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Long Term Care Provision, Hospital Length of Stay and Discharge Destination for Hip Fracture and Stroke Patients

CHE Research Paper 86

Long term care provision, hospital length of stay and discharge destination for hip fracture and stroke patients

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Executive summary

1. Expenditure on long term care is expected to rise, driven by an ageing population. Coordination between health and long term care is increasingly a priority for policymakers. Elderly individuals living at home who suffer trauma, such as hip fracture or stroke, generally require immediate acute hospital care, followed by long term care and assistance which can be provided either in their home or in a residential or nursing home. However, little is known about the effects of one sector on the other. This study examines the association between formal long term care supply and the probability of being discharged to a long-term care institution (a nursing home or a care home) and length of stay in hospital for patients admitted for hip fracture or stroke.

2. We used data on all patients aged 65 and over who had emergency admissions to English hospitals from their home for hip fracture or stroke and who were discharged alive in 2008/9. We linked each patient to small area socio-economic characteristics and the local supply of long-term care (nursing and care homes beds and prices) using their Lower Super Output Area of residence.

3. Hip fracture patients had an average length of stay of 22 days and 14.5% were discharged to a care home. Stroke patients have longer stays (29 days) and slightly smaller probability of discharge to a care home (13.5%). Patients discharged to care homes had much longer hospital stays relative to those discharged to their home (33 vs 20 days for hip fracture and 62 vs 23 days for stroke).

4. Demographic and clinical factors (such as age, gender, number of diagnoses and procedures) were the main factors affecting the probability of being discharged to a long-term care institution as opposed to returning home. Against an average probability of being discharged to a long-term care facility of 13-14%, we find that patients aged over 75 have about a doubled probability of being discharged to care. An additional diagnosis or procedure increases the probability by respectively 1-2 and 0.3-0.5 percentage points. Men have a 1-4 percentage points smaller probability of being discharged to a care institution, possibly because they have a higher probability of having a spouse or a partner who can provide informal long-term care at home.

5. Patients discharged home aged over 75 have about 30% longer length of stay than those aged 65-74. Patients with more procedures and secondary diagnoses stay longer in hospitals. An additional diagnosis or procedure increases length of stay by 0.5-1.3%.

6. Patients in areas in the highest quintile of income deprivation have a 1.3 percentage points smaller probability of being discharged to a care home, though the association is statistically significant only at the 10% level.

7. On average there were 2,350 care home beds within 10km of a patient's LSOA of residence. For hip fracture patients a greater availability of long-term care beds is associated with a higher probability of being discharged to care. A greater local supply of long-term care beds and lower prices are associated with shorter hospital length stays for hip fracture patients discharged to a care home or a nursing home but not for those discharged to their own home. There is 30% shorter length of stay for patients in areas in the highest quintile of bed supply relative to those in the lowest quintile. The results are consistent with the suggestion that hospital discharge decisions are constrained by long-term care beds supply: patients cannot be discharged quickly when a bed in a nursing home is not easily available. Moreover, when prices are high in the long-term care sector patients may take more time to search for the appropriate place and this further increases hospital length of stay.

8. For stroke patients there is little evidence of an association between care home accessibility and discharge destination or length of stay. Beds availability is associated with a shorter hospital length of stay for stroke patients in areas in the highest quintile of availability for patients discharged to care but, counter-intuitively, also for those discharged home. Stroke is a more impairing condition and this may limit the effect of access to care homes on decisions about discharge destination and length of stay.

9. We have found some cross-sectional evidence of association between care home accessibility, discharge destination and length of stay. In future work, we will use panel data on delayed discharges covering all types of patients which may also allow us to identify a causal relationship between social care supply, length of stay and discharge destination.

1. Introduction

With an ageing population the frequency and complexity of interactions between the health and long term care sectors are expected to rise. The provision of care for the elderly is a consistent focus of policy makers in the UK and other OECD countries (Department of Health, 2001; 2011; Glendinning, 2003; OECD, 2011; Wanless, 2006). Around 10% of individuals over 75 years old used health and long-term care in 2006/7 in England (Bardsley, et al 2012). Many of these were patients requiring health and long-term care following a trauma like a stroke or hip fracture.

Hospitals and nursing and care homes in the UK have different funding arrangements and the provision is also organised differently. Acute hospital care is predominantly provided in England by 164 public sector hospital trusts who receive prospective funding per patient treated (based on Healthcare Resource Groups, HRGs) from local Primary Care Trusts who in turn receive a budget from the Department of Health. National Health Service (NHS) patients do not pay for hospital care. There are over 18,000 providers of social care (nursing and residential homes) in England (Laing and Buisson, 2010) who are a mix of for profit, not for profit and public organisations. Most users - about 60% (Forder, 2007) - pay for social care, with those on low incomes or with low wealth being subsidised by their local authority. There are relatively few examples of organisations commissioning both health and social care.

Social care has costs and outcome consequences in health care and vice versa (Fernandez and Forder, 2008; Forder, 2009; Vetter, 2003). There is longstanding concern over coordination for patients requiring health and long-term care, in particular the delayed discharge of patients from hospital (Baumann, et al 2007; House of Commons, 2003; National Audit Office, 2000). This concern has led to the increased investment in intermediate care services in community hospitals and elsewhere (Stevenson and Spencer, 2002) and to the Community Care (Delayed Discharges) Act (2003). The Act imposed new duties on councils and NHS to communicate about discharge of patients from hospital. Councils were made liable for reimbursing hospitals for delayed discharges for which they were solely responsible.

To improve integration of health and social care services, policy makers need information about the effects of provision of one type of care on the other. In this paper we examine an aspect of health and social care interactions where there is currently little hard quantitative evidence: the extent to which the accessibility of long term care (i.e. nursing and care homes) affects both the length of stay in hospital and the probability of a patient being discharged back to their homes as opposed to a nursing or a care home.

We focus on patients aged 65 or over who suffered a hip fracture or stroke whilst living in their own home. These conditions were selected as ‘tracer’ conditions since they have been previously highlighted by policy makers (Department of Health, 2011) and in past research (Bond, et al 2000) as of particular significance when considering the treatment of the elderly. Both are acute conditions requiring immediate hospital care and longer term rehabilitation. Such rehabilitation could take place in hospital but also in outside units, at home with home help or in a long term care facility. Patients with these conditions are likely to be most directly affected by the accessibility of long term care. Those with less access to care homes are more likely to be discharged back to their home and to stay longer in hospital until a care home place becomes available or they have recovered sufficiently to be sent home (Bryan, et al 2006).

The study has two primary research questions. First, we investigate whether, after controlling for clinical and non-clinical factors, access to long term care in nursing and residential homes (as measured by beds and prices) influences the probability of patients, aged 65 or over who were admitted from their home with hip fracture or stroke and who do not die in hospital, being discharged to a care home following hospitalisation. Second, we investigate whether the supply of long term care influences their length of stay in hospital. The latter question can be interpreted as a test of the 'bed-blocking' hypothesis: patients tend to stay longer in hospitals if they have to wait for a place to free up in a care home.

