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Long-term care spending and hospital use among the older population in England

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Abstract

This paper examines the impact of changes in public long-term care spending on the use of public hospitals among the older population in England, and the cost and quality of this care. Mean per-person long-term care spending fell by 31% between 2009/10 and 2017/18 as part of a large austerity programme, but cuts varied considerably geographically. We instrument public long-term care spending with predicted spending based on historical national funding shares and national spending trends. We find public long-term care spending cuts led to substantial increases in the number of emergency department (ED) visits made by patients aged 65 and above, explaining between a quarter and a half of the growth in ED use among this population over this period. The effects are most pronounced among older people and those living in more deprived areas. This also resulted in an increase in 7-day ED revisits and emergency readmissions. However, there was no wider impact on inpatient or outpatient hospital use, and consequently little impact on overall public hospital costs. These results suggest that the austerity programme successfully reduced combined public spending on health and long-term care, but had adverse effects on the health of vulnerable users.

Keywords: Long-term care; Hospital use; Emergency Department; Quality of care; Health expenditure; Austerity.
JEL Classification: I10; H51.

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1 Introduction

The funding of long-term care is becoming an increasingly important policy concern across the developed world due to demographic changes. 1.3% of US GDP was spent on long-term care in 2010, and this is expected to rise to 3.0% by 2050 (Congressional Budget Office, 2013). Similar trends exist in the UK, where public spending on long-term care accounted for 1.2% of GDP in 2017, and is projected to grow to 1.8% by 2050 (Office for Budgetary Responsibility, 2018).[1] Long-term care provides assistance to people with difficulties in carrying out everyday activities, and is provided either formally or informally in private residences or in care institutions. The costs associated with this care are in addition to the large (and rising) sums of money spent by governments around the world on health care. Against this backdrop of growing costs, there is growing interest in the potential for improvements in the efficiency and quality of care provided to the elderly population.

Despite targeting similar populations, health care and long-term care are often funded and organised separately. For example, in the US, Medicare and Medicaid have separate responsibilities for health and long-term care of the elderly, respectively. In England, health care is provided centrally by the government through the National Health Service (NHS) and is free at the point of use to all residents. In contrast, long-term care is means-tested, and organised and funded by 152 separate local governments. As a result, there is much variation in the quality and quantity of care provided to local residents, and little coordination with the health care system. This raises the potential for poor coordination of health and long-term care for vulnerable individuals, with possible consequences for their health, and for the overall cost and efficiency of public services provided for older people.

In this paper we examine the impacts of reductions in public long-term care spending on hospital utilisation, costs and care quality among the older population in England. Specifically, we exploit the institutional features of the English public long-term care system, and the associated variation in local changes in public long-term care funding following the implementation of a large-scale austerity programme in the aftermath of the 2008 financial crisis, to estimate the impacts of long-term care funding cuts on the use and associated (public) costs of emergency department (ED) visits, inpatient admissions and outpatient care at public hospitals in England.

Cuts to central government grants to local areas over the last decade sharply reduced public spending on long-term care: mean per-capita public long-term care spending for the over 65 population fell by 31% between 2009/10 and 2017/18. However, there was substantial variation in the size of funding cuts across different areas. These funding reductions varied with local needs, changes in revenues and political choices. As a result, local spending changes are likely to be highly related to other factors that determine use of hospitals among the older population.

To address this potential endogeneity, we employ an instrumental variables approach. We instrument observed long-term care spending with predicted spending based on historic long-term care spending patterns and observed changes to the national level of public long-term care spending. This follows existing work that uses historical patterns of public spending to

[1] Long-term care is more commonly referred to as 'social care' in the UK.

instrument for potentially endogenous local public spending decisions (Chodorow-Reich et al., 2012; Wilson, 2012; Nakamura and Steinsson, 2014). Specifically, we predict local annual spending between 2009/10 and 2017/18 by allocating observed national long-term care spending in each year to each area based on their share of national long-term care spending in 2005/06. Predicted totals are strongly correlated with actual spending in each area, but reduce in line with national trends in spending. As a result, they are plausibly exogenous to any choices or local factors in any particular area. This approach would be invalid if areas with higher or lower historical spending shares have different trends in hospital use and costs over time. We therefore implement a series of robustness checks to examine whether this is likely to be the case, and find while the exact magnitude of our estimates vary across specifications, our conclusions are qualitatively robust.

Using this approach, we first examine the impact of long-term care spending on emergency department visits. We find that cuts in long-term care spending led to a large increase in the use of EDs by patients aged 65 and above. On average, per person spending on long-term care for this group fell by £391 (31%) over the period. This led to an additional 0.07 ED visits per resident aged 65 and over, or around one additional visit for every 15 residents in the age group. This represents around 18% of the mean of 0.37 ED visits per resident in 2009/10, and suggests that cuts to long-term care explain around half of the observed increase in ED use among the elderly over the period. We show that this increase in the number of visits is a result of both an increased likelihood of attending EDs, and a rise in the intensity of ED use, among the elderly population. We also provide evidence that cuts to long-term care had adverse consequences for the performance of these departments, as measured by patient outcomes. The mean cut to per-person spending of £391 is associated with a 1.0 percentage point increase in the proportion of patients aged 65 and above returning to the ED within 7 days of discharge (relative to a sample mean of 8.0%).

We then examine impacts of funding on inpatient and outpatient care use. We find no aggregate impact on inpatient admissions or outpatient visits. This indicates that the additional ED visits rarely resulted in extensive additional treatment for patients. This suggests that the increase in ED visits are concentrated among relatively low severity patients. We explore this further by examining the diagnoses of patients attending the ED. We find evidence that cuts to long-term care led to an increase in the number of patients presenting in the ED without a medical problem (with the diagnosis code recorded as 'nothing abnormal detected'). Some of these patients are, nonetheless, admitted to hospital for further observation and treatment. Accordingly, we show that cuts to long-term care led to an increased number of short emergency inpatient stays (of 3 days or less), but had no effect on the number of longer stays. This suggests that some older individuals, following a reduction in the quantity or quality of long-term care that they receive, ended up presenting in the hospital with minor complaints that would likely have been better addressed in a non-hospital environment.[2] These findings are consistent with

[2]This also contributes to a literature that examines the impact of long-term care provision on 'delayed discharges' from hospital in England (Fernandez and Forder, 2008; Forder, 2009; Gaughan et al., 2015; Gaughan et al., 2017). Previous work has found that reductions in the supply of nursing home beds (or associated funding) led to delays in medically-fit patients being discharged from hospital due to a lack of available post-hospital support. Examining a broader measure of supply for long-term care, including community-based care for individuals with relatively less severe care needs, we find no evidence that reductions in long-term care funding

evidence suggesting that the long-term care funding cuts were focused on community-based (rather than residential or nursing home care) and those with relatively low care needs.

The limited impact on the use of wider services also means that the effect on public hospital costs is very modest. We estimate that a reduction of £100 in per-capita long-term care spending resulted in an increase in ED costs of around £1.50, and no significant impacts on inpatient or outpatient costs. When aggregated together, there is no statistically significant impact on overall hospital costs, as ED costs account for only a small percentage of total hospital costs. This means that in this setting, the financial spillovers onto hospitals were nowhere near large enough to offset the initial public savings from reductions in spending on long-term care.

Publicly funded long-term care in England is both financially means-tested and needs-tested. As a result, we would expect the impacts of reductions in funding to vary across different population groups based on their likelihood of using such care, and their ability to substitute with privately financed formal, or informal, long-term care. We therefore also examine heterogeneity in our results across age and local area deprivation. We find that the estimated impact on ED visits among people aged 85 years and above was twice the size of the estimated impact on those aged between 65 and 74. Among the older group, funding reductions for long-term care also led to a statistically significant increase in emergency inpatient admissions: a 31% reduction in funding for the over 65s as a whole led to a 9% increase in emergency inpatient admissions among the over 85s (an additional 0.05 admissions per person aged 85 and above relative to a mean of 0.56 in 2009/10). This could be explained both by the fact that older people are more likely to need long-term care (and therefore would be most affected by the cuts) and have, on average, greater care needs conditional on receipt. We also show that the increase in ED visits is greatest among patients living in the most deprived third of areas. This is consistent with funding reductions having the greatest impact on those who are more likely to use publicly funded care (or having fewer alternative sources of care), with less affluent individuals more likely to use publicly funded care (Breeze and Stafford, 2010) and more likely to live alone at older ages and therefore less likely to receive informal care from a spouse (Gjonça et al., 2006). Reductions in the funding of long-term care therefore appear to have had important distributional impacts.

This paper contributes to two literatures. First, we build on previous work that examines substitution between long-term and health care. McKnight (2006) exploits changes to Medicare reimbursement rates for home medical care to examine the impact on broader medical care costs, and finds that reductions in the use of home care did not lead to large increases in medical utilisation. Kim and Lim (2015) use a regression discontinuity design in South Korea to estimate short-run impacts of public subsidies for formal home and institutional care on informal care use and medical expenditures. They find heterogeneous impacts of these subsidies: among the more able, subsidies for formal home care did not impact medical spending, while among the less able increased use of home care (and decreased institutional care) led to substantial decreases in hospital spending. Polsky et al. (2014) show that US states with entry regulations in home health used home health services less frequently, but that this did not affect re-hospitalisation rates or overall Medicare expenditures. Bakx et al. (2020) use administrative data from the Netherlands to examine the causal impact of eligibility for admission to a nursing home, and

led to delayed discharges from hospital over this period.

find that access to nursing home care leads to a reduction in hospital admissions and medical care costs, but has no impact on total (combined) health and long-term care costs. We extend the evidence base on this important topic by exploiting dramatic changes in the level of funding within the English long-term care system, where budgets cuts were achieved primarily through reductions in community-based (rather than residential or nursing home) care. We also exploit detailed administrative data to provide evidence on the different types of hospital activity that are affected by reductions in long term care provision.

Second, we contribute to a literature on the wider impacts of austerity and government spending programmes. Previous work has examined the relationship between schools spending and educational outcomes (Jackson et al., 2016; Hyman, 2017; Jackson et al., 2018), police spending and crime (Evans and Owens, 2007; Machin and Marie, 2011), fiscal austerity and electoral outcomes (Alesina et al., 2011; Galofré-Vilà et al., 2019; Fetzer; 2019), and budget cuts and social unrest (Ponticelli and Voth, 2020). Other work has examined austerity in terms of its distributional consequences (Woo et al., 2013; Paulus et al., 2017; Bourquin et al., 2019) and its impact on health (Karanikolos et al., 2013; Stuckler et al., 2017; Toffolutti and Suhrcke, 2019). We show that reductions in public spending on an important public service for a vulnerable population group had both distributional and health consequences. And while the spending cuts did not lead to large fiscal consequences for health expenditures in the short run, they did lead to significant disruptions in the provision of emergency care at public hospitals, with some evidence of deterioration in the quality of care provided to patients and their subsequent health outcomes. This suggests that the failure to maintain a well-financed system of long-term care will have broader consequences for public services and population health.

The rest of the paper is organised as follows. Section 2 explains how publicly funded health and long-term care are organised and funded in England, and briefly sketches out the theoretical implications of reductions to funding for long-term care for hospital use and costs. Section 3 describes the data. Section 4 describes our empirical strategy. Section 5 presents our results, first setting out the estimated aggregate impacts before examining heterogeneity across different groups of interest. Section 6 concludes.

2 Institutional background

2.1 Public hospital care in England

The majority of health care in England is provided and funded by the government. Care is free at the point of use for all residents, and secondary (or acute) care is typically provided by large, publicly owned hospitals operated by the NHS. Hospitals are compensated by the government directly for providing care through a series of national tariffs.[3]

Emergency care is initially provided through emergency departments (EDs) attached to large public hospitals.[4] This care is not pre-planned, with patients arriving at hospital (either

[3]Each treatment provided by hospitals is assigned to a Healthcare Resource Group (HRG), similar to Diagnosis Related Groups (DRGs) in the US, which groups procedures by the level of resources used. A set of national tariffs are then allocated to each HRG on an annual basis to determine transfers to hospitals, with small adjustments made for regional differences in costs and unusually long length of stays.

[4]EDs are commonly known as Accident and Emergency (or A&E) departments in England.

by ambulance or by other means) when required. Upon arrival, patients are triaged, and after undergoing basic treatment and preliminary investigations, will either be admitted to the hospital for further treatment or discharged home. Patients who are admitted for hospital will then be sent to a specialist ward (e.g. cardiology, urology etc.) where they will often undergo a specific procedure or surgery.

Inpatient care is provided to patients who are admitted to hospital. This care is often more extensive and expensive than care provided in other hospital settings (for example, many patients undergo more invasive testing or operations as an inpatient). An inpatient admission can be an unplanned emergency admission - often, but not exclusively, following presentation at the ED - or a pre-planned elective (non-emergency) stay.[5] In both cases, hospital stays may range from a single day to a period of months. Elective care is rationed by waiting times, and requires an initial referral from a primary care physician (General Practitioner, or GP) and a decision to admit by a senior hospital doctor (known as a consultant), usually in an outpatient setting.

Outpatient care is provided by hospitals without admitting patients. This includes appointments with consultants, diagnostic tests, and some basic treatments. These visits are often used by consultants to decide whether patients require further care within the inpatient department. Outpatient visits can occur both prior to inpatient treatment (to decide whether such treatment is necessary) and after treatment (to follow up with patients and continue recovery). Outpatient appointments typically require an initial referral from another member of medical staff. In around 85% of cases, this comes from a General Practitioner (GP), who acts as a gatekeeper for the hospital system, or a hospital consultant.[6] A referral from a hospital consultant can follow an emergency inpatient admission, an ED attendance, a domiciliary visit or another planned hospital episode (for example, to check on the progress of patients after planned surgery). Outpatient services represent the most commonly used form of hospital care.

2.2 Adult long-term care in England

Adult long-term care (commonly referred to in England as adult 'social care') includes a broad range of non-medical services that support individuals who have difficulties with activities of daily living such as washing, feeding, housework or general mobility. Care can be provided on a formal basis by trained professionals, or informally by family, friends and neighbours. In 2014/15, 26% of individuals aged 65 and over in England living outside of a care home received some form of long-term care, and 9% received some formal care (Crawford and Stoye, 2017).[7]

Formal care can be either privately or publicly financed. The majority of formal care received by individuals in 2014/15 was funded by the government (LaingBuisson, 2017). However, public funding is subject to both a needs test and a financial means test. Consequently only those with the most severe needs, who also have limited income and assets, benefit from publicly funded care. This is in direct contrast to medical care, which is provided for free to all residents.

