlsx` with a copy of file `input\projections_mortality - constant.xlsx`
    b. Open SimPaths file: `src\main\java\simpaths\experiment\SimPathsMultiRun.java`
    c. Change the name of configFile at line 53 to "sc analysis1c.yml"
    d. Run SimPathsMultiRun
    e. When the simulation is done, rename the newly created directory that has saved simulated output (located in `output\`) to `output\sc_analysis1c`
10. Run simulated healthy life scenario.

    a. Replace excel file `input\projections_mortality.xlsx` with a copy of file `input\projections_mortality - original.xlsx`
    b. Open SimPaths file: `src\main\java\simpaths\experiment\SimPathsMultiRun.java`
    c. Change the name of configFile at line 53 to "sc analysis1d.yml"
    d. Run SimPathsMultiRun
    e. When the simulation is done, rename the newly created directory that has saved simulated output (located in `output\`) to `output\sc_analysis1d`
11. Run the reduced social care gap scenario.
    a. Replace excel file `input\reg_socialcare.xlsx` with a copy of file `input\reg_socialcare - Scotland.xlsx`
    b. Open SimPaths file: `src\main\java\simpaths\experiment\SimPathsMultiRun.java`
    c. Change the name of configFile at line 53 to "sc analysis1.yml"
    d. Run SimPathsMultiRun
    e. When the simulation is done, rename the newly created directory that has saved simulated output (located in `output\`) to `output\care_gap`
    f. Replace excel file `input\reg_socialcare.xlsx` with a copy of file `input\reg_socialcare - original.xlsx`
12. Run the increased carer support scenario.
    a. Open UKMOD, and access the "UK" country.
    b. Under the "ConstDef_uk" policy, 4.6, add 2000 to values of parameter $CASup (4.6.12) for system years 2019 to 2027.
    c. Under the "bcrdicm_uk" policy, "Elig" function (26.1) delete "& (drgn1=12)" from the "Elig_Cond" parameter for system years 2019 to 2027.
    d. Save UKMOD, and run for system years 2019 to 2027, using the input data from (6h).
    e. Copy and paste output data from (12c) to SimPaths directory: `input\EUROMODoutput\database3`
    f. Copy and paste output data from (12c) to SimPaths directory: `input\EUROMODoutput`
    g. Run SimPathsStart
    h. Select option "Load new input data for tax and benefit systems" and click "next"
    i. Exit when "Start-up Options" are complete
    j. Open SimPaths file: `src\main\java\simpaths\experiment\SimPathsMultiRun.java`
    k. Change the name of configFile at line 53 to "sc analysis1.yml"
    l. Run SimPathsMultiRun
    m. When the simulation is done, rename the newly created directory that has saved simulated output (located in `output\`) to `output\carer_support`
13. Generate statistics reported in Section 4

a. Access model directory `analysis\`
b. Using Stata, edit files "care analysis 6.do", "care analysis 7.do" and "care analysis 8.do" to specify local directories.
c. Run "care analysis 8.do"
d. Results reported in Section 4.1:
    i. Open Excel file "care policy – sc_analysis1.xlsx"
    ii. Replace data in grey shaded cells with statistics reported in Stata log files, as directed in the "Notes" worksheet and by comments in top right corner of each region shaded in grey.
e. Results reported in Section 4.2.1:
    i. Open Excel file "care policy – sc_analysis1b.xlsx"
    ii. Replace data in grey shaded cells with statistics reported in Stata log files, as directed in the "Notes" worksheet and by comments in top right corner of each region shaded in grey.
    iii. Open Excel file "care policy – sc_analysis1c.xlsx"
    iv. Replace data in grey shaded cells with statistics reported in Stata log files, as directed in the "Notes" worksheet and by comments in top right corner of each region shaded in grey.
    v. Results summarised in Excel file "scenario - high mortality.xlsx"
f. Results reported in Section 4.2.2:
    i. Open Excel file "care policy – sc_analysis1d.xlsx"
    ii. Replace data in grey shaded cells with statistics reported in Stata log files, as directed in the "Notes" worksheet and by comments in top right corner of each region shaded in grey.
    iii. Results summarised in Excel file "scenario - healthy life.xlsx"
g. Results reported in Section 4.3.1:
    i. Open Excel file "care policy – care gap.xlsx"
    ii. Replace data in grey shaded cells with statistics reported in Stata log files, as directed in the "Notes" worksheet and by comments in top right corner of each region shaded in grey.
    iii. Results summarised in Excel file "scenario - care gap.xlsx"
h. Results reported in Section 4.3.2:
    i. Open Excel file "care policy – carer support.xlsx"
    ii. Replace data in grey shaded cells with statistics reported in Stata log files, as directed in the "Notes" worksheet and by comments in top right corner of each region shaded in grey.
    iii. Results summarised in Excel file "scenario - carer support.xlsx"