Previous studies investigating the probability of patients being discharged into care home as opposed to their own home, following hospitalisation, are summarised in Table 1. They find that age, gender and living arrangements were significant drivers of the probability of being discharged to a care home. Other drivers included comorbidities (Aharonoff, et al 2004; Gilbert, et al 2010), ethnicity (Aharonoff, et al 2004; Ellis and Trent, 2001), urbanisation (Gilbert, et al 2010) and income deprivation (Gilbert, et al 2010; Picone, et al 2003).

Patients with a longer length of stay were more likely to be discharged to a care home (Wong, et al 2010).

Only two of the studies looked at the impact of the supply of residential and nursing beds on the probability of discharge to care. Picone et al (2003) investigate the simultaneous determinants of hospital length of stay and discharge destination of Medicare patients following a severe condition (hip fracture, stroke and heart attack). They show that both informal care (as measured by being married and number of children) and supply variables (e.g. available of beds) affect the probability of being discharged home and to nursing facility. Overall, they conclude that there is evidence of substitution effects between hospital care and post-hospital care. Bond et al (2000) conduct a study of 440 stroke and 572 hip fracture patients in six NHS hospitals and found the probability of being discharged to a care home increased with greater supply of residential and nursing beds.

Although there is an extensive literature on the substitution between informal and formal long term care (Bonsang, 2009; Bolin, et al 2008; Van Houtven and Norton, 2004; Grabowski et al, 2012), there is only limited evidence on the effect of care homes supply on health care, i.e. the substitution between long term care and health care.

Fernandez and Forder (2008) in a local authority level study, found that LAs with more home help hours, and nursing and residential care beds had a lower rate of delayed discharge from hospital (for patients aged 75 and over) and lower emergency readmission rates. Forder (2009) used small-area data on 8000 census areas in England and found that an increase in spending on care homes by £1 generates a reduction in hospital expenditure by £0.35.

Our study contributes to the literature on the substitution between long term care and health care. By using individual level patient data we are able to control more precisely for patient diagnoses and socio-economic characteristics than area level studies. We extend Bond et al (2000) by using a much larger sample of all patients in England, including a rich set of covariates, and including a range of measures of accessibility of social care supply (beds, price and quality rating), and drawing on additional clinical and socioeconomic characteristics.

Section 2 describes the data and methods, section 3 gives the results. Section 4 discusses and section 5 concludes.

Table 1. Literature on discharge destination

Paper	Sample	Outcome	Analysis	Explanatories	Results
Aditya et al (2003)	150 consecutive elderly rehabilitation patients admitted to non-acute hospital	Discharge to nursing home or home	Logistic	Impaired vision, confusion, incontinence, falls in hospital, recurrent falls, living alone, high fall risk, use of tranquilizers and wandering behaviour and gait abnormality	Confusion, incontinence, falls in hospital, gait abnormalities, tranquilizers, impaired vision and living alone increased probability of nursing home discharge
Aharonoff et al (2004)	89,723 hip fracture 65+ patients, living at home, discharged home or nursing home. 1986-1996, New York State	Discharge to skilled nursing facility (SKN)	Logistic	Age, gender, race, type of fracture, treatment, comorbidities, dementia, LoS, year	Probability increased if 85+, female, white, 3+ comorbidities, history of dementia, admitted post 1990, intertrochanteric fracture
Bond et al (2000)	440 acute stroke, 572 hip fracture patients 65+ admitted from home, in 6 hospitals, England	Discharge destination	Logistic	Age, marital status, living arrangements, mental health status, pre-admission disability and use of home care, post admission functional dependency, nursing staff expectation of destination	All significantly related to probability of discharge to long term care institution. Patients in one of hospitals in area with lower availability of residential & nursing homes had higher probability of discharge to their home
Deakin et al (2008)	3240 consecutive hip fracture patients May 1999 to May 2004, Nottingham	Discharge to normal place of residence vs elsewhere	Logistic	Age, gender, place of fall, residence on admission, associated fractures, pre fall walking ability, ADLs, mental health, smoking, steroid user	Probability of discharge to home falls with age, male, admitted from elsewhere, living alone, institutionalised, worse walking ability, fewer ADLs
Donald et al (1999)	1818 over 75s with a standardised health check, Gloucestershire	Moved to care or death	Cox with forward conditional removal	Age, sex, single fall, multiple falls	Multiple falls (death and move to care). Single fallers also more likely to go into care
Ellis et al (2001)	103,902 first same level falls, California 1995-7	Discharge home, to care or death	Age adjusted proportion	Age, gender, ethnicity	More likely to be discharged to care if white or female. Death more frequent among whites.
Fernandez et al (2008).	150 English LAs, 1998/9, 1999/2000	Delayed discharge rate patients 75+, LoS, emergency readmissions	2SLS allowing for endogeneity	LA input prices, house prices, expenditure on 65+, mortality, hospital beds, year, hours of home care, residential & home care beds	Home care hours, residential & nursing home beds reduced emergency readmission rates, LoS, delayed discharge rate
Gilbert et al (2010)	1,259,350 fall patients 50+	Discharge to usual residence vs	Logistic, ward RE	Age, gender, Charlson Index. Ward IMD, rurality, ethnicity (output area)	Age, female, deprivation, urbanisation, morbidity reduce prob of discharge to usual

	admitted from usual residence, discharged alive England 1991-2002	temporary residence, NHS other provider, LA or NHS			residence
Kagaya et al (2005)	63 consecutive acute hip fracture patients aged 50+ in a Japanese hospital during 1998-1999	Discharge destination	Stepwise multiple logistic.	Age LoS, living alone, living at home/care, fracture type, dementia, heart disease, history of stroke mobility. Only mobility used in stepwise, others considered in univariate.	Better mobility increased probability of discharge home
Parker et al (1995)	643 consecutive hip fracture patients admitted from home, Peterborough district hospital	Patient living at home, in care or dead, 1 year after injury	Logistic Hierarchical log-lin	Sex, living alone, age, mobility, health state (ASA), mental state. (mental state not included in log-lin).	Logistic: Probability of not being discharged home (death or in care in 1 year) increased with age, impaired mobility, low ASA or mental state score. Log-linear: mobility, ASA and age.
Picone et al (2003)	US, 1984, 1989, 1994 rounds of NLTC survey, Medicare hip fracture, CHD, stroke, congestive heart failure patients admitted from home. 4608 patients	LoS and discharge home, nursing facility, home health agency, dead	Competing risk duration model los	Age, gender, income, insurance, cognitive function, diagnosis, ADL, number children, race, married; area income, population density, rehab and SNF beds per 10000	Age, lower income, ADLs, unmarried, no children, SNF beds, fewer rehab beds, lower area income, lower SNF prices, reduce hazard rate of discharge to home
Victor et al (2000)	456 patients 75+ admitted to 4 hospitals from home, discharged from specialist elderly care wards	Discharge delay of 3+ days	Logistic	Age, gender, family carer, living alone, medical conditions.	Living alone, no family carer increased delay. Significant differences across hospitals. Supply of residential/nursing home beds similar across hospital
Wong et al (2010)	Netherlands. 262,439 patients living at home, discharged in 2005, 65+, alive in 2006	Discharge to home vs to home with home care, nursing home, elderly home.	Conditional logit. Diagnoses as dummy variables.	Age, gender, living with spouse or child, LoS, diagnoses.	Type of disease, age, female, female spouse, LoS was main predictors of long term care discharge

Notes. ADLs: activities of daily living; LA: local authority; RE: random effects; IMD: Index of Multiple Deprivation; NLTC: National Long Term Care survey; CHD: coronary heart disease; SNF: skilled nursing facility; LoS: length of stay.