[5] Some emergency admissions are not via the ED, but instead follow a referral from a hospital consultant in another setting (e.g. following a routine appointment) or, in rare cases, from a primary care physician.

[6] Patients can also be referred from alternative sources, including from a general dental practitioner, optometrist, prosthetist or national screening programme.

[7] At the time of the 2011 census, a further 3% of this age group lived in a nursing or residential home.

An important feature of the long-term care system in England is that (unlike the NHS) it is is decentralised: the organisation and funding of long-term care is the responsibility of 152 local governments (known as 'local authorities'). This organisational structure creates large differences in per-capita spending for long-term care across different parts of England, despite efforts in recent years to reduce variation in the amount and quality of long-term care received by residents in different local authorities (Phillips and Simpson, 2017; Amin Smith et al., 2018).[8] These differences arise from different local preferences for spending on social care relative to local authorities' other spending priorities (including housing, local roads, waste collection, some aspects of education, and cultural services), and different budgetary constraints facing different local authorities.

2.3 The 2010s austerity programme

Local authority revenues come from two primary sources: grants from central government and local taxation. In May 2010 a large scale austerity programme was introduced in England following the election of a new government. As part of the cuts to public spending, the grants provided by central government to local government were reduced dramatically. Local authorities had some capacity to offset these cuts by raising additional revenue from local property taxation, but statutory limits set by central government limited the scale of increases to these taxes, and local authorities differ in the size of their local tax bases. As a result, total local authority revenues fell by 18% (in real terms) between 2009/10 and 2017/18 (Harris et al, 2019).

These cuts to local government funding fed through to cuts to public spending on local services, including adult long-term care. Annual total public spending on long-term care for adults aged 65 and over fell by 18.9%, from £9.0 billion in 2009/10 (in 2018/19 prices) to £7.3 billion in 2017/18. These reductions are even more dramatic when taking into account the strong population growth among this age group during this period. Figure 1 shows how total and per-capita long-term care spending for the over 65 population changed relative to 2009/10 in each year up to 2017/18. During this time, the population aged 65 years and above grew by 19.3%. As a result, per-capita spending fell by 31.2% over the eight year period.

This reduction in spending masks considerable variation across different local authorities. Figure 2 shows the change in real per capita spending on long-term care for the older population between 2009/10 and 2017/18, ranking local authorities by the size of the reduction in spending. The mean change in per-capita spending was a reduction of 31.2%, while the median change in spending was a reduction of 31.6%. However, the 95th percentile was 50.2%, and the 5th percentile only 4.5%, with some local authorities actually increasing long-term care spending over this period.

This variation in long-term care spending changes across areas will have reflected the different changing needs of different areas, and the choices made by local governments about spending

[8]Since 2014, there has been in place national minimum eligibility criteria, along with standardised processes for the assessment of care needs, in order to reduce variation in care receipt across local authorities. However, local authorities still retain a degree of flexibility. They must satisfy the national minimum eligibility criteria, but are free to use a more generous financial means test should they wish to do so. They also have some control over the level of co-payments charged to care recipients, and the quality of care provided to those who are eligible. As a result, there remain significant differences in the level of net (accounting for fee income) spending on adult long-term care even between local authorities with similar local needs.

priorities. However, to a large extent they will also have reflected variation across authorities in the reduction to their overall revenues. The cuts to central government grants over the period failed to equalise for the considerable differences in areas' spending need and ability to raise local tax revenues.[9] Instead, cuts to grants were distributed roughly equally across local authorities. This meant that local authorities that received a greater proportion of their revenues from central government grants at the start of the period (relatively deprived areas, with high needs and low revenue raising capacity) faced proportionally greater cuts to their total revenues.

2.4 Consequences of reductions in public long-term care funding

Local authorities implemented reductions to long-term care spending by adhering more strictly to eligibility criteria in the needs test for public funding, and limiting help only to those with 'substantial' or 'critical' needs (Humphries et al., 2016; House of Commons, 2017). As a result, spending cuts fell most heavily on those with relatively less severe care needs.

This is reflected in the relative changes in the receipt of different types of publicly-funded long-term care during this period. Figure 3 shows the changes in the number of individuals aged over 65 in receipt of publicly-funded community-based, residential and nursing long-term care between 2009/10 and 2017/18. Between 2009/10 and 2013/14, the total number of care recipients fell from 1,105,945 to 822,340, a fall of 25.6%. This means that around 280,000 fewer individuals received any publicly-funded long-term care in 2013/14 than four years previously. The vast majority of these reductions came through a reduction in the number of people receiving community-based care in their own homes. Over this four year period, the number of community care recipients fell by 275,455 (29.9% of the 2009/10 total). This compares to a reduction of 5,640 (3.5%) and 3,850 (5.0%) for residential and nursing care respectively. Due to changes in local authorities' data reporting requirements, consistent data are not publicly available for long-term care receipt for our entire period of interest. The data suggest, however, that the numbers of elderly individuals receiving state-funded care packages continued to fall slightly between 2014/15 and 2017/18, even as the pace of funding cuts slowed and the elderly population continued to grow.

Taken together, these figures suggest that there were meaningful reductions in the number of people aged 65 and over receiving publicly organised long-term care between 2009/10 and 2013/14, which were then maintained through to the end of our period (and certainly not reversed). These impacts appear to have been focused mainly (but not exclusively) on those receiving community-based care.[10] In addition, there may also have been reductions in the intensity or the quality of care received that are not captured by these data (such as the time allowed for each home visit).

[9] For example, in 2014/15 and 2015/16, all local authorities of a given type faced the same percentage cut to their grants from central government, with no attempt to account for differences in relative needs or local tax bases. In other years, more complicated funding formulae were used, but these also failed to fully reflect differences between areas. For a more detailed discussion see Innes and Tetlow (2015) and Section 2.2 of Amin Smith et al. (2016).

[10] As a result, while we examine the impacts of changes to overall public long-term care spending (as opposed to spending only on services received at home), our analysis is more similar to past studies focusing on the relationship between home help and health care (McKnight, 2006; Polsky et al., 2014) as opposed to studies examining changes in nursing home provision (Bakx et al., 2020).

The reduction in public long-term care funding could have important consequences for the health and well-being of those who no longer qualify for such services, or who receive lower intensity or poorer quality care. Such changes are likely to have increased the demand for health care, and the subsequent pressure on public hospitals. However, the implications for public hospitals will depend on three factors, with the combined effects captured by our estimates.

First, the degree of substitution between publicly funded long-term care and privately funded or informal care. An existing literature has noted substantial substitution between informal and formal care (Bonsang, 2009; Charles and Sevak, 2005; Van Houtven and Norton, 2004), and publicly and privately funded care (McKnight, 2006) in a number of institutional settings. Cuts to the provision of publicly funded care may therefore have been offset by increased provision of other types of care, reducing any effects on NHS hospitals.

Second, the extent to which different forms of long-term care reduce the need for medical care. This could be by preventing accidents (such as falls), assisting with management of chronic health conditions (such as diabetes) or the taking of medication, encouraging better nutrition, or otherwise having a beneficial impact on recipients' emotional and mental well-being. To the extent that this is the case, reductions in such long-term care receipt could lead to individuals presenting at hospital with diagnoses that would either not have arisen, or that may have been better treated in a non-hospital setting.[11]

Finally, the extent to which different forms of long-term care facilitate access to hospital care. For example, it is plausible that a carer could act as the agent of the care recipient, identifying unmet need, organising appointments and encouraging take-up of outpatient and elective (pre-planned) hospital care. In this case long-term care actually acts as a complement for hospital care, and reduced spending could negatively impact hospital use.

3 Data

3.1 Local authority finances

During our period of interest, local authorities (LAs) submitted annual returns to the Department for Communities and Local Government (DCLG) detailing their expenditures and incomes by service area. The net expenditure figures reported in these returns do not provide a consistent measure over time due to shifts in responsibilities between local authorities and the NHS, and the introduction of new funding arrangements over time. To account for this, we make a number of adjustments. These relate to particular spending programmes that shifted from the NHS to LAs over the period, and spending on long-term care financed from pooled budgets with the NHS.[12] The structure of the data is such that not all spending is allocated to narrow age groups, but with some assumptions we can allocate adult long-term care spending between

[11] A reduction in long-term care may also increase the use of hospital care if reduced availability of long-term care prolongs hospital stays.

[12] For 2009/10 and 2010/11, we add in spending on the 'Valuing People Now' programme (which later became the Learning Disability and Health Reform Grant) to reflect the transfer of responsibilities from the NHS to LAs. In subsequent years we add in transfers from the NHS, which from 2015/16 became the 'Better Care Fund'. We have assumed that the proportion of the 'Better Care Fund' going to long-term care is uniform across the country.

adults aged 18-64 and adults aged 65 and over.[13] This provides us with a measure of net expenditure on long-term care for the over 65 population in each year for each local authority.

Our unit of analysis is the 'upper tier' local authority level. There are currently 152 local authorities in England. We exclude from our final sample two small local authorities with unique funding arrangements, and four areas where the borders of the local authority change over time. We exclude a further six local authorities whose official returns include negative or implausibly low spending figures for one or more years. Our final sample therefore contains data for 140 local authorities in each financial year and 1,260 observations in total.

Table 1 summarises local authority spending in 2009/10 and 2017/18. Adult long-term care spending in 2009/10 accounted for just over one-third of total service spending by local authorities, and spending on care for the over 65s amounted to just over half of all adult long-term care spending. Spending on long-term for care for the population aged 65 and over thus amounted to 18.0% of all local authority service spending in 2009/10. Other major components of service spending include children's social care (13.9% of the total in 2009/10), highways and transport services (14.2%), environmental and regulatory services (11.5%), culture and related services (7.5%), housing (5.9%), and planning and development services (5.0%).[14]

Table 1 also shows summary statistics on the demographic and economic characteristics of the local authorities in our sample. This shows that there has been a large growth in the size of the older population, with the mean population aged 65 years and over increasing by 19.3%. In addition, there has been growth in the share of the population accounted for by those over the age of 85. This suggests that demand for long-term care is likely to have grown over this period even while public spending fell.

3.2 Hospital Data

Our data on hospital use comes from the Hospital Episode Statistics (HES). HES contain records of all visits to publicly-funded hospitals in England, including information on all visits to emergency departments (EDs), all inpatient admissions and all outpatient attendances since 2009/10. In 2009/10, there were over 15.5 million visits to EDs, of which 2.9 million were made by individuals aged 65 or over. In the same year, there were 16.0 million and 67.4 million inpatient hospital spells and outpatient attendances, respectively, of which 5.6 million and 21.5 million were patients aged 65 or over.

Patients are identified by a pseudo-anonymised identifier that allows us to follow patients over time and across all hospital activity at each public hospital in England.

The ED data record treatment at the visit level and include a hospital identifier, local authority code, date of arrival, whether the patient arrived by ambulance, whether the patient was admitted for further treatment, and basic patient characteristics such as age and sex. We also observe a diagnosis code, including whether the patient is recorded as having no observed

[13] Specifically, we allocate any expenditure on adult long-term care that is not explicitly allocated to either age group (such as 'assistive equipment and technology') in proportion to the share of allocated spending that is labelled as benefiting that particular age group. We have also assumed that the proportion of NHS transfers to local authorities allocated to older people is the same as the proportion of LA adult long-term care spending that goes to older people.

[14] See Harris et al. (2019) for further details on this spending.

medical diagnosis ('nothing abnormal detected'). The data include Healthcare Resource Group (HRG) codes for each episode, similar to Diagnosis Related Groups (DRGs) in the US. Hospitals in England are compensated through a system of national tariffs for each HRG, which allows us to construct a measure of the approximate cost of each visit by matching tariffs to the appropriate HRG.[15]

The inpatient records include admission and discharge dates, diagnosis codes and details on the procedures undergone by the patient. The data also include admission method, which we use to categorise inpatient treatment into emergency and non-emergency (elective) spells. We are also able to assign an estimated cost to each episode. Using the 2014-15 NHS Reference Costs Grouper, we calculate an average cost for each primary operation-elective bin (13,000 bins) and primary diagnosis-elective bin (15,000 bins). Episodes with a primary operation code are assigned the former; those with the operation code missing are assigned a cost based on the latter. 99.3% of inpatient episodes (across all years) are assigned a cost using this method, which are then converted into 2018-19 prices using the December 2018 GDP deflators.

Outpatient records contain similar information on date, diagnosis and procedure codes, along with the referral source. This means we can distinguish between patients whose appointment is the result of referral from their GP and those who were referred (for example) from elsewhere in the hospital. The data also contain information on whether the patient is making a first or follow-up attendance. In line with our approach for inpatient episodes, we use 2014-15 data to calculate the average cost for each primary operation-first attendance bin (678 bins), and primary diagnosis-first attendance bin (256 bins), which are used for episodes without a primary operation code attached. This results in 99.1% of episodes being assigned an imputed cost, which are then converted to 2018-19 prices, as above.

We construct a number of measures of annual hospital use to capture the number of patients visiting the hospital, and the intensity with which they use these services. We also create these measures for different sub-groups of the population to examine variation in the impact of spending cuts. First, we construct measures of hospital use for three different age groups (65-74, 75-84, 85+ years). Second, we look by local area deprivation, and construct measures of use for individuals living in three deprivation terciles.[16]

Our analysis focuses on the English population aged 65 years and over, and covers the period between April 2009 and March 2018. We keep all ED and inpatient records for patients in this age group and time period, and all outpatient records where the appointment was actually attended by the patient. We then collapse the hospital data to the 'upper tier' local authority level, the unit of our analysis. This provides measures of hospital use by the over 65 population in all 140 local authorities in our final sample, for each of the nine financial years of our period of interest.

The HES data only contains information on individuals who attend hospital. We therefore

[15]The national tariffs attached to each HRG code are designed to reflect the average cost of providing the associated treatment. This reflects average costs of treatment across all hospitals for providing particular treatment rather than the specific costs incurred by the hospital in the case of the specific episode.

[16]To do so, we use the patient's Lower Super Output Area (LSOA) of residence, as recorded in HES, and match this to the LSOA's 2010 Index of Multiple Deprivation (IMD) score. We assign each LSOA to a tercile of the national distribution of IMD scores (lowest, middle, highest). We can then construct, for each local authority and year, the number of hospital visits made by people living in areas classified as less, middle or more deprived.

link these data with official age-sex specific population data for each local authority in each financial year from the Office for National Statistics (ONS) to account for other residents aged 65 and above. We use these data to construct per-capita measures of ED, inpatient and outpatient care use for the over 65s.[17] This is further augmented with a number of measures of economic, social and health characteristics of the local authority to control for changes in these factors over time.[18] Summary statistics for these variables in 2009/10 and 2017/18 are presented in Table 1.