Appendix D Supplementary Results

D.1 Baseline scenario, social care receipt

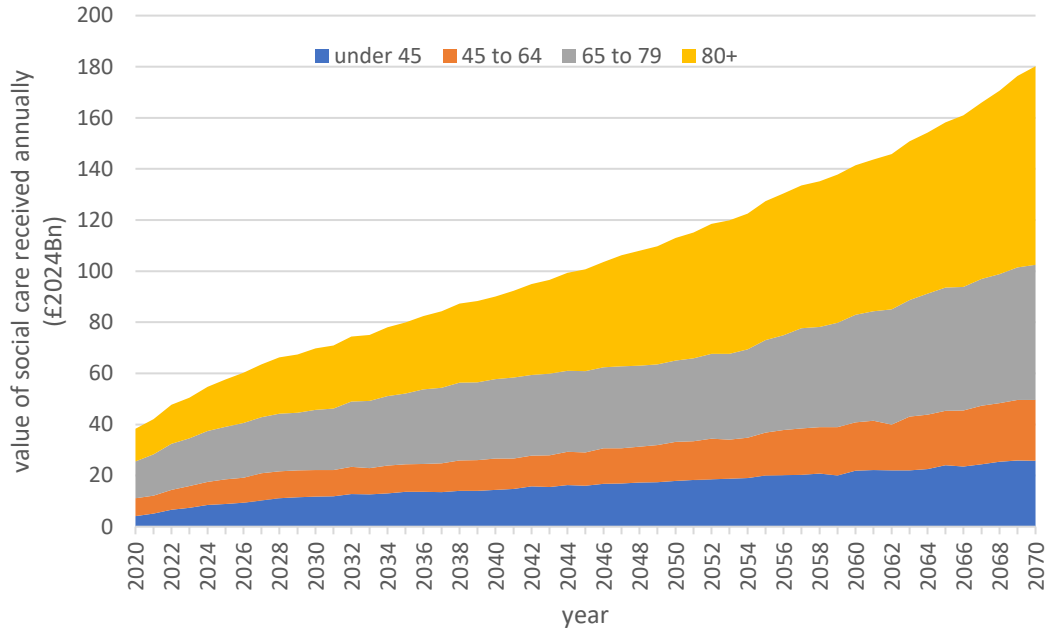


Figure D.1: Value of social care received by age band and simulation year

Source: Authors' calculations on simulated data

Notes: Projections for value of social care received obtained by interacting hours of social care received by year-specific projections for hourly wages of care workers. Hourly wages of care workers reported for 2020 to 2023 by ONS Earnings and hours worked, care workers: ASHE Table 26. Projections for hourly wages based on median reported wages, adjusted to reflect wage growth and adjusted to 2024 prices based on the CPI reported by the OBR in its baseline projections reported 16 May 2024.