2. Data and methods

2.1. Sample

We use cross-section administrative data from Hospital Episodes Statistics (HES). Our sample includes all patients who were aged 65 or over, resident in England, treated in NHS hospitals, admitted from home as an emergency with a primary diagnosis of hip fracture or stroke, and who were discharged in the financial year 2008/9. Patients who died in hospital, were discharged to a penal institution or to a secure psychiatric unit, or for whom final discharge destination is not known, were excluded from the analysis. We also dropped patients treated at a Hospital Trust with less than 10 hip fracture and stroke patients per year and we only include the first spell if the patient had two or more spells with hip fracture or stroke.

There were 33,082 and 59,316 emergency admissions where part of the spell was in 2008/9 for patients whose primary diagnosis was hip fracture and stroke. Of these cases respectively 11,113 and 26,211 were excluded from the analysis because: the patient died in-hospital (4,253 for hip fracture and 15,501 for stroke), the hospital spell was incomplete (2,080 for hip fracture and 2,518 for stroke), the patient was discharged elsewhere than to usual residence or care home (1,595 for hip fracture and 3,211 for stroke), was admitted from elsewhere than usual residence (1,910 for hip fracture and 2,437 for stroke), had a repeat emergency admission (376 for hip fracture and 1,194 for stroke), was treated in a hospital with 10 or fewer cases in 2008/9 (46 for hip fracture and 60 for stroke). We also excluded cases with very long length of stay, i.e. the logarithm of the length of stay was more than three standard deviations above the mean (205 for hip fracture), and cases with missing data (658 for hip fracture and 1294 for stroke). The final sample had 21,959 hip fracture patients and 33,101 stroke patients.

2.2. Individual patient characteristics

For each patient we have information about age, gender, number of diagnoses, number of procedures, whether the patient was transferred to a different provider during their hospitalisation and the discharge day of the week. Information from the HES diagnostic fields was used to construct three co-morbidity dummy variables based on the Charlson index which is a good predictor of patient's risk of mortality (Charlson, et al, 1987). The three variables distinguish between (i) no Charlson co-morbidities, (ii) a single non-severe co-morbidity, (iii) at least one severe or at least two non-severe co-morbidities. Since stroke is one of the Charlson co-morbidities we exclude it when constructing these variables for stroke patients. For hip fracture patients we create dummy variables to distinguish between pertrochanteric, subtrochanteric, and unspecified hip fracture to account for the different case-mix of the patients. For stroke patients we distinguish between cerebral infarction, haemorrhage, unspecified stroke, occlusion, and other stroke.

2.3. Dependent variables

Our dependent variables are the patient's hospital length of stay and whether the patient is discharged to a long-term care institution as opposed to returning home following hospitalisation. Patients were coded as being discharged to their home if their HES discharge destination field indicated discharge to usual residence (disdest = 19) or temporary residence (disdest = 29). Patients were coded as discharged to a long-term care facility if their destination was an NHS-run nursing home, a residential home or group home (disdest = 54), a local authority care home (disdest = 69) or non-NHS (other than local authority) residential care home (disdest = 85). Patient length of stay was computed as the number of days between admission and discharge from hospital at the end of their spell. The definition of the spell allowed for patients being transferred between hospitals (see Appendix for more details).

2.4. Accessibility of formal long-term care

To measure long-term care beds, prices and quality, we use data provided by Laing and Buisson (Laing and Buisson, 2010) on residential and nursing care homes in England. The data includes, for each long-term care provider, the number of registered beds, prices of different types of rooms, and the quality rating by the Care Quality Commission (CQC). The data also distinguish the different groups of patients the provider primarily caters for.[1] We use data on care homes whose primary client group is old age or dementia. We exclude homes with other primary client categories because they are not relevant for patients with stroke or hip fracture.

The accessibility of long term care depends both on the supply of beds and on their price. We measure supply for patients by the number of beds in residential and nursing homes in an area around the patient's small area of residence. A higher bed supply, at given prices, implies a shorter waiting time, making access easier and increasing the probability of being discharged to a nursing or residential home. A higher supply of long term care should also imply a shorter hospital length of stay since patients will have shorter waits for a place in a nursing or residential home. By contrast, a smaller supply of long term care will mean that the patient remains longer in the hospital while searching for a place.

Although hospital care is free to patients, long term care is not, though some patients with low income may in part or in full be subsidised by the local authority in which they reside. We measure the average price charged by the nursing and residential homes in an area around the patient's small area of residence. Higher prices, at given supply and quality, should be associated with a lower probability of the patient opting for a nursing or residential home as opposed to returning to their own home, and possibly a longer search process which will lead to a longer hospital length of stay. The quality of care provided by the nursing/residential homes may also play a role in deciding whether the patient returns home or goes to a facility. We proxy quality through an aggregate quality rating produced by the Care Quality Commission which acts as the sector regulator.

HES records the patient's Lower Super Output Area (LSOA) of residence. There are 32482 LSOAs in England with an average population of 1500. We measure the supply of long-term care beds available to a patient as the total number of registered beds in long-term care facilities within 10km of the centroid of the patient's LSOA of residence.

For each long-term care provider, we have information on the minimum and maximum price charged by type of room (single or shared) and type of care (nursing or non-nursing). We compute the average price for each facility and calculate the average price for care homes within 10km of each LSOA centroid. 1682 long term care facilities included in the sample (14%) did not report any price and so we imputed to them the average price for care providers in the same quintile of beds supply. We measured the average quality of care homes within 10km by assigning numerical values 1 to 4 to the CQC quality rating categories (poor, adequate, good, and excellent). We used the same strategy as for missing price data to impute quality rating for the 1953 care providers without quality information (16.5%).

We also had a local authority level measure of the number of people receiving local authority community based care in the financial year 2009/10. This was constructed as the sum of individuals receiving at least one of the following services: home care, day care, meals on wheels, short term

[1] Patients are divided into ten groups: alcohol dependence, drug dependence, dementia, mental health (eating disorders), brain injury rehabilitation, old age (65 and over), learning disability, mental health, physical disability, sensory impairment and terminally ill. The "primary client" of each facility is the patient group for which the largest number of beds is registered.

residential care (not respite), existing or new recipients of direct payments and personal budgets, professional support, equipment or adaptation or other community based services.

Since areas with higher availability of long-term care supply are also characterised by higher population, we compute the population of retirement age (60 years and over for women; 65 years and over for men) living in LSOAs whose centroids were within 10km of the patient's LSOA centroid in mid 2008.