3.3 Changes in hospital use over time

The use of hospital services by the older population has increased substantially over time. This is particularly true for ED services. The total number of ED visits made by people aged 65 and over increased from around 2.9 million in 2009 to more than 4.5 million in 2017. Panel A of Table 2 summarises a range of measures of ED use by older people in 2009/10 and 2017/18, and presents data both for the entire over 65 population and for specific age groups. The average number of visits to the ED per resident aged 65 and over increased from 0.37 in 2009 to 0.49 in 2017. The proportion of over 65s making at least one visit to the ED during the year also increased from 23% to 27%. As we might expect, older individuals are both more likely to attend the ED at least once in a given year, and also have a higher mean number of visits. The mean number of ED visits per resident aged 85 and over increased from 0.67 to 0.89 over the period, and the proportion making at least one visit to the ED increased from 40% to 47%. There was also an increase in the mean number of admissions to hospital via the ED (for all age groups, but particularly pronounced for the oldest individuals) and in the mean number of ambulance arrivals (again for all age groups, with the largest increase for the very oldest).

Use of inpatient and outpatient hospital services are summarised in Panels B and C of Table 2. The mean number of emergency and elective inpatient spells per resident aged 65 or over increased between 2009/10 and 2017/18, from 0.27 to 0.29 and from 0.42 to 0.45 respectively. There was a particularly marked increase in the mean number of emergency spells amongst the very oldest group (aged 85+): a 17.9% increase from 0.56 to 0.66 spells per year. This was accompanied by only a modest increase in the proportion of individuals aged over 85 having at least one emergency spell during the year (from 34% to 36%), indicating that this increase was driven by a greater number of spells among patients with at least one admission during the year. The average number of annual outpatient attendances per resident aged 65 and over increased by more than a quarter over the period, from 2.69 to 3.45. As for other types of hospital care,

[17] When constructing separate measures for each age group, sex or deprivation tercile, we calculate per-capita measures using the local population belonging to the group in question, e.g. the local population aged 85 and above, the local female population, or the local population living in LSOAs in the bottom third of the national IMD distribution.

[18] These include: the proportion of adults claiming carer's allowance, the proportion of adults claiming the income component of Employment and Support Allowance, the proportion of over 65s claiming Pension Credit Guarantee Credit, the proportion of over 65s claiming disability benefits (defined as any of Attendance Allowance, Personal Independence Payment (PiP) or Disability Living Allowance (DLA)), the economic inactivity rate among the local 18-64 population, gross disposable household income per head, and unemployment (as measured by the claimant count). These are all sourced from ONS Nomis official labour market statistics, with the exception of PiP and DLA, which are taken from DWP Stat-Xplore. We also include the ratio of the median house price to median gross annual earnings (sourced from ONS House Price Statistics for Small Areas) and median gross weekly earnings (sourced from ONS Annual Survey of Hours and Earnings).

utilisation increased for all age groups, but the increase was most pronounced among the very oldest(85+) group.

Panel D summarises estimated per-capita spending on each type of care. Mean spending per resident aged 65 and over on ED care increased by around 80% in real terms, from around £37 in 2009/10 to £67 in 2017/18. Costs are higher for older individuals, reflecting both the greater number of visits made by this age group and a more severe case mix. In 2017/18, mean ED spending on a resident aged 65-74 was £45.14. The equivalent figure for the over 85s was £134.07. This represents only a small share of overall hospital spending, however, as ED care is relatively inexpensive - patients who need more extensive and expensive treatment are typically admitted to hospital as an inpatient, and outpatient attendances are by far the most commonly used form of hospital care. Panel D shows that per-capita emergency inpatient costs are highest among those aged 85 and above, while elective inpatient and outpatient costs are highest among those aged 75 to 84.

3.4 Correlations between long-term care spending and hospital use

Figure 4 shows the correlation between changes to public spending on long-term care and changes in the mean use of four different hospitals services by residents aged 65 years and above, across all local authorities between 2009/10 and 2017/18. Panel A shows mean annual number of ED visits. Panels B and C shows mean emergency and elective spells respectively. Panel D shows mean outpatient attendances.

The figure shows that the raw correlation between changes in per capita long-term care spending and each type of hospital use is close to zero. None are statistically significantly different from zero. However, this does not control for any other factors that might explain changes in both long-term care spending and the use of hospitals over this period. For example, areas with strong growth in the number of older and sicker individuals would experience both increases in the need for long-term and hospital care. As a result, these areas might experience the greatest growth in the use of hospital care, while also choosing to protect long-term care spending for the over 65s in the local area. Areas with smaller cuts to long-term care spending would therefore also have larger increases in hospital use regardless of the effect of long-term care on the use of hospitals. If not accounted for, this would underestimate the impact of long-term care funding on hospital use.

We therefore now move to a formal examination of the relationship between public funding for long-term care and hospital use, controlling for other potential factors. In Section 4 we first describe our baseline estimation strategy before discussing the potential endogeneity of long-term care spending decisions with respect to hospital use, and set out an instrumental variables strategy to address these issues. We then present the results using this approach in Section 5.

4 Empirical strategy

Our basic empirical strategy employs a difference-in-difference approach, comparing changes in hospital use across areas with differential changes in the local level of long-term care spending. We estimate the following baseline specification:

$$y_{it} = \beta LTC_{it} + \delta X_{it} + \mu_i + \gamma_t + \epsilon_{it} \quad (1)$$

where y_{it} is a measure of hospital use in local authority i in financial year t. LTC_{it} represents the level of per capita public funding for long-term care provided to adults aged 65 and over in local authority i in year t. X_{it} captures a range of time-varying local area characteristics associated with the use of hospital care. μ_i controls for permanent differences in hospital use across local authorities, and γ_t captures the national time trend in hospital use between 2009/10 and 2017/18. ϵ_{it} is an error term. β is the object of interest, and represents, under the identifying assumption discussed in detail below, the impact of public long-term care spending on the use and costs of hospital services by the older population.

We estimate this specification for a number of outcomes (y_{it}) related to the use of ED, inpatient and outpatient hospital services. For EDs, we examine annual ED visits per resident (65+), analysing separately whether any changes in the overall number of visits are explained by changes in the number of unique patients attending the ED, or an increase in the intensity of use among patients. We examine similar dimensions for use of inpatient and outpatient care. We also study the cost of providing each type of care.

The identifying assumption is that, conditional on X_{it}, μ_i and γ_t, public long-term care spending is uncorrelated with the error term. This assumption would be violated if there are unobservable differences in factors associated with both the use of hospital care and the level of long-term care spending. The inclusion of local authority fixed effects will control for permanent differences in the underlying need and access to care across local authorities. However, as noted above, it is highly likely that areas with larger growth (or smaller cuts) in spending on adult long-term care would have experienced greater increases in the use of hospital services in any case: for example, areas with more deprived, older and sicker patients would have growing hospital use over time while also being likely to better protect spending on long-term care. To address this we include a rich set of time-varying local area characteristics in X_{it} that could plausibly be related to the need for both hospital and long-term care. This includes the size and composition (age and gender) of the population, claimant rates for various means-tested and disability-related benefits, local economic conditions and measures of the socio-economic composition of the local population.

However, the identifying assumption would still be violated if there are remaining unobserved factors that cause changes in hospital use, and that are also correlated to changes in long-term care spending. This would be the case, for example, if local authorities use the expectations of local hospitals for future use of the ED and inpatient services when setting their adult long-term care budgets.

To address this concern we employ an instrumental variables analysis. We instrument long-term care spending in each local authority with predicted spending, combining the historical share of national spending on long-term care attributed to each area with the actual changes in the national level of long-term care spending. This follows an existing literature that uses historical patterns of public spending to instrument for potentially endogenous local public spending decisions (Chodorow-Reich et al., 2012; Wilson, 2012; Nakamura and Steinsson, 2014).[19]

[19]Nakamura and Steinsson (2014) exploit variation across US states in sensitivity to aggregate military build-

Formally, we predict spending in each area i for each financial year t, $\hat{LTC}_{it}$, in the following way. First, we calculate the share of national long-term care spending that took place in area i in our baseline financial year (2005/06) as follows:[20]

$$\delta_{i,2005} = \frac{LTC_{i,2005}}{\sum_{i=1}^{140} LTC_{i,2005}} \tag{2}$$

We then predict spending for each area in each financial year between 2009/10 and 2017/18 by multiplying the observed national spending in year t, LTC_t, with the 2005/06 share:

$$\begin{aligned} \hat{LTC}_{it} &= \delta_{i,2005} * LTC_t \\ \text{where } LTC_t &= \sum_{i=1}^{140} LTC_{i,t} \end{aligned} \tag{3}$$

For a valid instrument, we require a variable that is (i) related to changes in the level of public spending on adult long-term care but is (ii) otherwise unrelated to changes in the use of hospitals over the same period. Our approach provides an instrument that potentially fulfils both criteria. The historical pattern of spending should have strong predictive power for how spending evolves in each local authority. The reliance of local authorities on central government grants for much of their revenue means that relative revenues across different areas do not fluctuate significantly from year to year. As a result, even though the exact level of long-term care spending in each local area changes over time (and will decrease or increase more quickly in particular areas due to local conditions or choices), the rankings of local authorities in terms of their share of national long-term care spending remains stable. Figure 5 plots predicted per resident spending against observed per resident spending. It also plots a 45 degree line, where predicted and observed spending are equal. It shows that our measure of predicted spending is highly correlated with observed spending, with a correlation coefficient of 0.87. This suggests that our instrument will fulfil the first criterion.

On the other hand, predicted changes to spending are independent of the recent choices that specific local authorities make with regard to their long-term care spending. The national level of spending will reflect changes to central government spending and the combined choices of all local authorities. Predicted spending therefore reflects these aggregate decisions, as no single local authority budget alone is large enough to have a sizeable impact on the national trend.

The identifying assumption could still be violated if areas with different historical shares of spending have different trends in hospital use over time. For example, if areas with a higher share of spending in 2005/06 (and therefore a higher predicted share of spending throughout the period) would have experienced stronger growth in hospital use over this period regardless of long-term care spending, then the instrument would not be valid.[21] In this case our estimates

ups to estimate fiscal multipliers, while Wilson (2012) and Chodorow-Reich et al. (2012) use pre-recession Medicaid spending to instrument for stimulus spending by the Medicaid fiscal relief fund as part of the American Recovery and Reinvestment Act (ARRA).

[20] Note that here we are using 'national' as shorthand for the sum of the 140 English local authorities included in our final sample (out of a total of 152). Historical spending shares are calculated using the Social Care Actuals tables from the Chartered Institute of Public Finance & Accountancy (CIPFA).

[21] One potential explanation for such a trend would be if areas with high shares of long-term spending were forced to make larger cuts to other areas of public spending (in order to protect long-term care spending), and cuts in these spending areas directly change the demand for hospital care among the elderly. To the extent that

would be biased towards zero, underestimating the impact of cuts to long-term care funding on the use of hospital services. Conversely, if areas with smaller shares in 2005/06 would have experienced stronger growth in hospital use over the period, the estimates would overstate the impact of the cuts.

To examine this, Figure 6 plots the change in the mean number of emergency inpatient spells (panel (a)) and the proportion of over 65s having an emergency inpatient spell (panel (b)) between 2005/06 and 2009/10.[22] Both panels show there is no statistically significant relationship; the same is true when we repeat the exercise for elective inpatient and outpatient visits.[23] In section 5.5 we test more formally for the possibility that high- and low-spending areas were on different pre-existing trends prior to our period of interest. We find no evidence that this was the case. As a further robustness check, we also include trends in the use of hospital use among the 40-64 population to control for underlying changes in hospital use in the area. The inclusion of these variables does affect the size of our estimates but does not substantially alter our conclusions.

As a final robustness check, we also repeat our analysis using different base years to predict long-term care spending. We find that the results are insensitive to the choice of base year.

5 Results

We start by presenting the estimated impacts of long-term care spending on measures of ED, inpatient and outpatient care use and costs. We then extend this analysis to examine the impact on the medical severity of patients presenting at hospital, and on hospital performance. This is followed by a series of robustness checks to address potential threats to identification. Finally, we examine how changing hospital use varies across different population groups, including by age and local area deprivation.

5.1 Headline hospital use

Table 3 shows the estimated impact of per capita long-term care spending on the annual number of ED visits made by individuals aged 65 and above. The first column simply regresses the mean number of ED visits per resident aged 65 and over on per capita public spending on long-term care for the over 65s in that local authority (expressed in £100s), and a set of financial year dummies. The estimated coefficient on long-term care spending is positive and statistically significant, indicating that areas with greater per capita long-term care spending also have a greater average number of ED visits made by their older population.

The second column adds a set of time-varying demographic and economic characteristics to control for local need for hospital services. The inclusion of these controls reverses the sign on the coefficient of interest, which becomes negative and statistically significant. This indicates

much of this other spending (as set out in Section 3.1) is on areas that should have little impact on older people's demand for hospital care (e.g. services such as children's long-term care spending, culture and planning) this seems unlikely to be a substantial driver of any differential trends in hospital care use across areas.

[22] Note that ED data are not available prior to 2008, and so our analysis of pre-trends is limited to inpatient and outpatient hospital services.

[23] Results available upon request.

that areas with higher per capita long-term care spending also have higher need for hospital care. The third specification includes the same set of time-varying controls, along with local authority fixed effects. This controls for permanent geographical differences in hospital use. The coefficient remains negative but the magnitude falls and it is no longer statistically different from zero.

The final column shows results from the IV regression, the first stage of which has a F-statistic of 32.74.[24] The estimated coefficient on per capita long-term care spending is now negative and statistically significant at the 5% level. Our results indicate that a £100 increase in per capita long-term care spending is associated with 0.017 fewer visits to the ED per resident aged 65 and above. This is a relatively large effect. For context, between 2009/10 and 2017/18, mean per-capita spending fell by £391 (31.2%). Our estimates imply that a cut in per capita spending of this size increased the mean number of visits to the ED per 65+ resident by around 0.07 per year: that is, around 7 additional visits for every 100 residents aged 65 years and above. This represents around 18% of the mean of 0.37 visits per resident in 2009/10 (Table 2) and suggests that just over half of the observed increase in ED use among the elderly over the period (from 0.37 visits per 65+ resident in 2009/10 to 0.49 in 2017/18) is explained by cuts to long-term care spending.[25]

These results indicate that reductions to long-term care spending did increase the use of emergency departments by older individuals. This could be driven by two mechanisms: an increase in the number of unique patients using the ED, or an increase in the number of visits made by pre-existing patients. Table 4 explores each of these channels. In columns 1 to 3, we repeat the analysis with the proportion of the local 65+ population who made at least one visit to the ED over the course of the year, and see a similar pattern. The IV estimates indicate that a £100 reduction in long-term care spending led to a 0.6 percentage point increase in the proportion of over 65s making at least one visit to the ED (significant only at the 10% level). This equates to a mean reduction in per-capita spending (£391) causing a 2.3 percentage point increase, relative to a mean of 23% in 2009/10. This suggests that the additional visits to the ED are at least partially driven by an increase in the number of unique individuals using this type of care.