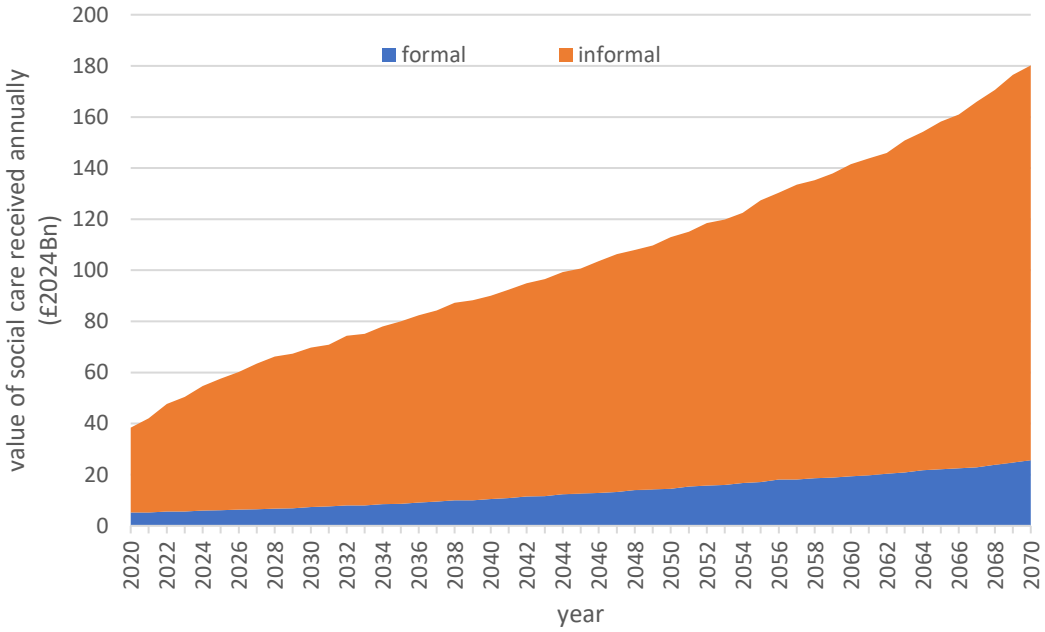


Figure D.2: Value of social care received by provider and simulation year

Source: See Figure D.1.

D.2 Counterfactual scenarios

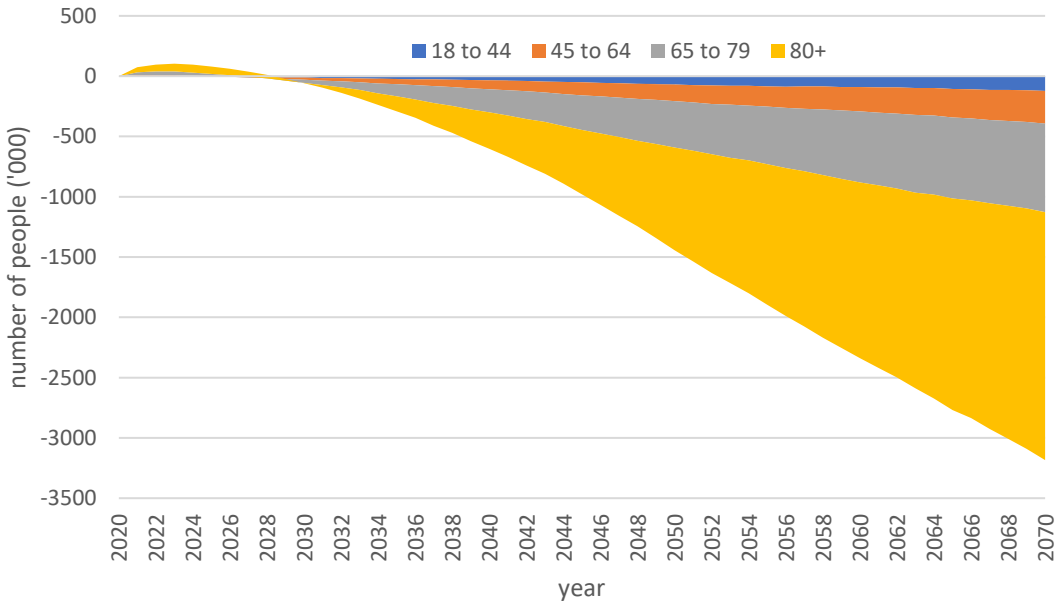


Figure D.3: Effects on population sizes of replacing the baseline scenario with the 'high mortality' scenario, by age band and year

Notes: See Figure 4.7.