2.5. Socioeconomic characteristics

To control for differences in socioeconomic status, we attribute socioeconomic variables from the 2001 Census and the 2004 Index of Multiple Deprivation to patients by their LSOA of residence. These include the proportions of non-white residents, households with a single pensioner, and those reporting self assessed health as not good. We measure income deprivation as the proportion of the LSOA's population aged over 60 who were claiming income support or job seekers allowance. LSOAs are classified as urban, town or village. We include a dummy variable for patients resident in a London LSOA to allow for unobserved peculiarities of health and long-term care provision. Because of lack of information on Scottish or Welsh long term care we also include dummy variables indicating whether patients were resident in an LSOA within 10km of the English border with Scotland or Wales.

2.6. Methods

2.6.1 Modelling strategy

To investigate the determinants of the probability of the patient being discharged to a nursing or residential care home as opposed to the patient's home, we estimated multiple regression linear probability models. The models were estimated separately for hip fracture and stroke patients.

To allow for possible non-linearities in the effects of long-term care beds on patient's length of stay and probability of being discharged to a care home, we split the beds variable into five quintile categories, with the baseline being the lowest quintile, using the national distribution of LSOAs. We also use quintiles for the long term care price.

We estimated ordinary least squares (OLS) models for the length of stay, and, as the length of stay in days is right skewed (see Figures 1, 2), we use the natural logarithm of length of stay as the dependent variable. The models were estimated separately for patients discharged to their home and for patients discharged to a care home. This is because we expect higher availability of long-term care to reduce length of stay of those being discharged to a care home but to have either no effect or a positive effect on patient's length of stay of patients discharged home. The models were estimated separately for hip fracture and stroke patients.

In both the discharge destination and length-of-stay regressions, our preferred specification includes hospital fixed effects to allow for unobserved factors common to patients admitted to a hospital. For example, hospitals may systematically differ in the protocols used to discharge patients. Or they may be better or worse at treating patients. Or, since patients will be admitted to one of their local hospitals, there may be some factors common to patients within the hospital that we have not captured in our small area socio-economic variables. There might be something about the large area where the hospital is located which has an effect on the supply of long term care. When the fixed effects are included, the coefficients on supply show whether, within the same hospital, patients residing in LSOAs with a higher availability of long-term care supply have shorter length of stay and higher probability of being discharged to a care home.

2.6.2 Sensitivity tests

In addition to comparing models with and without hospital fixed effects, we tested the sensitivity of our results to different estimation methods and to different specifications of the effects of variables on discharge destination and length of stay.

For the discharge destination models we estimate logit and probit models. Unlike the linear probability models they have the advantage of constraining predicted probabilities to be between 0 and 1. However, expressing results as the effects of variables on the probability of discharge to a care home is less straightforward than for the linear probability models, and in the case of the logistic regression with fixed effects it is not possible to estimate marginal effects on the probability of discharge to a care home.

We also estimated models with hospital random effects or with no hospital effects. The estimated coefficients from these models estimate the effect of supply by combining both the variation of long term care supply across hospitals and within hospitals. If the average level of supply across LSOAs of a hospital's patients is not correlated with unobserved factors affecting length of stay or discharge destination the estimates from random effects models will be more precise than models with fixed effects.

To allow for the possibility that patients who are discharged to care differ from those discharged to their home in unobserved ways which affect their length of stay we estimated length of stay models using the Heckman selection correction. This allows for biases arising from unobserved factors which affect discharge destination and length of stay though it requires stricter assumptions than in our baseline models. We also estimated Cox proportional hazard models for length of stay which imposes fewer assumptions than the simple linear model.

It is plausible that long-term care supply and price have different effects on the probability of discharge to a care home and length of stay for better and worse off patients. For example, patients with low income or few assets are more likely to have their care funded by their local authority and therefore to be less affected by care home charges. We therefore estimated models to test for such differential effects by interacting a measure of income deprivation (the percentage of people in the patient's LSOA aged 60 or more and on income support) with the supply and price variables.

We varied the way in which some variables were entered in the regressions. We calculated measures of long-term care supply (beds, price and quality) using patient catchment areas of 20km and 30km from the patient's LSOA of residence (instead of 10 km). We also estimated models with continuous measures of the long-term care variables but allowing for a non-linear effect by also including the square of the long-term care variables. We also estimated models with bed supply defined as beds per capita, rather than entering beds and population separately as in the main models.

We also experimented with adding a measure of the number of people in a local authority who were receiving various forms of local authority community care. This variable was measured at local authority and was attributed to hospital patients by their LSOA of residence.

The results for the sensitivity analyses are reported in Appendix B.

3. Results

3.1. Summary statistics

Figures 1 and 2 show the distributions of the length of stay for hip and stroke patients. It can be seen that although the distribution of length of stay measured in days is highly skewed the distribution of the natural logarithm of the length of stay is much less skewed for hip fracture patients and for stroke patients discharged to a care home. The distribution of the logarithm of the length of stay for stroke patients discharged to their own home is still right skewed.