In columns 4 to 6, we examine the mean number of ED visits among patients (i.e. conditional on making at least one visit over the course of the year). This captures intensity of use. The IV results in column 6 show a negative, statistically significant relationship between long-term care spending and intensity of ED use among the over 65s: a £100 reduction in spending led to an additional 0.016 ED visits per patient. Our results therefore suggest that cuts to long-term care spending increased both the number of people attending EDs, and the frequency with which they used these services.

[24]The full results from the first stage regression are shown in Table A1. This shows there is a strong, positive relationship between predicted and observed per-capita spending: a £1 increase in predicted spending is associated with a £1.15 increase in observed spending, and this relationship is statistically significant at the 1% level. The F-statistic reported is the Kleibergen-Paap rk Wald F-statistic as we cluster standard errors at the local authority level.

[25]An alternative comparison is with the number of residents using long-term care services. The population aged 65 and above was 8.1 million in 2009/10, 1.1 million (13.6%) of which received some publicly-funded long-term care. An increase of 7 visits per 100 residents therefore equates to approximately 1 additional visit on average for every 2 residents receiving long-term care in 2009-10).

We explore the impact of per-resident long-term care spending on two further measures of ED use: the mean number of admissions via the ED and the mean number of arrivals at the ED via ambulance.[26] The results are shown in Table A2 in the Appendix. Both of these measures proxy the severity of patients, with more severe patients more likely to require an admission for further treatment and to arrive by ambulance. The coefficients from the IV estimates (columns 3 and 6) are in in both cases close to, and not statistically different, from zero. The lack of meaningful effects on ED admissions or ambulance arrivals suggest that the additional ED visits made as a result of long-term care cuts are for less severe conditions than usual. We explore this in further detail below.

In Table A3 we examine the impact of long-term care spending on use of inpatient care. We examine the impact both on the mean number of inpatient spells per resident aged 65 years and above, and the proportion of these residents having at least one inpatient spell. In both cases, we distinguish between emergency and elective (pre-planned) admissions. In all cases we find no evidence of a statistically significant effect of cuts to long-term care funding on the use of inpatient care. This suggests that the reductions in long-term care funding have had little impact on the use of more severe, and more expensive, inpatient treatment.

Table A4 in the Appendix shows the estimated of long-term spending on the use of outpatient care. Similarly to inpatient care, we find no evidence that long-term care spending affects use of outpatient hospital services among the over 65s. This is true both when studying total outpatient attendances, and separately analysing attendances following a referral from either a GP or a hospital consultant.[27]

5.2 Hospital costs

We turn now to examine the impact of changes to long-term spending on the public cost of providing hospital care. The key reason for the government's decision to cut funding for local authorities (who subsequently reacted to this by cutting funding for long-term care) was to make budgetary savings as part of a broader austerity programme. If savings from cutting long-term care spending were partially offset by higher spending on public hospitals, then the overall level of saving for public spending would be smaller.

Table 5 examines the impact of per capita long-term care spending on per capita hospital costs for the 65 population as a whole. Column 1 shows the impacts on ED costs specifically. It shows evidence of a small financial spillover on public hospitals from cutting public funding for long-term care: the estimates suggest that cutting public per capita long-term care spend by £100 per head is associated with an increase in per capita ED spend of £1.52. This compares to mean costs of £37.28 in 2009/10. In columns 2 and 3 we examine the estimated effect on inpatient and outpatient costs, and find no statistically significant effect. Similarly, when we examine the impact on total costs in column 4 (summing costs across all three types of care), we find no overall impact of cuts to public long-term care spending on mean public spending on hospital care in the local area.

[26] Following initial triage at the emergency department, patients are either admitted to the hospital for further treatment - if required - or they are discharged home.

[27] We also no find no effects when we look specifically at first attendances and follow-up appointments, and find no significant effects when we look separately by age, sex and deprivation. Results are available on request.

Taken together, these results suggest that cuts to public spending on long-term care led to large increases in the use of emergency departments by the older population in England. This has potentially serious consequences for the long-term health of residents, and will cause significant distress in the short run. However, this did not lead to an observable increase in the use of wider hospital services. Consistent with this, the impact on hospital costs are muted: the impacts are concentrated among increased ED use, where the marginal cost of treating a patient is relatively small (as shown in Table 2, spending on care in the ED is dwarfed by spending on inpatient and outpatient care).

5.3 Patient severity

A key advantage of our large administrative dataset on hospital activity is that we observe the medical condition those presenting at hospital are diagnosed with, and how long they remain in hospital if they are admitted. We can therefore examine the impact of long-term care spending on visits to hospital for specific reasons, which may help understand the mechanisms through which long-term care substitutes for (or complements) hospital use.

We first examine how our estimated effects vary for different diagnosis codes recorded for patients at the ED. One diagnosis code of particular interest is 'nothing abnormal detected'. This indicates that the patient has presented in the emergency department without an obvious medical problem, something that vulnerable older people could feasibly do more frequently in the absence of sufficient long-term care.[28]

Table 6 shows the estimated impact of long-term care spending on the number of visits to and admissions via the ED where the diagnosis is recorded as 'nothing abnormal detected', and on the number of visits and admissions with other diagnosis codes (i.e. where *something* abnormal was detected). The results in column 1 show that a reduction in long-term care spending increases the mean number of ED visits without a (diagnosable) medical problem. We also find a statistically significant effect on the number of admissions via the ED without anything abnormal being detected (column 3). In contrast, we find no statistically significant effect on visits or admissions for other diagnosis codes (columns 2 and 4).[29] This provides a strong indication that many of the additional ED visits that arose as a result of the reductions to long-term care spending were for patients with relatively low severity conditions. This suggests these patients could have presumably been treated better in a non-hospital environment.

An alternative way to examine impacts across patients of varying severity is to examine impacts on admissions with different lengths of stay. If patients who are now admitted as a result of the cuts to long-term care funding are, on average, of a lower severity, then we would expect to see an increase in the number of patients admitted to hospital for a short period of time (but no corresponding changes to emergency admissions of longer lengths, or elective admissions of any length). We therefore examine the impact of long-term care spending separately on emergency and elective stays lasting one day or less, three days or less, four

[28]This medical diagnosis is likely to be a proxy for low severity conditions which either require no explicit medical treatment or low intensity treatment (including admissions for continued observation). It is distinct from missing diagnoses in the data (i.e. it is a specific diagnoses recorded by the doctor).

[29]We also find no significant effects when we examine each diagnosis code separately, with the magnitude of the coefficients close to zero. Results are available on request.

to six days, and seven days or more. Tables A7 and A8 in the Appendix show the results for emergency and elective spells, respectively. The first two columns of Table A7 shows that the mean reduction in per-capita long-term care spending (£391) led to an increase of 0.009 emergency spells lasting for one day or less, and 0.016 emergency spells lasting three days or less (equivalent to 21.7% and 13.5% of the 2009/10 mean, respectively). However, there was no change in the number of longer emergency stays (and no impact on elective stays of any length).

The lack of an impact on the incidence of long stays is also an important result in its own right. Throughout we have focused on the impacts of long-term care spending on *entry* to hospitals. However, a lack of available long-term care could additionally affect *exit* from hospital, if an appropriate care package cannot be arranged and the patient's discharge from hospital is delayed. This could manifest itself in a greater number of long spells in hospital. However, do we not find evidence of such effects.[30] This suggests that while much of the media focus has been on the impact of long-term care on *exit* from hospital (via delayed discharges), our results indicate that the most notable effects are on *entry* to hospital.

This at first appears somewhat at odds with previous findings that show that reduced availability of nursing and residential care is associated with increases in the number of delayed discharges from hospital (Gaughan et al., 2015; Gaughan et al., 2017). Similarly, our results on hospital costs also differ from the findings of Bakx et al. (2020), who found significant impacts on medical care costs following changes to eligibility for nursing home care in the Netherlands. However, it is important to note that these studies examine specifically the impacts of cuts to funding for, or the availability of, more intensive long-term care provided to residents of care facilities as opposed to more general funding for long-term care in all settings. As noted in Section 2.4, much of the reductions in funding in this setting appear to have been achieved through reductions in the funding of care provided to people in their own homes, while the numbers of people receiving nursing or residential care was less affected. Our estimated impacts on hospital use among patients with relatively low medical needs, and no estimated effects on longer stays, are therefore consistent with the descriptive evidence that the reduction in public funding for long-term care fell mostly on people with relatively lower care needs.

5.4 Hospital performance

The results in Section 5.1 show that reductions in long-term care spending increased the use of hospital emergency departments (EDs) by older individuals. We therefore now examine whether this increase in activity affected the performance of those departments. If, by placing greater pressures on EDs, cuts to long-term care had adverse effects on the quality of patient care, we might expect to find an impact on patient outcomes. Here, we focus on four particular measures: the proportion of patients who have a further attendance at the ED within 7 and 30 days of discharge, and the proportion who are admitted via the ED within 7 and 30 days of discharge.[31]

[30] We have tested the robustness of these results to different cut-off points for length of stay but the conclusions remain the same.

[31] Another outcome of interest is waiting times in Emergency Departments. However, in the first few years of our period (when the greatest cuts to long-term care funding were made), the waiting time variable is missing for a sizeable proportion of patients in the data, meaning that we are unable to examine this directly.

The results of this exercise are shown in Table 7. The results in the first column indicate that a £100 reduction in per capita long-term care spending on the over 65s is associated with a 0.26 percentage point increase in the proportion of patients aged 65 and above who return to the ED within a week of discharge (statistically significant at the 5% level). The mean cut (£391, or 31.2%) is associated with a 1.0 percentage point increase, relative to a sample mean of 8.0%. The coefficient in the second column (for re-attendances within 30 days) is of a similar magnitude but is less precisely estimated, and is therefore no longer statistically significant. In column three, we look at the proportion of patients aged 65 and above who are *admitted* to hospital via the ED within 7 days of discharge. A £100 (£391) reduction in spending is associated with a 0.09 (0.36) percentage point increase, relative to a sample mean of 4.0%. The estimated impact of re-admissions within 30 days is around a third smaller, and is again less precisely estimated and not statistically significantly different from zero (column four).

These findings suggest that by increasing the burden on resource-stretched hospitals, cuts to long-term care led to worse short-run patient outcomes (as measured by the proportion who returned to the ED within a week of discharge). This is indicative of long-term care cuts having adverse consequences for the quality of care provided to patients.

5.5 Robustness checks

Our identifying assumption is that, conditional on our control variables, areas that had higher historical spending on long-term care would not have had different hospital outcomes to lower spending areas in the absence of reductions in national long-term care spending. This would be violated if there were differential trends in hospital use among the older population across areas with different shares of national long-term care spending. We therefore test the robustness of our results to such trends in two ways.

First, we examine whether there was any evidence of trends in hospital use in the period immediately prior to our period of interest.[32] To do so, we first place each local authority into a quartile based on their 2005/06 spending share. We then examine the period from 2005/06 to 2009/10 and regress measures of inpatient and outpatient hospital use on a set of financial year dummies, the same set of controls as in our baseline analysis, interactions between spending share quartile and financial year, and local authority fixed effects. The results of this exercise are shown in Table A9 in the Appendix. We find no evidence that high-spending and low-spending areas were on different trends prior to 2009/10.

Second, we attempt to control for underlying local trends in the use of hospital care by including measures of hospital use by the local population aged 40-64. These individuals should be directly unaffected by long-term care spending on the over 65 population as they are ineligible for such care. However, this should capture changes in the general health of the local population, or changes in the supply of hospital services in the local area. We therefore repeat the analysis for the main ED outcomes explored above including the mean visits of the 40-64 population in the local area, and an interaction between these mean visits and a full set of year dummies to capture differential national trends in ED use between individuals in the two age groups.

[32] Note that because Emergency Department data is not available prior to 2008, we are limited here to measures of inpatient and outpatient hospital use.

Table 9 shows the results. In all cases, the magnitude of the coefficients are reduced but the overall conclusions are largely unaltered. In column 1, the estimated impact of a cut of £100 to long-term care spending on mean ED visits among the over 65 population is approximately halved, from a reduction of 0.017 mean visits to a reduction of 0.007 mean visits. However, the difference between the two coefficients is not statistically significantly different. The more conservative estimate suggests that around a quarter of the national increase in ED use among the older population is explained by reductions in long-term care funding. Columns 2-4 show similar results for the proportion of the population visiting ED, the number of visits per patient, and the per-resident cost of ED care, respectively. These all show a similar pattern, with coefficients that are reduced in magnitude but not significantly different from the baseline estimates.[33] Taken together these suggest that the magnitude of the estimated impacts are sensitive to the inclusion of additional health trends but our main conclusions that cuts to long-term care spending let to increased use of EDs remains unchanged.

We also test the sensitivity of our results to the choice of a different 'base year' to calculate historical spending shares. Our baseline results use each local authority's share of spending on long-term care for the over 65s in 2005/06 to construct our instrument. In Table A10 in the Appendix we show how our results for ED visits change if we instead construct our instrument using spending shares in 2000/01, 2002/03, and 2007/08. Our results remain broadly unchanged. In our baseline analysis a £100 reduction in long-term care spending is estimated to lead to 0.017 additional ED visits per resident aged 65 and above. When the base year is altered to be 2000/01, 2002/03, and 2007/08, the equivalent figure is 0.018, 0.020 and 0.017, respectively. Our findings therefore appear to be highly robust to alternative specifications of our instrument.

5.6 Patient characteristics

Our results so far indicate that the sharp reductions in long-term care spending had large impacts on the overall use of emergency departments by older people (and little impact on other types of hospital care). However, these estimated impacts would be expected to vary across different population groups. Among those aged over 65 some groups are more likely than others to be receiving publicly funded care, and to be more or less affected by cuts to that spending. It is also likely that long-term care recipients with different characteristics may respond differently to cuts to public funding. In particular, the ability to substitute informal care or self-financed formal care will vary across individuals, as may the health impacts of unmet long-term care needs.