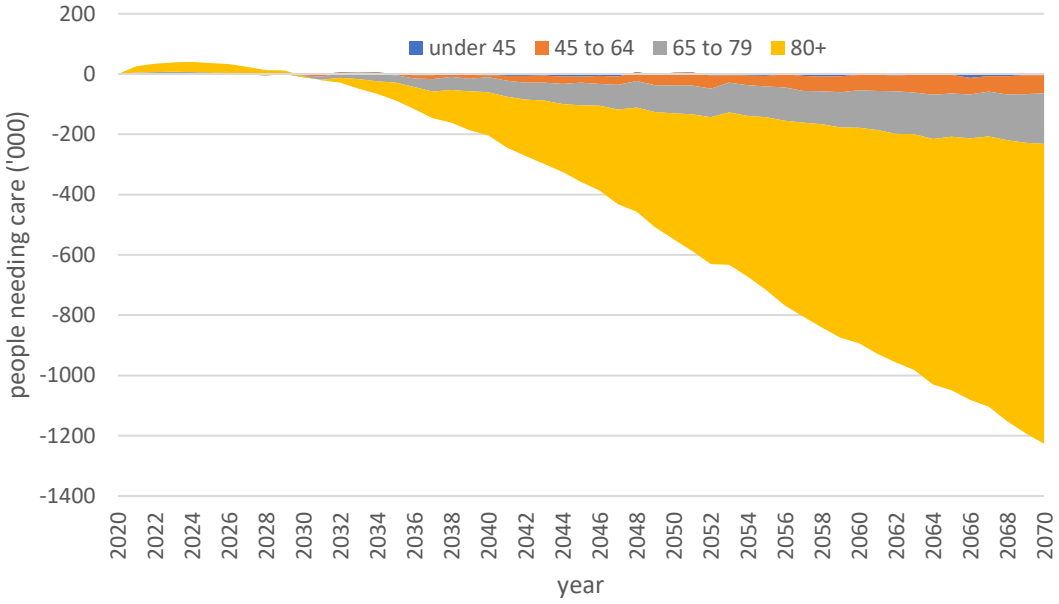


Figure D.4: Effects on number of people needing social care of replacing the baseline scenario with the 'high mortality' scenario, by age band and year

Notes: See Figure 4.7.

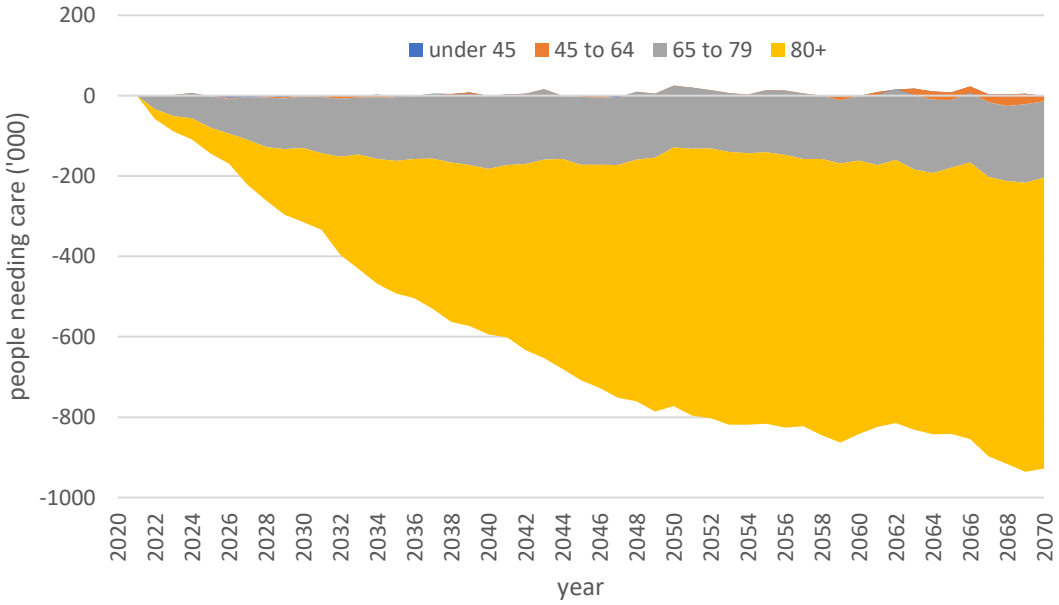


Figure D.5: Effects on number of people needing social care of replacing the baseline scenario with the 'healthy life' scenario, by age band and year

Notes: See Figure 4.8.