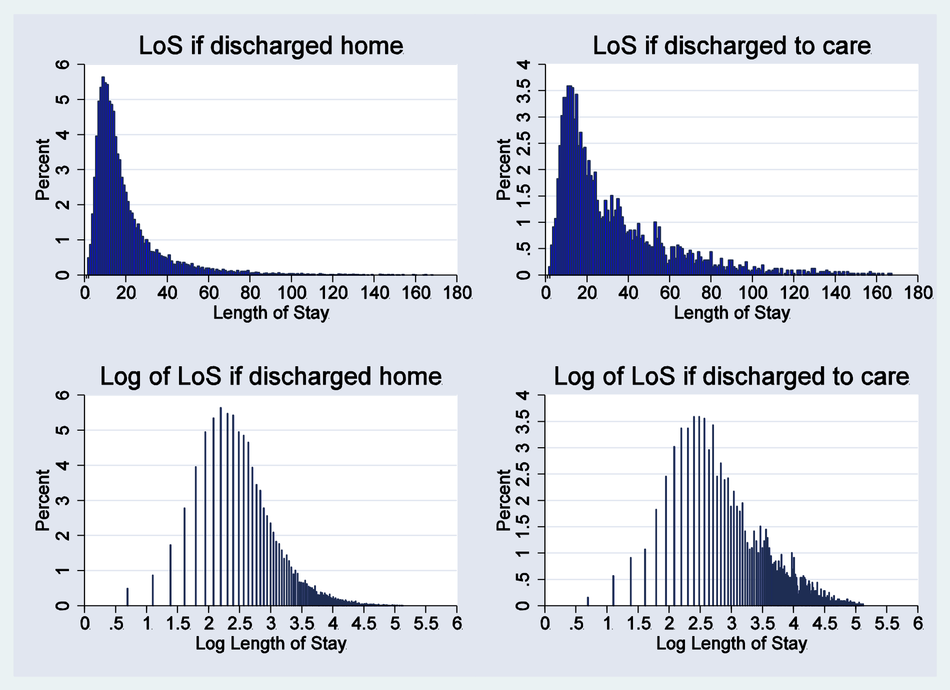

Figure 1. Distribution of length of stay: hip fracture patients

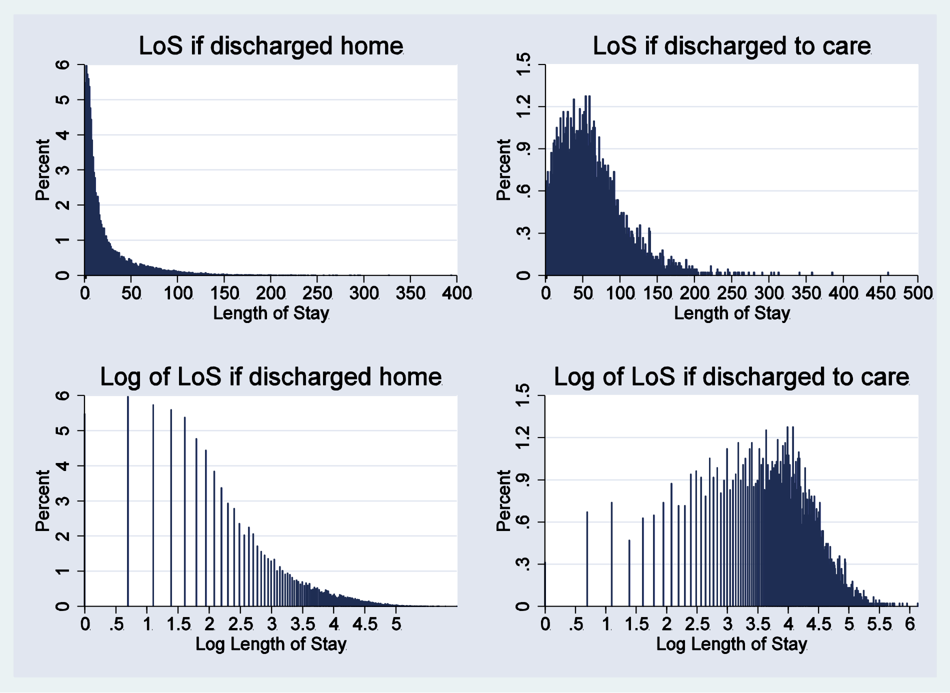

Figure 2. Distribution of length of stay: stroke patients

Table 2 provides descriptive statistics for patients with hip fracture and stroke. The proportion of patients discharged to a long-term care institution is similar: 14% for hip fracture and 13% for stroke patients. The average hospital length of stay is shorter for hip fracture (22 days) than stroke (29 days). Length of stay is shorter for patients returning home (20 days for hip fracture and 23 for stroke) than for those discharged to a care home (33 days for hip fracture and 62 for stroke).

Table 2. Hip fracture and stroke patients: summary statistics 2008/9

	Hip Fracture				**Stroke**			
Variable	mean	sd	min	max	mean	sd	min	max
Discharged to care home	0.145	0.352	0	1	0.135	0.342	0	1
Length of stay	21.79	20.18	2	168	28.60	34.97	1	460
Length of stay if discharged into care home	32.68	27.98	2	167	62.07	44.16	1	460
Length of stay if discharged home	19.95	17.90	2	168	23.38	30.13	1	394
Age group: 65-74	0.166	0.372	0	1	0.299	0.458	0	1
Age group: 75-84	0.409	0.492	0	1	0.429	0.495	0	1
Age group: 85plus	0.425	0.494	0	1	0.271	0.445	0	1
Male patient	0.223	0.416	0	1	0.466	0.499	0	1
Total diagnoses	5.713	2.919	1	39	6.234	3.511	1	32
Total procedures	2.818	1.546	0	24	2.671	1.786	0	22
Patient transferred in CIPS	0.049	0.217	0	1	0.137	0.343	0	1
Pertrochanteric fracture	0.228	0.420	0	1	N/A	N/A	N/A	N/A
Subtrochanteric fracture	0.029	0.167	0	1	N/A	N/A	N/A	N/A
Unspecified hip fracture	0.743	0.437	0	1	N/A	N/A	N/A	N/A
Stroke caused by a haemorrhage	N/A	N/A	N/A	N/A	0.137	0.344	0	1
Stroke caused by an infarction	N/A	N/A	N/A	N/A	0.615	0.487	0	1
Stroke not haemorrhage or infarction	N/A	N/A	N/A	N/A	0.213	0.410	0	1
Occluded cerebral vessels no infarction	N/A	N/A	N/A	N/A	0.003	0.051	0	1
Other stroke	N/A	N/A	N/A	N/A	0.032	0.176	0	1
No Charlson comorbidities	0.493	0.500	0	1	0.515	0.500	0	1
1 minor Charlson comorbidity	0.334	0.472	0	1	0.266	0.442	0	1
≥2 minor or≥1 major Charlson comorbidity	0.172	0.378	0	1	0.218	0.413	0	1
Discharged on Monday	0.152	0.359	0	1	0.174	0.379	0	1
Discharged on Tuesday	0.191	0.393	0	1	0.186	0.389	0	1
Discharged on Wednesday	0.190	0.392	0	1	0.185	0.388	0	1
Discharged on Thursday	0.180	0.385	0	1	0.180	0.385	0	1
Discharged on Friday	0.209	0.406	0	1	0.216	0.411	0	1
Discharged on Saturday	0.052	0.223	0	1	0.044	0.204	0	1
Discharged on Sunday	0.017	0.131	0	1	0.015	0.122	0	1
Care home beds within 10km (000s)	2.31	1.79	0	7.81	2.41	1.92	0	7.82
Care home beds within 20km	7.00	5.33	0.019	26.04	7.21	5.66	0.02	26.10
Care home beds within 30km	12.98	8.910	3.07	38.24	13.21	9.36	0.02	38.21
Beds within 10km/retired population	0.037	0.010	0	0.116	0.037	0.010	0	0.116
Average price within 10km	523.21	93.05	232	971	525.25	91.49	232	961
Average price within 20km	521.85	84.29	336	792	524.44	84.07	383	808

Average price within 30km	521.98	77.38	395	735	524.39	76.82	395	734
Average care home rating within 10km	3.03	0.17	1	4	3.03	0.17	1	4
Population receiving LA community care (000ss)	10.34	7.03	0	27.09	10.16	6.81	0	27.09
Total retired population within 10km (000s)	67.2	62.1	0.5	328.7	70.9	67.1	348	328.2
% LSOA 60+ pop on income based benefit	19.65	11.81	1.0	95.0	19.81	12.31	1.0	95.0
% LSOA pop who are non white	6.21	11.20	0	90.45	7.09	13.00	0	94.8
% LSOA pop with good SAH	67.13	6.51	37.3	87.6	67.22	6.34	37.3	87.0
% LSOA pop with fairly good SAH	23.03	3.47	10.4	36.1	23.07	3.41	10.7	37.3
% LSOA pop with not good SAH	9.84	3.62	1.7	31.0	9.71	3.51	1.7	31.0
% single pensioner households in LSOA	16.09	6.01	0.5	51.0	15.92	6.00	0.0	51.0
Patient resident in London	0.089	0.284	0	1	0.103	0.304	0	1
LSOA within 10km of Scottish border	0.001	0.026	0	1	0.001	0.029	0	1
LSOA within 10km of Welsh border	0.012	0.109	0	1	0.015	0.121	0	1
Urban > 10k people	0.791	0.407	0	1	0.788	0.409	0	1
Town and fringe	0.111	0.314	0	1	0.114	0.318	0	1
Village or hamlet and isolated dwellings	0.098	0.297	0	1	0.098	0.297	0	1
Number of patients	21959				33101			

Note: emergency patients with spell finishing in 2008/9, resident at home, admitted as emergency, discharged to home or to care home.