We therefore now estimate how the overall long-term care cuts impact the hospital use of individuals of different ages, and those living in areas with different levels of local area deprivation. While we do not observe public long-term care spending on narrow age groups or in small local areas, and therefore cannot examine these separate mechanisms in detail, we can examine how aggregate changes in spending have affected separate groups. This will highlight any distributional effects of the reductions in long-term funding. It also provides an important final robustness check: we would expect the oldest and least affluent to be more reliant on publicly funded long-term care, and as a result the estimated impact on the hospital activity

[33] The coefficient on visits per patient is no longer statistically significantly different from zero.

of these groups should be greater (while younger adults and those living in more affluent areas should be relatively less affected).

We first consider how how cuts to per capita spending (on all individuals aged 65 and above) affects ED use for patients in three separate age groups: those aged between 65 and 74, those aged between 75 and 84, and those aged 85 and above. We repeat our IV analysis separately for each age group. The results are shown in Table 8. Among all age groups, the estimates indicate that a reduction in per capita spending on long-term care increases mean ED visits. The effects are largest in magnitude for the oldest individuals (85+). Our estimates indicate that the mean reduction in long-term care spending per resident aged 65+ (£391) led to an additional 0.106 ED visits per resident aged 85 and above (15.8% of mean visits per resident in this age group in 2009/10). This compares to equivalent estimates of 0.055 (20.3%) and 0.078 (19.1%) for those aged 65-74 and 75-84, respectively. The effects for those aged 85 and above are therefore roughly twice as large as for those aged between 65 and 74 in absolute terms but are actually smaller as a percentage of mean visits among these age groups at the start of the period, reflecting the much more frequent use of ED services among the oldest population.

We repeat this exercise for admissions from the ED in columns 4 to 6. In Table A2, we found that there was no aggregate impact on emergency admissions. However, among the oldest adults (85 years and above) we do now find evidence of reductions in long-term care spending increasing admissions from the ED. The estimates suggest that the mean reduction in per capita long-term care spending of £391 (equivalent to a 31% cut) led to residents aged 85 and above having an additional 0.04 admissions to hospital via the ED. This compares to a mean of 0.41 ED admissions in 2009/10 for that age group.

We then examine whether the impact on hospital admissions is greater among individuals living in local areas with greater deprivation. Since publicly funded long-term care is subject to a relatively severe financial means test, receipt of such care at the beginning of our period would be expected to be higher in less affluent areas (Breeze and Stafford, 2010). In addition, less affluent individuals may have been less able to afford privately funded care as an alternative if their publicly funded care was reduced or was lost entirely.

We assign small local areas (Lower Super Output Area, or LSOA) to a deprivation tercile based on the national distribution.[34] We then consider how cuts to per capita long-term care spending in the local authority affected per capita hospital use among among individuals living in differently deprived areas.[35] The results are shown in Table 10. There are no statistically significant effects on ED use among individuals living in the least deprived areas. This is in line with our expectations as few people living in these areas will qualify for publicly funded long-term care. In contrast, cuts to long-term care spending led to an increase in both the mean number of ED visits and the probability of an ED visit for individuals living in more deprived areas. The effects were greatest for those living in the 33% most deprived areas. The mean reduction in per-capita spending (£391, or 31%) led to 0.09 additional visits per resident living in the most deprived third of areas (equivalent to 20.6% of the mean 0.44 visits for those

[34]There were 32,990 LSOAs in England in 2009/10, with an average population of 1,594. We assign a deprivation score to each LSOA using the 2010 Index of Multiple Deprivation (IMD), as discussed in Section 3.

[35]We do not observe directly the amount of long-term care funding at the LSOA level but only at the broader local authority level.

individuals in 2009/10) and a 3.1 percentage point increase in those individuals' likelihood of having at least one ED visit (relative to a mean of 26.1% in 2009/10). These effects are greater than for the 65+ population as a whole. This is consistent with individuals in poorer areas being more likely to have their care affected by funding cuts, and with those individuals being less able to replace lost publicly funded care with care from other sources.

Taken together, these results show that cuts to long-term care spending had important distributional consequences. The impacts on hospital use were greater among groups more reliant on publicly funded care and thus more likely to be affected by the cuts. For those affected by the reduction in long-term care, we provide evidence of sizeable spillovers onto hospital activity. This is indicative of adverse consequences for their health and standard of living, despite only modest increases in the cost of providing ED care to affected individuals.

6 Conclusion

This paper examines the effects of reductions in funding for long-term care on public hospitals in England following a national austerity programme that reduced per-person spending on long-term care by 31% between 2009/10 and 2017/18. We find evidence of considerable spillovers between long-term care and hospital activity. Cuts to long-term care funding for the population aged 65 years and above led to substantially increased use of emergency department visits by patients in this age group: our estimates suggest that these reductions in funding explain between a quarter and a half of the increase in ED use among the elderly over this period. This in turn appears to have led to a reduction in the quality of care provided by hospitals, with an increase in emergency revisits and readmissions in the week following initial ED attendance as a result of cuts to long-term care funding.

Much of the additional ED activity was driven primarily by an increase in low-severity patients attending the ED, with a notable increase in the number of people presenting without a diagnosable medical problem. Consistent with this, we find that cuts to long-term care led to a greater number of short emergency inpatient stays (lasting 3 days or less). We find no evidence of an impact on longer emergency inpatient stays, elective inpatient care, or outpatient hospital care.

Publicly funded long-term care in England is subject to both a needs test and a stringent financial means test, and so is used primarily by less affluent individuals with relatively severe care needs. We show that the impacts on ED use are greatest among those most likely to be reliant on publicly funded long-term care at the start of the period, and thus more likely to be affected by the cuts (those aged 85 and above, and those living in more deprived areas). This suggests that as well as having adverse health consequences for those affected, cuts to long-term care spending had important distributional impacts.

Despite the sizeable increase in hospital activity, we show that this did not translate into a substantial increase in hospital spending. A £100 reduction in long-term care spending caused an increase in ED costs of around £1.50, with no statistically significant effect on aggregate hospital costs. This owes to the fact that care in the ED is relatively inexpensive to provide, and ED costs therefore account for only a small fraction of total hospital spending.

Our results demonstrate the importance of considering the implications for patient health and hospitals when allocating resources to long-term care. Sharp reductions in long-term care spending, and associated falls in the provision of community-based care especially, led to considerable increases in the use of emergency departments. This is distressing for patients and may have further implications for their health in future. This increased use also put substantial additional pressure on public hospitals at a time when those hospitals have faced well-publicised problems of over-crowding and lengthening emergency department waiting times.[36] Despite having minimal impacts on the costs for public hospitals in the short run, sustained increases in hospital use may also require expensive expansions of hospital resources in these areas in future.

It is important to note that reductions in long-term care spending in England have been mostly achieved by reducing assistance provided to those with the least severe needs. This is reflected in the fact that the vast majority of reductions in the volume of care recipients came from reductions in the number receiving community-based (home-based) care, rather than in the number receiving nursing home or residential care. This is consistent with previous evidence that suggests there was minimal impact on hospital utilisation as a result of reductions to the quantity or quality of such care in the US (McKnight, 2006; Polsky et al., 2014). We build on this work by using detailed hospital data to show which types of hospital activity have been most affected by reductions in funding for this care in a different setting.

However, if cuts to funding continue (or fail to keep up with the substantial demographic pressures) the consequences are likely to be even starker. Previous work has shown that the relationship between long-term care use on medical spending varies according to the severity of care need (Kim and Lim, 2015), and papers that find a substantial impact of long-term care on medical spending (such as Bakx et al., 2020) typically focus on nursing home care (where the severity of patient need is typically greater). A further tightening of resources would likely impact on the care of those with more severe needs and in nursing home settings, and would therefore be expected to lead to worse outcomes for patients and greater pressure on hospitals.

Our analysis is limited to the effects of long-term care spending on the use of hospital services, and must be seen in the context of wider evidence on the impact of recent cuts. Many of the potential negative impacts associated with reduced long-term care provision may be primarily seen in increased use of primary care services, which have been under increasing pressure in recent years, and are not examined here. We also do not attempt to capture any dynamic effects of these cuts, with health potentially worsening over time if insufficient care is provided over a prolonged period. Our analysis does not examine the potential effect on individuals' quality of life, which recent research has shown to be significantly improved by community-based care (Forder et al., 2017). We also cannot explicitly account for the potential for greater use of privately funded long-term care or informal care provided by family, friends or neighbours. New longitudinal data on the individual receipt of both primary and secondary health care and long-term care will be key in addressing more of these issues, and collecting such data should be a priority for policymakers and researchers seeking to better understand

[36] See, for example, https://www.theguardian.com/society/2019/nov/14/ae-waiting-times-in-england-hit-worst-ever-level.

the wider impact of long-term care cuts and the relationship between different types of care.

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Table 1: Local Authority characteristics in 2009/10 and 2017/18

	2009/10		2017/18	
	Mean	S.D.	Mean	S.D.
Local Authority finances				
Service spending (£ 000's)	359,118	232,077	272,546	188,986
Net adult long-term care spending (£ 000's)	125,236	93,874	119,203	91,815
Income from LTC fees (£ 000's)	19,770	16,524	20,028	17,247
Net LTC spending on over 65s (£ 000's)	64,467	48,282	52,311	38,898
Per capita LTC spending on over 65s (£)	1,251.94	428.28	861.03	293.77
Demographic characteristics				
Population aged 65+	57,734	49,859	68,884	61,120
Share of total population aged 65+ (%)	15.62	3.46	17.50	4.47
Share of total population aged 65 - 74 (%)	8.17	1.77	9.59	2.48
Share of total population aged 75 - 84 (%)	5.36	1.22	5.57	1.42
Share of total population aged 85+ (%)	2.09	0.58	2.34	0.65
Female share of population aged 65 - 74 (%)	52.32	0.87	51.97	0.93
Female share of population aged 75 - 84 (%)	57.29	1.23	55.17	1.19
Female share of population aged 85+ (%)	68.49	1.48	64.02	1.71
Economic characteristics				
Share of +65s claiming PCGC (%)	14.40	8.46	10.92	6.36
Share of +65s claiming disability benefits (%)	25.07	6.28	21.59	5.63
Share of adults claiming carer's allowance (%)	1.11	0.36	1.67	0.60
Share of +18s claiming income component of ESA (%)	0.41	0.16	2.65	1.02
Claimant count as % population aged 16-64	3.98	1.28	2.08	0.96
Economic inactivity rate as % population aged 16-64	24.04	4.10	21.96	4.15
Median gross weekly earnings (£)	481.02	91.21	466.34	76.52
Gross disposable household income per head (£)	19,356	6,309	20,370	7,572
Ratio of median house price to median annual earnings	6.60	2.21	9.05	4.81

Note: Figures shown are for the 140 local authorities included in our final sample. LTC denotes long-term care. PCGC denotes Pension Credit Guarantee Credit. ESA denotes Employment and Support Allowance. Long-term care spending on the over 65 population has been calculated on the basis of assumptions set out in the text. Per capita spending on the over 65 population is spending per resident aged 65 and over. All £ figures are expressed in 2018-19 prices.

Table 2: Hospital use in 2009/10 and 2017/18

	Aged 65+		Aged 65-74		Aged 75-84		Aged 85+	
	09/10	17/18	09/10	17/18	09/10	17/18	09/10	17/18
Panel A: Emergency Department								
Mean visits to ED	0.37	0.49	0.27	0.35	0.41	0.56	0.67	0.89
Prop. visiting ED	0.23	0.27	0.18	0.21	0.26	0.31	0.40	0.47
Mean admissions via ED	0.18	0.20	0.10	0.11	0.21	0.24	0.41	0.48
Prop. admitted via ED	0.13	0.13	0.08	0.08	0.15	0.16	0.28	0.31
Mean ambulance arrivals	0.21	0.24	0.11	0.12	0.24	0.28	0.50	0.62
Prop. having ambulance arrival	0.13	0.14	0.08	0.08	0.16	0.17	0.31	0.35
Panel B: Inpatient care								
Mean emergency inpatient spells	0.27	0.29	0.16	0.17	0.31	0.35	0.56	0.66
Prop. having emergency spell	0.16	0.17	0.10	0.10	0.19	0.20	0.34	0.36
Mean elective inpatient spells	0.42	0.45	0.40	0.42	0.47	0.54	0.34	0.36
Prop. having elective spell	0.20	0.20	0.19	0.19	0.22	0.24	0.18	0.18
Panel C: Outpatient care								
Mean outpatient attendances	2.69	3.45	2.46	3.00	3.07	4.05	2.63	3.89
Prop. having outpatient attendance	0.58	0.63	0.55	0.59	0.65	0.73	0.63	0.72
Panel D: Estimated hospital costs								
Per capita ED spend	£37	£67	£26	£45	£42	£78	£69	£134
Per capita emergency inpatient spend	£560	£544	£339	£316	£653	£646	£1,191	£1,235
Per capita elective inpatient spend	£629	£560	£620	£546	£697	£644	£485	£417
Per capita outpatient spend	£296	£334	£271	£292	£337	£391	£290	£373

Note: Figures shown are for the 140 local authorities included in our final sample. Spending figures are expressed in 2018-19 prices and have been rounded to the nearest pound.

Table 3: Estimated impact of long-term care spending on mean visits to the emergency department per 65+ resident

	Mean ED visits per 65+ resident			
	(1) OLS	(2) OLS	(3) FE	(4) FE-IV
Per capita long-term care spending on +65s (£00s)	0.020***	-0.005**	-0.000	-0.017**
	(0.002)	(0.003)	(0.001)	(0.008)
Share of population aged 65-74		-0.001	0.003	0.009
		(0.010)	(0.010)	(0.012)
Share of population aged 75-84		0.018	-0.029	-0.025
		(0.023)	(0.019)	(0.022)
Share of population aged 85+		-0.037	0.031	0.031
		(0.027)	(0.051)	(0.056)
Female share of population aged 65-74		0.016**	-0.006	-0.007
		(0.007)	(0.008)	(0.008)
Female share of population aged 75-84		0.016***	0.003	0.004
		(0.006)	(0.006)	(0.007)
Female share of population aged 85+		0.005	-0.003	-0.001
		(0.005)	(0.004)	(0.004)
Prop. +65s claiming PCGC		0.009***	0.005	0.007*
		(0.002)	(0.003)	(0.004)
Prop. +65s claiming disability benefits		0.007***	0.004	0.003
		(0.002)	(0.005)	(0.005)
Prop. adults claiming carer's allowance		-0.011	0.038	0.050
		(0.027)	(0.027)	(0.035)
Prop. adults claiming income component of ESA		-0.001	-0.006	-0.018*
		(0.009)	(0.008)	(0.010)
Real median gross weekly earnings (£00s)		0.033***	-0.004	-0.005
		(0.011)	(0.011)	(0.011)
Real gross disposable household income per head (£000s)		0.003*	0.001	-0.001
		(0.002)	(0.004)	(0.004)
Claimant count as % local population aged 16-64		-0.001	0.002	0.003
		(0.007)	(0.005)	(0.006)
Economic inactivity rate among local population aged 16-64		-0.002	-0.000	-0.001
		(0.001)	(0.001)	(0.001)
Ratio of median house price to median gross annual earnings		0.001	-0.000	-0.003
		(0.003)	(0.003)	(0.003)
Year dummy	✓	✓	✓	✓
Local authority fixed effects			✓	✓
Instrumental variable				✓
Observations	1260	1260	1260	1260
Number of local authorities	140	140	140	140
R-squared †	0.392	0.697	0.491	0.369
First stage F statistic	-	-	-	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
† Adjusted R^2 is shown for columns 1-3; the within-R^2 is shown for the FE-IV regression in column 4.
F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. PCGC and ESA stand for Pension Credit Guarantee Credit and Employment and Support Allowance, respectively.