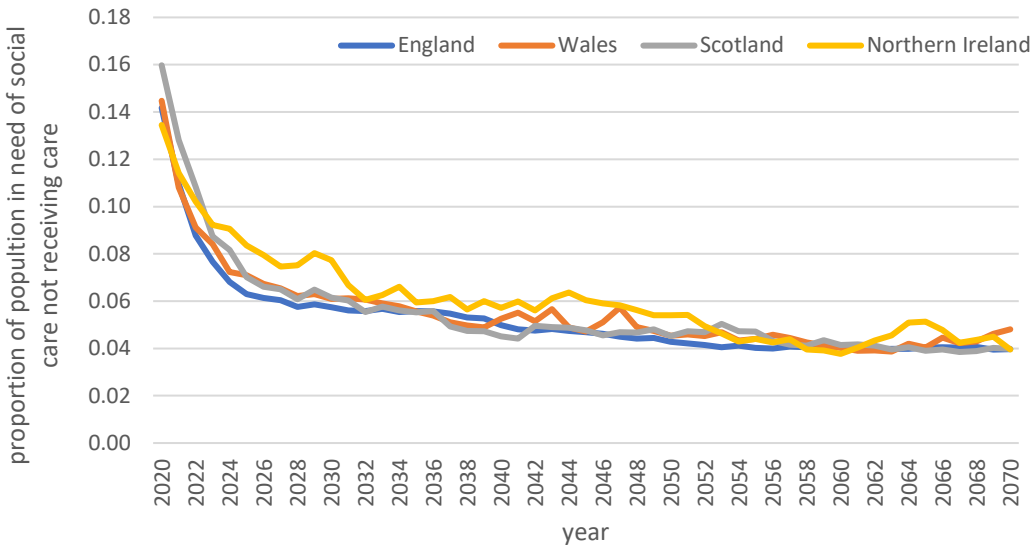


Figure D.6: Evolution of social care gap for people aged 65 and over projected under the "reduced social care gap" scenario, by year and country

Source: Authors' calculations on simulated data derived from the SimPaths microsimulation model.
Notes: "Social care gap" defined here as the number of people in need of social care who do not receive care.
See Section 3.3 for description of 'reduced social care gap' scenario.

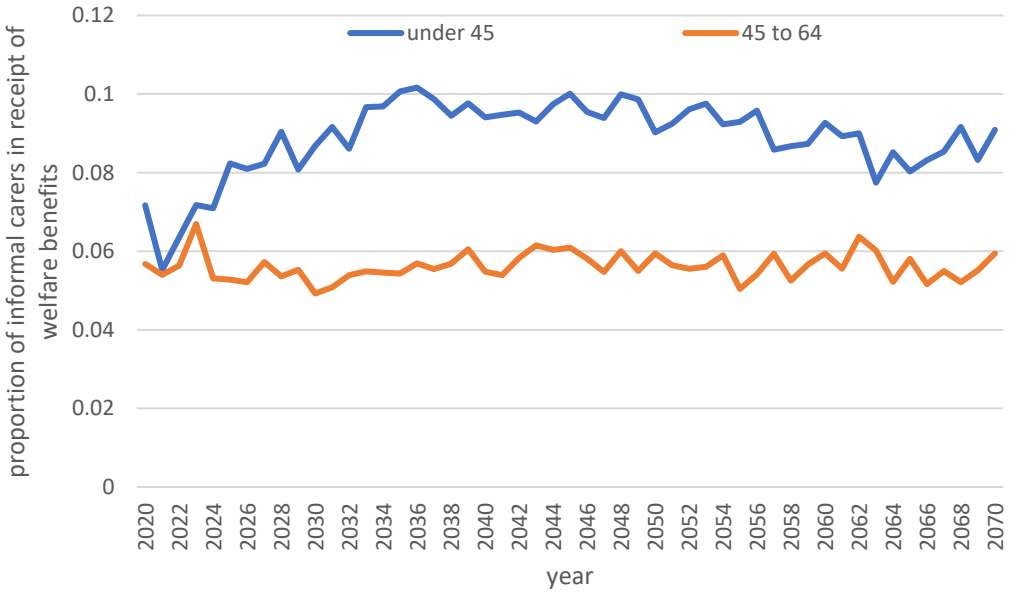


Figure D.7: Effects on proportions of informal carers receiving carer welfare benefits of replacing the baseline scenario with the 'increased carer support' scenario, by age band and year

Source: Authors' calculations on simulated data derived from the SimPaths microsimulation model.
Notes: See Section 3.3 for description of 'increased carer support' scenario.