Though hip fracture patients are more likely to be women (78%), there is little difference for stroke where 53% are female. Hip fracture and stroke patients are on average aged 82 and 79. Both types of patient have, on average, six diagnoses and three procedures. The majority of hip fracture patients (74%) were not diagnosed with a specific type of fracture. A petrochanteric fracture was diagnosed in 23% of cases and a subtrochanteric fracture in 3% of cases. The most frequent cause of stroke is infarction (62%) with 14% specified as a haemorrhage.

Stroke is one of the diagnoses included in the Charlson comorbidity index for hip fracture patients but it is excluded for the index for stroke patients. Around 50% of both samples have no other Charlson comorbidities. Stroke patients are more likely to be transferred to another hospital during their spell (14% compared to 5%). Fewer patients are discharged on a Saturday or a Sunday than on other day of the week.

There is little difference between for hip fracture and stroke patients in average long term care provision within 10km: there are on average 2300 beds (for hip fracture) and 2400 beds (for stroke) within 10km; the average price is £523 (for hip fracture) and £525 (for stroke) per week, and the average care home quality rating is three, which is equivalent to 'good'. Patients with hip fracture or stroke are less likely to be resident in LSOAs in the highest quintile of the national distribution of beds within 10km (only 14-16% of the patients are resident in LSOAs in the highest quintile of the national distribution).

Hip fracture and stroke patients were resident in LSOAs with similar levels of income deprivation, self assessed health, and single pensioner households. Compared to hip fracture patients, stroke patients lived in LSOAs with a higher percentage of non-white residents (7.1% versus 6.2%) and more likely to live in London (10.3% vs 8.9%).

3.2. Discharge Destination

Table 3 reports the results from linear probability models of discharge destination for hip fracture and stroke. The discussion of the results focuses on our preferred specification when hospitals' fixed effects are included. We then briefly compare them to the results from models with no hospital fixed effects.

Table 3. Determinants of discharge to care home

	Hip Fracture				Stroke			
	OLS		OLS FE		OLS		OLS FE	
Variable	b	p	b	p	b	p	b	p
Age 75-84	0.060	0.000	0.062	0.000	0.056	0.000	0.054	0.000
Age 85plus	0.113	0.000	0.114	0.000	0.130	0.000	0.125	0.000
Male	-0.017	0.002	-0.016	0.003	-0.044	0.000	-0.043	0.000
Number diagnoses	0.011	0.000	0.011	0.000	0.016	0.000	0.018	0.000
Number procedures	0.003	0.056	0.005	0.002	0.003	0.002	0.002	0.042
Patient transferred	0.004	0.736	0.005	0.669	0.023	0.000	0.029	0.000
Pertrochanteric fracture	-0.002	0.781	0.000	0.936				
Subtrochanteric fracture	0.012	0.378	0.004	0.761				
Stroke caused by a haemorrhage					0.015	0.008	0.014	0.013
Stroke haemorrhage or infarction					-0.016	0.001	-0.019	0.000
Occluded cerebral no infarction					0.003	0.934	0.009	0.793
Other stroke					-0.073	0.000	-0.074	0.000
1 minor Charlson comorbidity	0.025	0.000	0.031	0.000	0.006	0.209	0.002	0.623
≥2 minor/≥1 major Charlson comorbidity	0.017	0.020	0.019	0.010	0.001	0.896	-0.001	0.913
LSOA 5th income depriv quintile	-0.003	0.738	-0.013	0.098	-0.006	0.362	-0.012	0.054
% LSOA pop non white	0.000	0.364	0.000	0.496	0.000	0.238	0.000	0.310
% LSOA not good SAH	-0.001	0.306	0.000	0.707	0.003	0.001	0.004	0.000
% LSOA single pensioner h'hold	0.001	0.120	0.001	0.208	0.000	0.227	-0.001	0.051
London LSOA	-0.047	0.001	-0.031	0.209	0.008	0.462	-0.027	0.220
LSOA 10km of Scottish border	0.103	0.249	-0.012	0.888	-0.064	0.305	-0.069	0.274
LSOA 10km of Welsh border	0.081	0.000	-0.003	0.910	0.020	0.183	0.024	0.203
Town and fringe	-0.012	0.151	-0.007	0.372	-0.006	0.371	-0.003	0.598
Village, hamlet, isolated dwellings	-0.011	0.203	-0.011	0.208	-0.006	0.405	-0.004	0.594
Beds within 10km second quintile	0.024	0.002	0.009	0.314	0.016	0.007	0.002	0.755
Beds within 10km third quintile	0.041	0.000	0.021	0.078	0.008	0.246	0.012	0.203
Beds within 10km fourth quintile	0.026	0.027	0.025	0.118	0.042	0.000	0.018	0.140
Beds within 10km top quintile	0.047	0.011	0.041	0.090	0.036	0.012	0.014	0.435
Price within 10km second quintile	0.037	0.000	-0.010	0.271	-0.001	0.814	0.002	0.797
Price within 10km third quintile	0.039	0.000	-0.012	0.299	0.001	0.808	0.011	0.207
Price within 10km fourth quintile	0.032	0.000	0.006	0.682	0.006	0.362	0.019	0.098
Price within 10km top quintile	0.025	0.012	-0.004	0.804	0.009	0.248	0.020	0.154
Population within 10km (100000s)	0.012	0.294	0.013	0.451	-0.029	0.001	0.011	0.394
Care home ratings 10km mean	-0.001	0.969	-0.005	0.780	-0.023	0.039	0.001	0.927
Constant	-0.061	0.178	-0.021	0.730	0.034	0.339	-0.063	0.173
Hospital fixed effects	NO		YES		NO		YES	
R^2	0.034		0.029		0.071		0.068	
Observations								

Notes. Patients resident at home admitted as emergency patients with spell ending in 2008/9.

3.2.1 Hip fracture

The probability of being discharged to a care home is greater for patients who are older, female, and have more diagnoses. Patients who are 75-84 years old and are older than 85 years have 6.2 and

11.4 percentage points higher probabilities of being discharged to a care home. Men have a 1.6 percentage points smaller probability of being discharged to a care home. Patients with more procedures and secondary diagnoses have a higher probability of being discharged to care. An additional diagnosis and procedure increases the probability by 1 and 0.5 percentage points. Patients with Charlson comorbidities have 1-2 percentage points higher probabilities of being discharged to a care home. Patients in the fifth most income deprived quintile have 1.3 percentage points lower probability (though this is statistically significant only at 10% level).