Table 4: Estimated impact of long-term care spending on use of the emergency department

	Proportion of over 65s having an ED visit			Mean ED visits per 65+ patient (conditional on attendance)		
	(1) OLS	(2) FE	(3) FE-IV	(4) OLS	(5) FE	(6) FE-IV
Per capita LTC spending on +65s (£00s)	-0.002	-0.000	-0.006*	-0.009***	0.001	-0.016*
	(0.001)	(0.001)	(0.003)	(0.003)	(0.002)	(0.009)
Year dummy	✓	✓	✓	✓	✓	✓
Demographic and economic controls	✓	✓	✓	✓	✓	✓
Local authority fixed effects		✓	✓		✓	✓
Instrumental variable			✓			✓
Observations	1260	1260	1260	1260	1260	1260
Number of local authorities	140	140	140	140	140	140
R-squared	0.654	0.396	0.316	0.646	0.495	0.444
First stage F-statistic	-	-	32.74	-	-	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1
Adjusted R^2 is shown for OLS and FE specifications; the within-R^2 is shown for the FE-IV specification in columns 3 and 6. F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Mean visits per patient is calculated per resident aged 65 and over who had at least one ED visit over the course of the year. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+. Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Table 5: Estimated impact of long-term care spending on hospital costs

	Mean hospital costs per resident aged 65+			
	ED	Inpatient	Outpatient	Total
	(1) FE-IV	2) FE-IV	(3) FE-IV	(4) FE-IV
Per capita long-term care spending on +65s (£00s)	-1.517**	3.931	-0.240	2.365
	(0.719)	(4.705)	(6.041)	(7.656)
Year dummy	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓
Observations	1260	1260	1260	1260
Within R-squared	0.816	0.416	0.198	0.208
Number of local authorities	140	140	140	140
First stage F statistic	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1
F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. All £ cost figures are in 2018/19 prices. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+. Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings.

Table 6: Estimated impact of long-term care spending on use of the emergency department, by diagnosis code

	Mean ED visits with diagnosis recorded as:		Mean admissions via ED with diagnosis recorded as:	
	'Nothing abnormal detected'	All other codes	'Nothing abnormal detected'	All other codes
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV
Per capita LTC spending on +65s (£00s)	-0.003**	-0.014	-0.002*	0.000
	(0.002)	(0.009)	(0.001)	(0.002)
Year dummy	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓
Observations	1260	1260	1260	1260
Within R-squared	0.104	0.390	-0.060	0.246
Number of local authorities	140	140	140	140
First stage F statistic	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1
F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Mean visits and admissions are calculated per resident aged 65 and over. 'All other codes' includes all ED diagnosis codes codes other than 'nothing abnormal detected'. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+. Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Table 7: Estimated impact of long-term care spending on the proportion of Emergency Department patients aged 65 and above who have a re-attendance or re-admission within 7 and 30 days

	Proportion of ED patients with a re-attendance within:		Proportion of ED patients with a re-admission within:	
	7 days	30 days	7 days	30 days
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV
Per capita LTC spending on +65s (£00s)	-0.257**	-0.258	-0.092*	-0.063
	(0.130)	(0.159)	(0.053)	(0.119)
Year dummy	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓
Observations	1260	1260	1260	1260
Within R-squared	0.065	0.402	0.284	0.408
Number of local authorities	140	140	140	140
First stage F statistic	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1
F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Outcome variables defined in percentage points. Reattendance defined as having an ED visit within 7 or 30 days of departure from the ED. Readmission defined as having an admission via the ED within 7 days or 30 days of departure. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+. Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Table 8: Estimated impact of long-term care spending on use of the emergency department, by age

	Mean ED visits, for ages:			Mean ED admissions, for ages:		
	65-74	75-84	85+	65-74	75-84	85+
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV	(5) FE-IV	(6) FE-IV
Per capita LTC spending on +65s (£00s)	-0.014*	-0.020**	-0.027**	-0.000	-0.002	-0.011*
	(0.008)	(0.009)	(0.012)	(0.001)	(0.003)	(0.006)
Year dummy	✓	✓	✓	✓	✓	✓
Demographic and economic controls	✓	✓	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓	✓	✓
Observations	1260	1260	1260	1260	1260	1260
Number of local authorities	140	140	140	140	140	140
Within R-squared (Panel A)	0.255	0.428	0.511	0.185	0.240	0.286
Within R-squared (Panel B)	0.255	0.428	0.511	0.185	0.240	0.286
First stage F-statistic	32.74	32.74	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1
F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Mean visits to the ED and admissions via the ED are calculated per resident in the respective age group (65-74, 75-84, or 85+). Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+.Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Table 9: Robustness of Emergency Department results to alternative specification

	Mean ED visits per 65+ resident	Proportion +65s having ED visit	Mean ED visits per 65+ patient (conditional on attendance)	Mean ED costs per 65+ resident
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV
Per capita LTC spending on +65s (£00s)	-0.007**	-0.003**	-0.008	-1.199**
	(0.003)	(0.001)	(0.005)	(0.512)
Year dummy	✓	✓	✓	✓
Mean ED visits per resident aged 40-64	✓	✓	✓	✓
Mean ED visits per resident aged 40-64 * Year	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓
Observations	1260	1260	1260	1260
Within R-squared	0.904	0.848	0.634	0.878
Number of local authorities	140	140	140	140
First stage F statistic	31.77	31.77	31.77	31.77

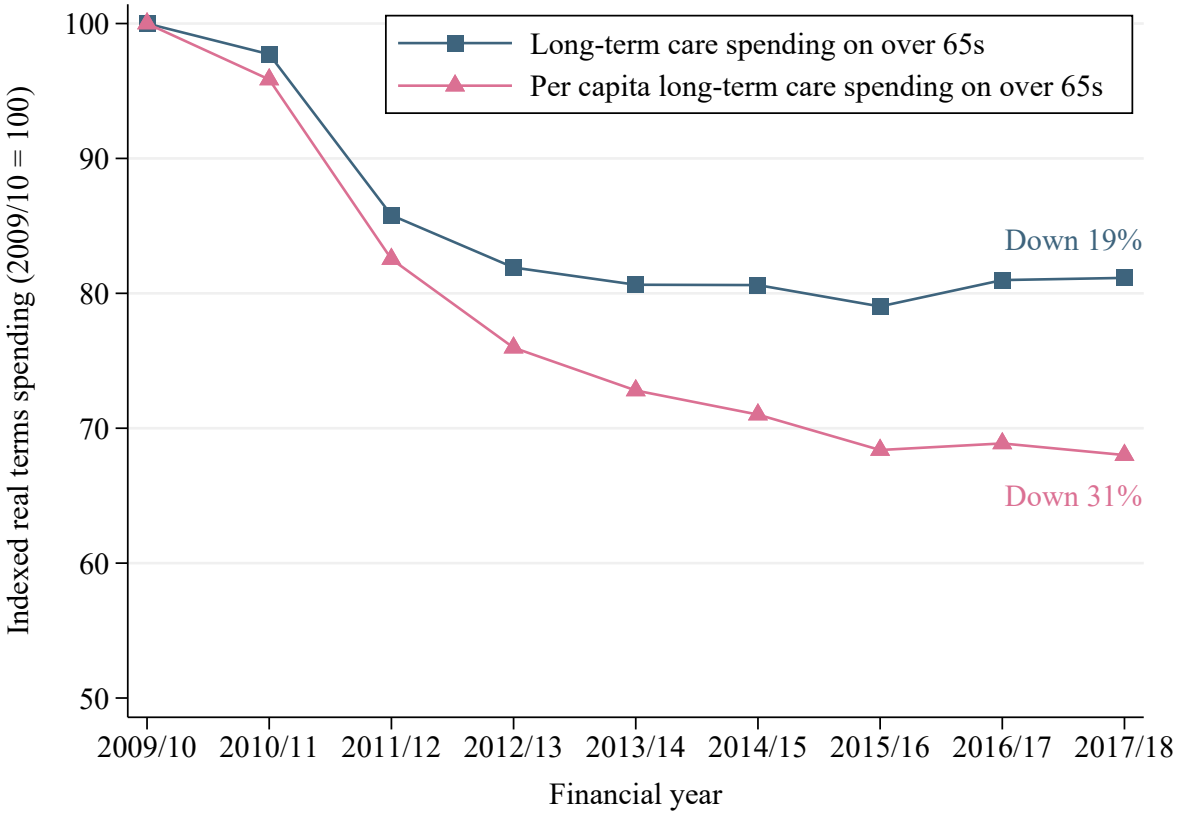
Standard errors clustered at the local authority level are displayed in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Mean visits per patient is calculated per resident aged 65 and over who had at least one ED visit over the course of the year. ED £ cost figures are in 2018/19 prices. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+.Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Table 10: Estimated impact of long-term care spending on emergency department use, by local area deprivation

	Mean ED visits per 65+ resident, by deprivation tercile:			Proportion of over 65s having an ED visit, by deprivation tercile:		
	Least deprived	Middle tercile	Most deprived	Least deprived	Middle tercile	Most deprived
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV	(5) FE-IV	(6) FE-IV
Per capita LTC spending on +65s (£00s)	-0.013	-0.014*	-0.023**	-0.005	-0.007**	-0.008**
	(0.011)	(0.009)	(0.009)	(0.004)	(0.003)	(0.004)
Year dummy	✓	✓	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓	✓	✓
Observations	1224	1260	1242	1224	1260	1242
Within R-squared	0.325	0.402	0.351	0.300	0.320	0.294
Number of local authorities	136	140	138	136	140	138
First stage F statistic	26.99	32.74	32.23	26.99	32.74	32.23

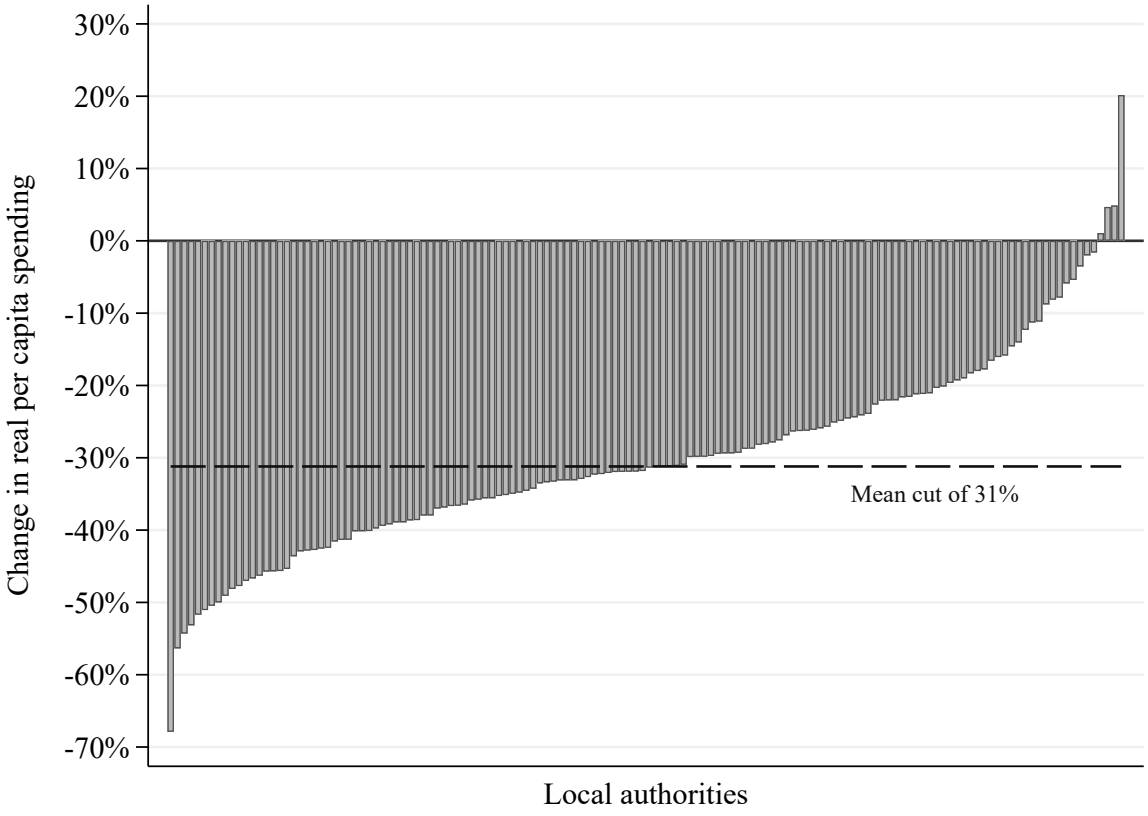
Standard errors clustered at the local authority level are displayed in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Deprivation terciles are calulated using the 2010 Indices of Deprivation for Lower Super Output Areas (LSOAs). 'Least deprived', 'Middle tercile' and 'Most deprived' refer to the bottom, middle and top third of the national distribution of LSOAs in terms of their 2010 deprivation (IMD) score. Mean ED visits and proportion visiting the ED are calulated relative to the 65+ population in each local authority in each year who live in LSOAs in the relevant deprivation tercile. The number of local authorities (LAs) and observations differ across columns because four LAs have no LSOAs in the bottom third of the national distribution (least deprived), and two LAs have no LSOAs in the top third of the national distribution (most deprived). Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+.Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Figure 1: Real terms local authority spending on long-term care for the elderly population in England, 2009/10 to 2017/18