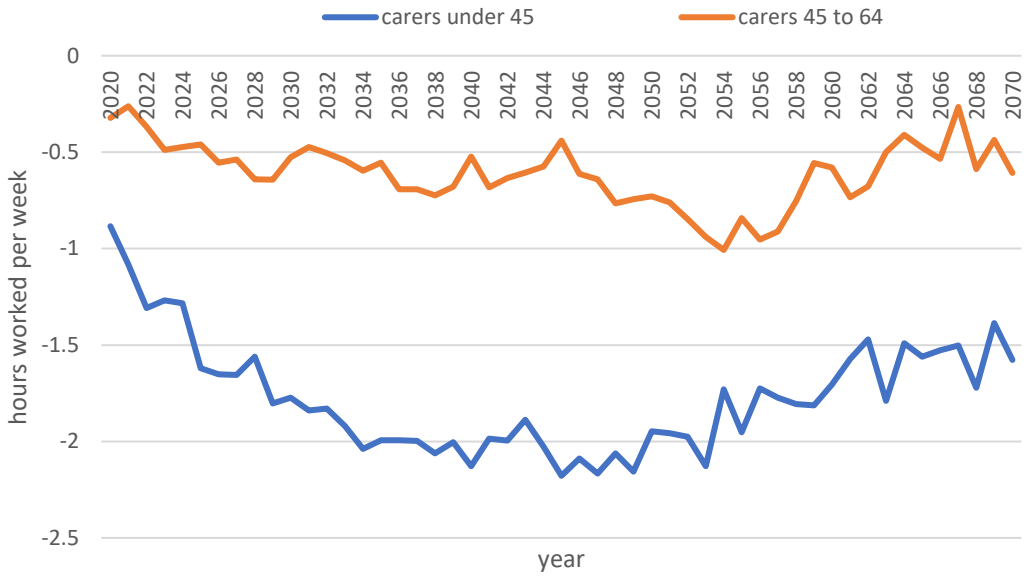


Figure D.8: Effects on average hours of employment of informal carers of replacing the baseline scenario with the 'increased carer support' scenario, by age band and year

Source: See Figure D.7.

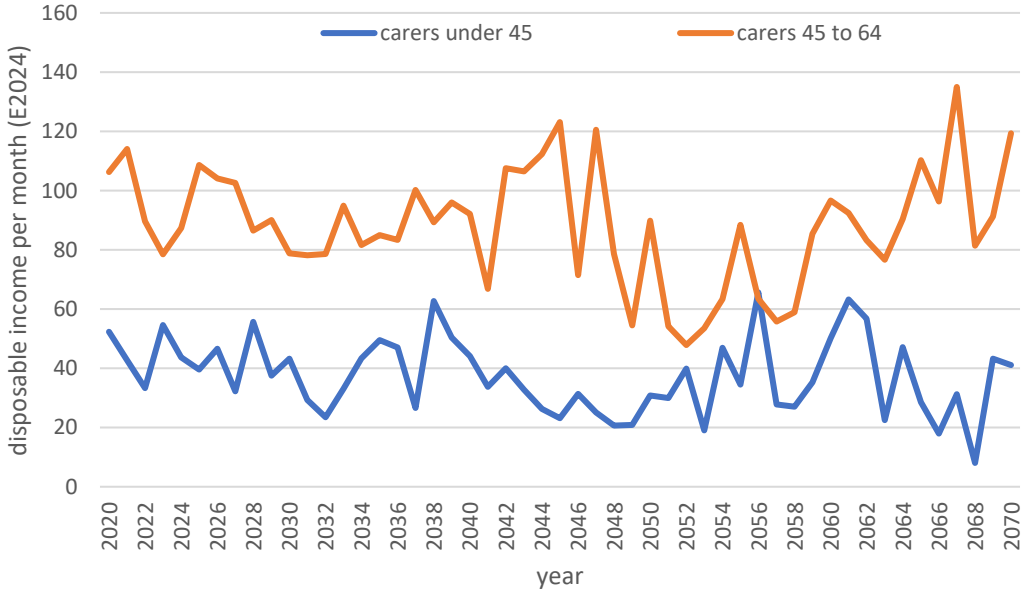


Figure D.9: Effects on disposable income of informal carers of replacing the baseline scenario with the 'increased carer support' scenario, by age band and year

Source: See Figure D.7.