Patients living in LSOAs with greater supply of care home beds within 10km from their residence are generally more likely to be discharged to a care home. Compared to patients in LSOAs in the lowest quintile of beds within 10km, the probability of being discharged to care for patients in LSOAs in the third, fourth and fifth beds quintiles was 2, 2.5, and 4 percentage points higher (though this is statistically significant at 10% level for the third and fifth quintile only, with a p-value of 0.12 on the coefficient on the fourth quintile). The price of care homes or the quality rating of care homes has no effect on the probability of being discharged to a care home.

When hospitals' fixed effects are not included, higher availability of long-term care is positively associated with the probability of being discharged to care for both hip fracture and stroke patients. The coefficients are generally quantitatively larger compared to the fixed effects specification. This stronger beds gradient is generated by variations of beds across hospitals rather than within hospitals. The inclusion of hospitals' fixed effects removes any effect that is due to systematic differences in long-term care beds availability across hospitals. The results therefore suggest that hospitals with higher availability of long-term beds are characterised by patients with a higher probability of being discharged to care.

With no hospital fixed effects, hip fracture patients in the higher quintiles have generally a higher probability of being discharged to care compared to those in the lowest price quintile. This is counter-intuitive since we would expect higher prices to deter access to care homes. We prefer specifications with hospital fixed effects because they test for associations between prices and discharge destination across patients in each hospital who are more likely to be homogenous with respect to unobserved factors. Taking the result at face value, it is possible explanation is that price is correlated with quality, with care homes with lowest prices also providing lowest quality of care that patients would try to avoid. We measure quality by CQC ratings but these are aggregated measures and there may be other dimensions of quality that remain unobservable.

3.2.2 Stroke

Patients who are 75-84 years old and are older than 85 years have respectively a 5.4 and 13 percentage points higher probability of being discharged to a care home. Men have a 4 percentage points smaller probability of being discharged to a care home. An additional diagnosis and procedure increase the probability by respectively 1.8 and 0.2 percentage points. Patients who were transferred to a different hospital have a 3 percentage points higher probability. Compared to patients whose stroke is caused by cerebral infarction, the probability of discharge to care is 1.4 percentage points higher if stroke is caused by haemorrhage. It is 2 percentage points smaller when the stroke is unspecified and 1 percentage point smaller if other forms of stroke are diagnosed but unspecified. Charlson comorbidities do not have an effect on the probability of being discharged to care. Patients in the fifth most income deprived quintile have a probability of being discharged to a care home which is 1.2 percentage points smaller.

Greater accessibility of long term care, either in terms of greater beds supply or lower price, is not associated with the probability of being discharged to care. Unlike hip fracture patients, the probability of stroke patients being discharged to care does not seem to respond to supply variables and seems to be driven only by clinical factors.

When hospital fixed effects are excluded from the linear probability model the availability of beds is generally positively associated with probability of being discharged to care (with statistically significant coefficients at the 5% level for three of the four beds quintiles). The price is still not significantly associated with probability of being discharged to care in models without hospital fixed effects.

3.3. Length of Stay

3.3.1 Hip fracture

Table 4 reports results from the model of length of stay for hip fracture patients. Since length of stay, our key dependent variable, is transformed with the natural logarithm, coefficients can be interpreted as the proportionate change in length of stay in days from a one unit increase in the explanatory variable.[2]

Older patients have longer length of stay. Among patients discharged to care, patients who are 75-84 years old and older than 85 years have respectively 6.5% and 12% longer stays. For patients discharged home, older patients stay respectively 21% and 32% longer. Male patients have 6% longer length of stay if they are discharged to care. There are no differences by gender for patients discharged home. Patients stay longer in hospital if they have more procedures, irrespective of their discharge destination. An additional procedure increases length of stay by 8%. One additional diagnosis increases length of stay by 6.7% for patients discharged to care but there is no effect on patients discharged home. Patients who are transferred to a different hospital have an 80% longer length of stay. Surprisingly, patients with Charlson comorbidities have a shorter length of stay. Patients living in villages and sparsely populated areas have 10% (5%) shorter stays than those living in urban areas if they are discharged to care (home). Patients from the fifth most income deprived quintile have 7.5% longer length of stay when the patient is discharged home. Patients have generally a longer stay if they are discharged on a Monday than any other day of the week. This is likely to be due to the smaller probability of being discharged during the weekend.

The accessibility of long term care beds affects length of stay for hip fracture patients who are discharged to a care home: patients in LSOAs in higher quintiles of long-term care beds within 10km have shorter hospital lengths of stay. Those in the top two quintiles have a length of stay which is 22% and 32% shorter than those in the bottom beds quintile, a difference is which is both quantitatively large and statistically significant. There is no effect of beds supply on length of stay for patients discharged home.

There is some indication that patients in areas with higher care home prices also stay longer, though the effect of price is only significant at 10% for the two highest price quintiles. Patients in LSOAs in the top price quintiles have longer length of stay by about 16-17% if discharged to care. Thus greater accessibility in terms of lower prices of long term care reduces hospital length of stay. There is a negative association of price and length of stay but only at the second and third quintile if the patient is discharged home. The effect is about 2-3% and therefore substantially smaller in magnitude. Variations in quality of long term care provision, as proxied by quality reports, do not affect length of stay. In summary, the analysis suggests that higher accessibility of long-term care in terms of more beds and lower prices are associated with shorter length of stay.

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[2] The regression model is $\ln y_i = \beta x_i + \varepsilon_i$, so that $y_i = \exp(\beta x_i)\exp(\varepsilon_i)$, $\mathrm{E}\left[y_i \middle| x_i\right] = \exp(\beta x_i)\mathrm{E}(\exp(\varepsilon_i))$, and

$\left\{\partial \mathrm{E}\left[y_i \middle| x_i\right] / \partial x_i\right\} / \mathrm{E}\left[y_i \middle| x_i\right] = \beta$.