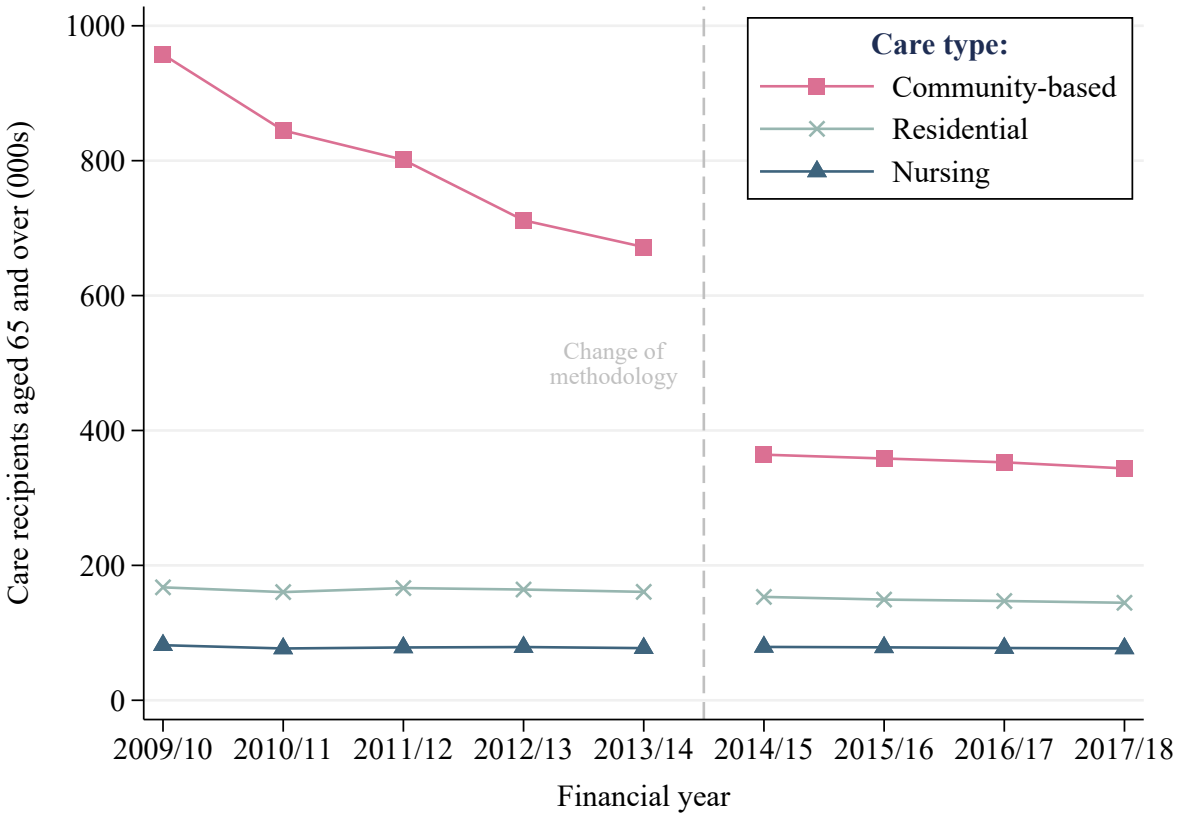
Note: Figures shown are for our final sample of 140 local authorities in England. Per capita spending denotes spending per resident aged 65 or over. Long-term care spending in 2009/10 and 2010/11 is adjusted for the transfer of responsibility for the 'Valuing People Now' programme from the NHS to local authorities. In subsequent years, long-term care spending includes transfers from the NHS, which from 2015/16 became the 'Better Care Fund'. Spending that is not explicitly allocated to an age group is allocated to the over 65 population in proportion to the share of allocated spending that is labelled as benefiting that age group.

Figure 2: Change in real-terms per capita spending on long-term care for the elderly population in England, 2009/10 to 2017/18, by local authority



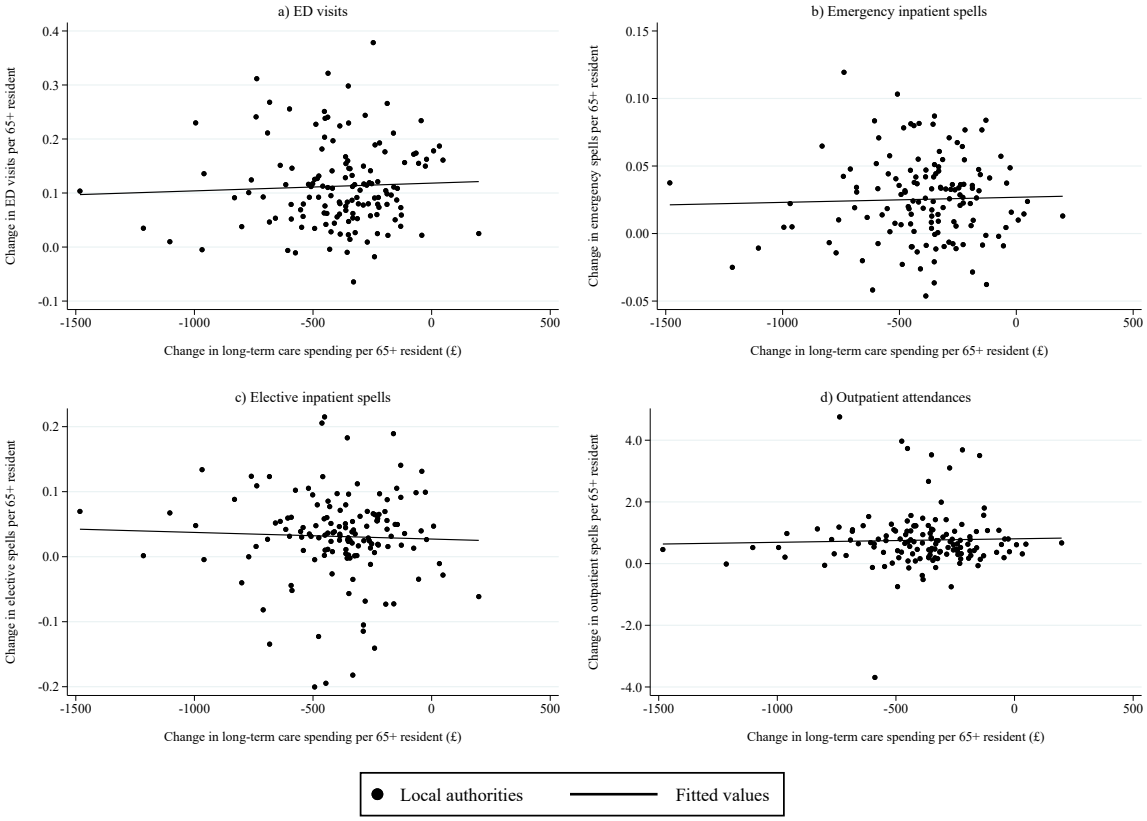
Note: Figures denote the real-terms percentage change in per capita spending on long-term care for the over 65s between 2009/10 and 2017/18, by local authority, where local authorities are ranked in order of the percentage change. Figures are shown for our final sample of 140 local authorities in England. Long-term care spending in 2009/10 and 2010/11 is adjusted for the transfer of responsibility for the 'Valuing People Now' programme from the NHS to local authorities. In subsequent years, long-term care spending includes transfers from the NHS, which from 2015/16 became the 'Better Care Fund'. Spending that is not explicitly allocated to an age group is allocated to the over 65 population in proportion to the share of allocated spending that is labelled as benefiting that age group.

Figure 3: Number of individuals aged over 65 in receipt of publicly funded long-term care in England, 2009/10 to 2017/18, by type of care



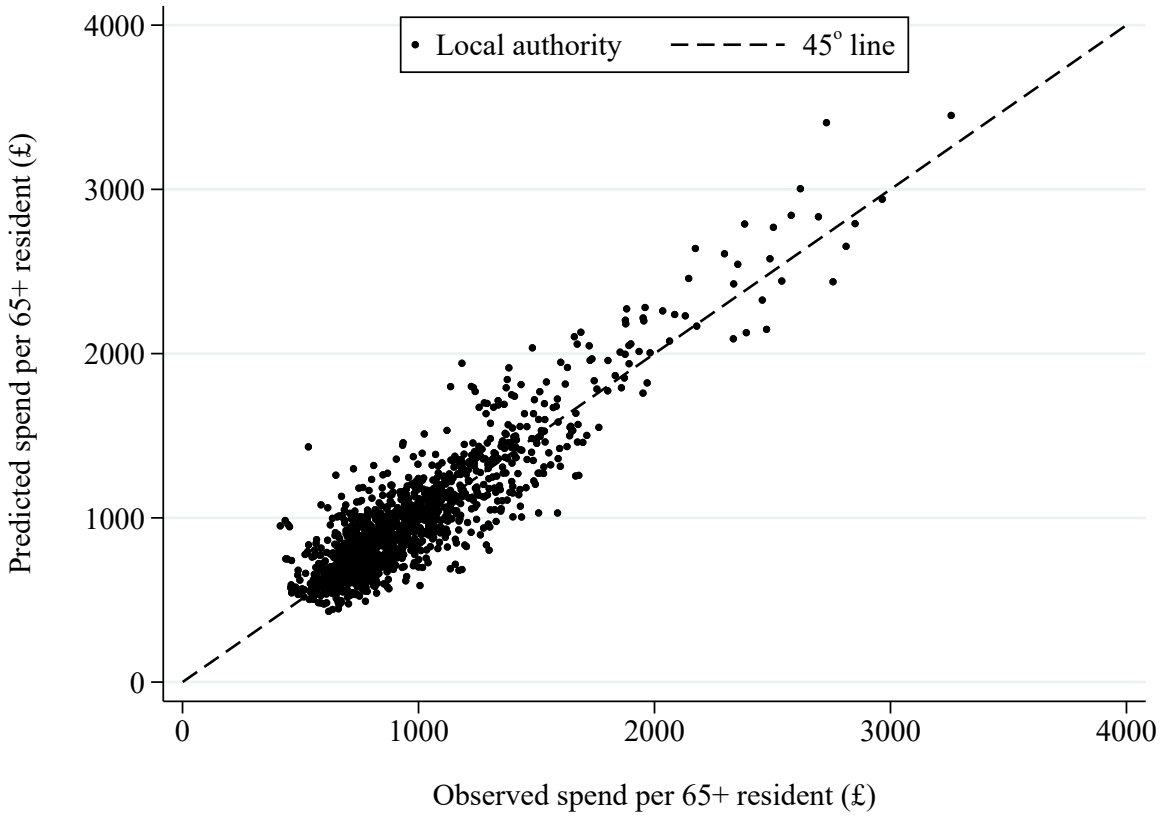
Note: Figures denote care receipt in England, sourced from the NHS Community Care Statistics. A change of methodology in data collection in 2014/15 means that figures before and after that point are not comparable. Community-based care is domiciliary care provided in the recipient's home. Residential homes provide accommodation and personal care. Nursing homes provide accommodation and personal care, alongside care from qualified nurses.

Figure 4: Changes in mean hospital use by the over 65 population vs. changes in per capita long-term care spending on the over 65s, 2009/10 to 2017/18



Note: Data shown for the 140 local authorities in our final sample. The vertical axes show the change in the mean number annual hospital visits of each type, per resident aged 65 and above, between 2009/10 and 2017/18. The horizontal axes show the £ change in long-term care spending per resident aged 65 and above (in 2018/19 prices), between 2009/10 and 2017/18. The mean reduction was £391, or 31%. Long-term care spending in 2009/10 and 2010/11 is adjusted for the transfer of responsibility for the 'Valuing People Now' programme from the NHS to local authorities. In subsequent years, long-term care spending includes transfers from the NHS, which from 2015/16 became the 'Better Care Fund'. Spending that is not explicitly allocated to an age group is allocated to the over 65 population in proportion to the share of allocated spending that is labelled as benefiting that age group. ED denotes the Emergency Department.

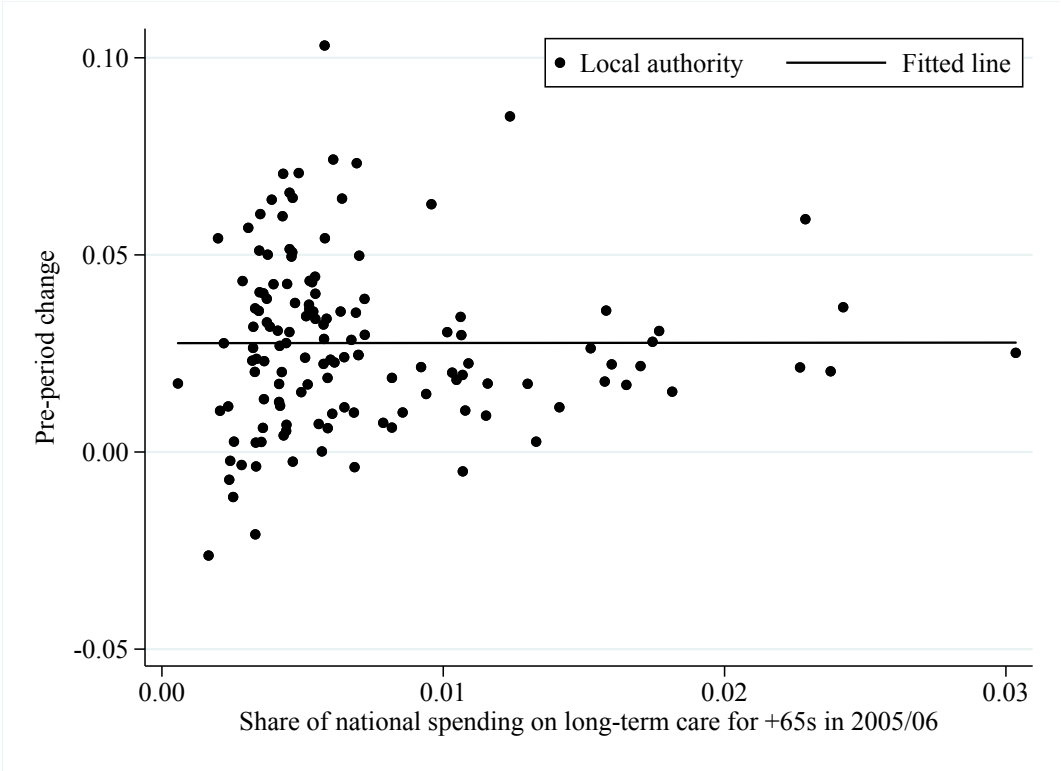
Figure 5: Predicted per resident spending vs observed per resident spending



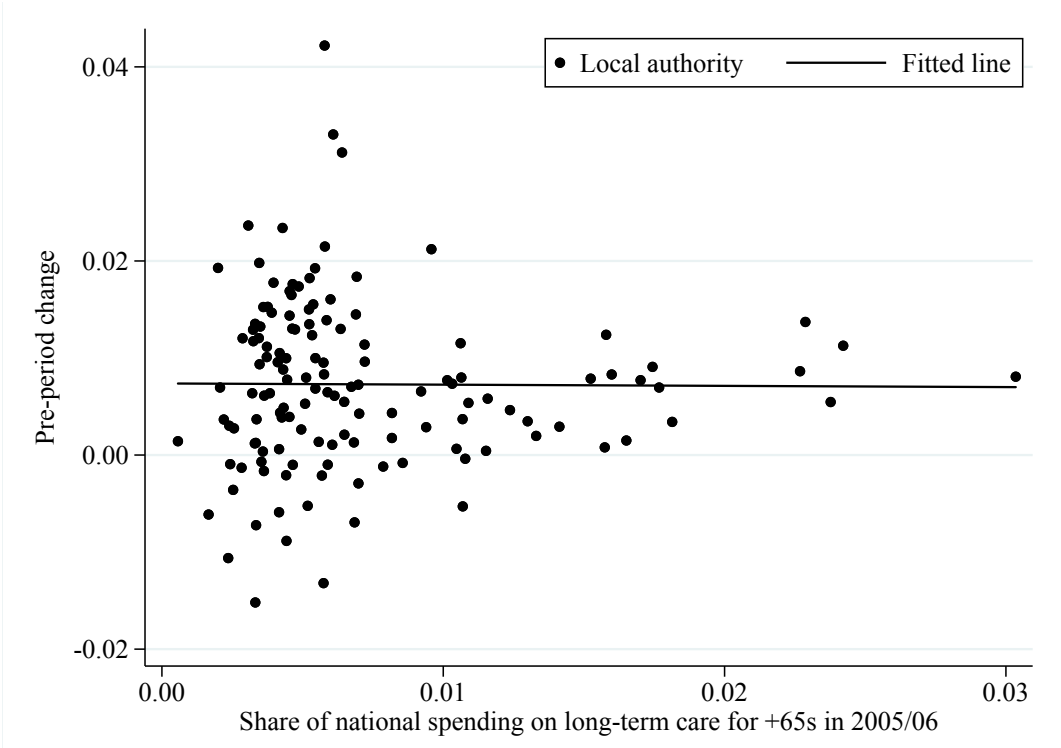
Note: All figures are for long-term care spending on the over 65s, calculated per resident aged 65 and above, and are expressed in 2018/19 prices for the 140 local authorities in our final sample. The 45 degree line shows the correlation if observed (actual) spending was equal to predicted spending. Predicted spending is defined as the product of observed national spending in a given year and the local authority's share of national spending in 2005/06. Long-term care spending in 2009/10 and 2010/11 is adjusted for the transfer of responsibility for the 'Valuing People Now' programme from the NHS to local authorities. In subsequent years, long-term care spending includes transfers from the NHS, which from 2015/16 became the 'Better Care Fund'. Spending that is not explicitly allocated to an age group is allocated to the over 65 population in proportion to the share of allocated spending that is labelled as benefiting that age group.

Figure 6: Change in pre-period utilisation (2005/06 - 2009/10) by initial share of national long-term care spending

(a) Mean emergency inpatient spells



(b) Proportion having emergency inpatient spell



Note: All figures are for our final sample of 140 local authorities. 'Pre-period change' refers to the change in the mean number of annual emergency inpatient spells per 65+ resident (panel a)) or the change in the proportion of over 65s having at least one emergency inpatient spell per year (panel b)) between 2005/06 and 2009/10.

A Appendix

Table A1: First stage results

	Observed per capita long-term care spending on +65s (£00)
Predicted per capita long-term care spending on +65s (£00s)	1.146***
	(0.200)
Share of population aged 65-74	0.258
	(0.225)
Share of population aged 75-84	0.222
	(0.475)
Share of population aged 85+	-0.491
	(0.964)
Female share of population aged 65-74	0.075
	(0.169)
Female share of population aged 75-84	0.035
	(0.149)
Female share of population aged 85+	0.068
	(0.102)
Prop. +65s claiming PCGC	-0.370***
	(0.107)
Prop. +65s claiming disability benefits	-0.012
	(0.111)
Prop. adults claiming carer's allowance	0.133
	(0.964)
Prop. adults claiming income component of ESA	-0.451**
	(0.196)
Real median gross weekly earnings (£00s)	-0.122
	(0.229)
Real gross disposable household income per head (£000s)	-0.132
	(0.089)
Claimant count as % local population aged 16-64	0.270*
	(0.164)
Economic inactivity rate among local population aged 16-64	-0.034
	(0.021)
Ratio of median house price to median gross annual earnings	-0.068
	(0.093)
Year dummy	✓
Local authority fixed effects	✓
Observations	1260
Number of local authorities	140
Adjusted R-squared	0.683
First stage F statistic	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Predicted spending is defined as the product of observed national spending in a given year and the local authority's share of national spending in 2005/06. PCGC and ESA stand for Pension Credit Guarantee Credit and Employment and Support Allowance, respectively.

Table A2: Estimated impact of long-term care spending on use of the emergency department

	Mean admissions via the ED per 65+ resident			Mean ambulance arrivals per 65+ resident		
	(7) OLS	(8) FE	(9) FE-IV	(10) OLS	(11) FE	(12) FE-IV
Per capita LTC spending on +65s (£00s)	-0.003***	0.001	-0.002	-0.002*	-0.000	0.000
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.005)
Year dummy	✓	✓	✓	✓	✓	✓
Demographic and economic controls	✓	✓	✓	✓	✓	✓
Local authority fixed effects		✓	✓		✓	✓
Instrumental variable			✓			✓
Observations	1260	1260	1260	1260	1260	1260
Number of local authorities	140	140	140	140	140	140
R-squared	0.601	0.227	0.222	0.499	0.176	0.192
First stage F-statistic	-	-	32.74	-	-	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1 Adjusted R^2 is shown for OLS and FE specifications; the within-R^2 is shown for the FE-IV specification in columns 3, 6, 9 and 12. F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Mean admissions and ambulance arrivals are calculated per resident aged 65 and over. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+. Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Table A3: Estimated impact of long-term care spending on use of inpatient hospital services

	Mean inpatient spells per 65+ resident			Proportion of 65+ residents having inpatient spell		
	All (1) FE-IV	Emergency (2) FE-IV	Elective (3) FE-IV	All (4) FE-IV	Emergency (5) FE-IV	Elective (6) FE-IV
Per capita LTC spending on +65s (£00s)	-0.002	-0.002	0.000	0.001	-0.000	0.001
	(0.005)	(0.002)	(0.005)	(0.001)	(0.001)	(0.001)
Year dummy	✓	✓	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓	✓	✓
Observations	1260	1260	1260	1260	1260	1260
Within R-squared	0.245	0.299	0.158	0.273	0.349	0.113
Number of local authorities	140	140	140	140	140	140
First stage F statistic	32.74	32.74	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1 F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+.Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Table A4: Estimated impact of long-term care spending on use of outpatient hospital services

	Mean outpatient visits, by referral source:			
	All	GP	Hospital	Other
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV
Per capita long-term care spending on +65s (£00s)	-0.022	-0.048	0.047	-0.021
	(0.066)	(0.036)	(0.035)	(0.043)
Year dummy	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓
Observations	1260	1260	1260	1260
Within R-squared	0.306	0.398	0.039	0.127
Number of local authorities	140	140	140	140
First stage F statistic	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1 F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+.Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings.

Table A5: Estimated impact of long-term care spending on use of the emergency department, by age and diagnosis

	Mean ED visits with diagnosis recorded as 'nothing abnormal detected', for ages:			Mean ED admissions with diagnosis recorded as 'nothing abnormal detected', for ages:		
	65-74	75-84	85+	65-74	75-84	85+
	(7) FE-IV	(8) FE-IV	(9) FE-IV	(10) FE-IV	(11) FE-IV	(12) FE-IV
Per capita LTC spending on +65s (£00s)	-0.002**	-0.004**	-0.006*	-0.001*	-0.002*	-0.004*
	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.002)
Year dummy	✓	✓	✓	✓	✓	✓
Demographic and economic controls	✓	✓	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓	✓	✓
Observations	1260	1260	1260	1260	1260	1260
Number of local authorities	140	140	140	140	140	140
Within R-squared	0.121	0.097	0.087	-0.068	-0.060	-0.056
First stage F-statistic	32.74	32.74	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1 F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Mean visits to the ED and admissions via the ED are calculated per resident in the respective age group (65-74, 75-84, or 85+). Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+.Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Table A6: Estimated impact of long-term care spending on use of inpatient hospital services, by age

	Mean number of emergency inpatient spells, for ages:			Mean number of elective inpatient spells, for ages:		
	65-74	75-84	85+	65-74	75-84	85+
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV	(5) FE-IV	(6) FE-IV
Per capita LTC spending on +65s (£00s)	-0.000	-0.003	-0.013**	-0.004	0.003	0.011
	(0.001)	(0.002)	(0.006)	(0.004)	(0.006)	(0.007)
Year dummy	✓	✓	✓	✓	✓	✓
Demographic and economic controls	✓	✓	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓	✓	✓
Observations	1260	1260	1260	1260	1260	1260
Number of local authorities	140	140	140	140	140	140
Within R-squared	0.274	0.313	0.325	0.090	0.223	0.032
First stage F-statistic	32.74	32.74	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1 F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Mean inpatient spells of each type are calculated per resident in the respective age group (65-74, 75-84, or 85+). Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+. Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. LTC denotes long-term care.

Table A7: Estimated impact of long-term care spending on use of emergency inpatient hospital services, by length of stay

	Mean emergency inpatient spells per 65+ resident, of length:			
	≤ 1 day	≤ 3 days	≥ 4 days	≥ 7 days
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV
Per capita long-term care spending on +65s (£00s)	-0.002**	-0.004**	0.001	0.001
	(0.001)	(0.002)	(0.001)	(0.001)
Year dummy	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓
Observations	1260	1260	1260	1260
Within R-squared	0.337	0.358	0.163	0.249
Number of local authorities	140	140	140	140
First stage F statistic	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1 F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+.Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings.

Table A8: Estimated impact of long-term care spending on use of elective inpatient hospital services, by length of stay

	Mean elective inpatient spells per 65+ resident, of length:			
	$\leq$ 1 day	$\leq$ 3 days	$\geq$ 4 days	$\geq$ 7 days
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV
Per capita long-term care spending on +65s (£00s)	-0.001	-0.001	0.001*	0.001
	(0.004)	(0.004)	(0.001)	(0.000)
Year dummy	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓
Observations	1260	1260	1260	1260
Within R-squared	0.308	0.256	0.677	0.642
Number of local authorities	140	140	140	140
First stage F statistic	32.74	32.74	32.74	32.74

Standard errors clustered at the local authority level are displayed in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1 F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+.Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings.

Table A9: Pre-period robustness checks (2005/06 - 2009/10)

	Mean hospital visits per 65+ resident		
	Emergency inpatient	Elective inpatient	Outpatient
	(1) FE	(2) FE	(3) FE
Baseline controls	✓	✓	✓
Financial year dummies	✓	✓	✓
Local authority fixed effects	✓	✓	✓
*Quartile of 2005/06 spending share * Financial year* ‡			
Quartile 2 * 2005/06	-0.011**	0.001	0.042
	(0.005)	(0.013)	(0.193)
Quartile 2 * 2006/07	0.001	0.002	0.204
	(0.008)	(0.015)	(0.185)
Quartile 2 * 2007/08	-0.004	0.001	0.200
	(0.005)	(0.012)	(0.188)
Quartile 2 * 2008/09	-0.003	0.006	0.200
	(0.003)	(0.009)	(0.141)
Quartile 3 * 2005/06	-0.005	-0.018	0.018
	(0.006)	(0.016)	(0.191)
Quartile 3 * 2006/07	0.010	-0.008	0.082
	(0.006)	(0.017)	(0.196)
Quartile 3 * 2007/08	0.001	-0.021	0.145
	(0.006)	(0.013)	(0.190)
Quartile 3 * 2008/09	0.001	-0.005	0.094
	(0.003)	(0.010)	(0.149)
Quartile 4 * 2005/06	-0.006	0.010	0.231
	(0.005)	(0.013)	(0.190)
Quartile 4 * 2006/07	0.002	0.008	0.202
	(0.007)	(0.015)	(0.183)
Quartile 4 * 2007/08	-0.002	-0.008	0.208
	(0.004)	(0.012)	(0.177)
Quartile 4 * 2008/09	-0.002	-0.004	0.119
	(0.002)	(0.009)	(0.136)
Observations	660	660	660
Number of local authorities	132	132	132
Adjusted R-squared	0.471	0.570	0.814

Standard errors clustered at the local authority level are displayed in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
‡ Reference quartile is the first (lowest) quartile of 2005/06 spending shares. Reference year is 2009/10.
Baseline controls are: the share of the total population aged 65-74, 75-84, and 85+, the female share of the population aged 65-74, 75-84 and 85+, the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming carer's allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings. Note that the proportion of adults claiming the income component of Employment and Support Allowance is not included due to lack of data availability for the period prior to 2009. A further eight local authorities have been excluded from the sample due to changing boundaries and administrative structure.

Table A10: Robustness checks: alternative base years of local authority spending shares

	Mean ED visits per resident aged 65+			
	Instrument constructed using local authority spending share in:			
	2005/06	2000/01	2002/03	2007/08
	(1) FE-IV	(2) FE-IV	(3) FE-IV	(4) FE-IV
Per capita long-term care spending on +65s (£00s)	-0.017**	-0.018*	-0.020**	-0.017**
	(0.008)	(0.011)	(0.010)	(0.008)
Year dummy	✓	✓	✓	✓
Demographic & economic controls	✓	✓	✓	✓
Local authority fixed effects	✓	✓	✓	✓
Instrumental variable	✓	✓	✓	✓
Observations	1260	1260	1260	1260
Within R-squared	0.369	0.352	0.317	0.368
Number of local authorities	140	140	140	140
First stage F statistic	32.74	24.12	20.47	33.08

Standard errors clustered at the local authority level are displayed in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ F-statistic reported for the first stage is Kleibergen-Paap rk Wald F-statistic. Spending shares calculated as the % of national spending on long-term care for the over 65s accounted for by each local authority, using the CIPFA Social Care Actuals tables for the financial year in question. 2005/06 spending shares are used in our baseline analysis. Demographic controls included are: the share of the total population aged 65-74, 75-84, and 85+, and the female share of the population aged 65-74, 75-84 and 85+.Economic controls included are: the proportion of +65s claiming each of Pension Credit Guarantee Credit and disability benefits, the proportion of adults claiming each of carer's allowance and the income component of Employment and Support Allowance, real median gross weekly earnings, real gross dispoable household income per head, the claimant count as a share of the local population aged 16-64, the share of 16-64 year olds who are economically inactive, and the ratio of the median house price to median gross annual earnings.