Table 4. Determinants of length of stay: hip fracture patients

	Discharged to care				Discharged to home			
	OLS		OLS FE		OLS		OLS FE	
Variable	b	p	b	p	b	p	b	p
Age 75-84	0.075	0.073	0.065	0.174	0.219	0.000	0.209	0.000
Age 85plus	0.146	0.001	0.120	0.011	0.332	0.000	0.315	0.000
Male	0.046	0.159	0.067	0.027	0.011	0.357	0.008	0.428
Number diagnoses	0.085	0.000	0.089	0.000	0.075	0.000	0.081	0.000
Number procedures	0.074	0.000	0.077	0.000	0.076	0.000	0.080	0.000
Patient transferred	0.819	0.000	0.855	0.000	0.860	0.000	0.870	0.000
Pertrochanteric fracture	-0.068	0.042	-0.036	0.220	-0.012	0.425	-0.005	0.609
Subtrochanteric fracture	-0.029	0.706	0.035	0.612	0.091	0.003	0.117	0.000
1 minor Charlson comorbidity	0.046	0.167	0.009	0.746	-0.044	0.001	-0.039	0.000
≥2 minor/ ≥1 major Charlson	-0.103	0.008	-0.136	0.000	-0.073	0.000	-0.074	0.000
LSOA 5th income depriv quintile	-0.014	0.770	0.023	0.580	0.092	0.000	0.075	0.000
% LSOA pop non white	0.002	0.270	0.000	0.821	0.000	0.980	0.001	0.132
% LSOA not good SAH	-0.004	0.604	-0.006	0.284	-0.008	0.027	-0.008	0.000
% LSOA households single	-0.004	0.220	-0.002	0.332	0.004	0.005	0.005	0.000
London LSOA	-0.057	0.685	-0.185	0.208	0.053	0.572	-0.018	0.689
LSOA 10km of Scottish border	0.184	0.007	0.448	0.251	-0.045	0.507	0.099	0.560
LSOA 10km of Welsh border	-0.057	0.520	-0.224	0.071	-0.079	0.536	-0.140	0.006
Town and fringe	0.013	0.786	0.009	0.848	-0.001	0.946	0.000	0.989
Village, hamlet isolated dwellings	-0.126	0.014	-0.105	0.035	-0.060	0.004	-0.048	0.003
Beds within 10km second quintile	-0.056	0.318	-0.049	0.298	0.027	0.247	-0.012	0.441
Beds within 10km third quintile	-0.044	0.558	-0.064	0.310	0.043	0.228	0.011	0.597
Beds within 10km fourth quintile	-0.122	0.222	-0.216	0.017	0.109	0.025	0.007	0.817
Beds within 10km top quintile	-0.222	0.124	-0.319	0.014	0.072	0.222	-0.022	0.631
Price within 10km second quintile	0.041	0.419	-0.014	0.775	0.021	0.510	-0.030	0.090
Price within 10km third quintile	-0.009	0.889	0.006	0.921	-0.027	0.470	-0.044	0.039
Price within 10km fourth quintile	0.099	0.217	0.162	0.049	-0.014	0.770	-0.031	0.252
Price within 10km top quintile	0.052	0.629	0.175	0.082	-0.023	0.656	-0.010	0.761
Population within 10km (100000s)	0.086	0.336	0.230	0.020	0.020	0.639	0.048	0.130
Care home ratings 10km mean	0.099	0.473	0.127	0.262	-0.002	0.975	0.030	0.392
Discharged on Tuesday	-0.126	0.005	-0.087	0.035	-0.087	0.000	-0.076	0.000
Discharged on Wednesday	-0.212	0.000	-0.175	0.000	-0.088	0.000	-0.082	0.000
Discharged on Thursday	-0.129	0.001	-0.110	0.006	-0.084	0.000	-0.086	0.000
Discharged on Friday	-0.161	0.000	-0.141	0.001	-0.118	0.000	-0.116	0.000
Discharged on Saturday	-0.184	0.001	-0.154	0.011	-0.190	0.000	-0.189	0.000
Discharged on Sunday	-0.223	0.039	-0.197	0.042	-0.156	0.000	-0.135	0.000
Constant	2.167	0.000	1.977	0.000	1.885	0.000	1.782	0.000
Hospital fixed effect included	NO		YES		NO		YES	
R^2	0.294		0.305		0.301		0.311	
Observations	3175		3175.		18784		18784.	

Notes. OLS regressions; dependent variable: natural logarithm of the length of stay. Coefficients are the proportionate change in length of stay in days from a one unit increase in the explanatory variable.

The analysis relies critically on the inclusion of hospital fixed effects. When these are excluded, beds and price are never statistically significant as 10% level. This is in contrast to the clinical variables which are qualitatively unaffected.

3.3.2 Stroke

Table 5 reports results for the length of stay for stroke patients. Among patients discharged to care, patients who are 75-84 years old and older than 85 years have respectively a shorter length of stay by 7.3% and 22% longer stay. In contrast, among patients discharged home, length of stay increases with age (respectively 16% and 32% longer for patients who are 75-84 years old and older than 85 years). Male patients have a longer stay if they are discharged to care (by 2%) and a shorter stay if discharged home (by 15%). Patients stay longer in hospital if they have more diagnoses and procedures, irrespective of their discharge destination. An additional procedure increases length of stay by respectively 5% and 10% if discharged to care and to home. One additional diagnosis increases length of stay by respectively 7% and 12% for patients discharged to care and discharged home. Transferred patients have a longer length of stay of 51% if discharged to care and of 90% if discharged home. As with hip fracture cases, patients with Charlson comorbidities have a shorter length of stay by respectively 12% and 7% if discharged to care and discharged to home. Patients living in villages or remote areas have similar length of stay to those living in urban areas if they are discharged to care. Patients from the fifth most income deprived quintile have 4.3% longer length of stay when the patient is discharged home. Compared to patients whose stroke is caused by cerebral infarction, length of stay is shorter when the cause of stroke is unspecified, by 8% when the patient is discharged to care and 20% when discharged home. It is 50% and 67% shorter if other forms of stroke are diagnosed but unspecified. Patients have a longer length of stay if discharged on a Monday.

Among patients discharged to care, there is a clear gradient in the effect of long term care beds supply with those in higher quintiles having shorter lengths of stay. Patients residing in LSOAs in the top beds quintile have a length of stay which is 20% shorter than those in the bottom beds quintile. However, the effects are only statistically significant at 10% for the highest beds quintile.

Greater long term care beds availability also reduces length of stay also for stroke patients discharged home with a coefficient of 21% at the highest quintile. This is, on the face of it, surprising since we would not expect beds supply to affect hospital length of stay of patients discharged home. Note, however, that since the length of stay for patients discharged to care is about three times the length of stay of those discharged home, a 20% effect on the first group implies a much larger effect in terms of reduced number of days in hospital than for the second group.

Variations in prices and quality reports do not generally have an effect on length of stay for stroke patients, whether they are discharged home or to a care home.

Again, hospital fixed effects play an important role. When these are excluded the beds and price variables are never statistically significant as 10% level, while the clinical variables remain qualitatively unaffected.

3.4. Sensitivity analyses

The detailed results from the sensitivity analyses are reported in Appendix B. As with the comparison of the linear models with and without hospital fixed effects, we find that the results on the association of demographic and clinical variables are robust across the alternative specifications.

The estimated associations between beds supply and prices and discharge destination and length of stay are more sensitive to alternative specifications but our main results from the linear models with hospital effects reported above continues to hold with other estimation methods.

Table 5. Determinants of length of stay: stroke patients

	Discharged to care				Discharged to home			
	OLS		OLS FE		OLS		OLS FE	
Variable	b	p	b	p	b	p	b	p
Age 75-84	-0.067	0.077	-0.074	0.032	0.162	0.000	0.160	0.000
Age 85plus	-0.232	0.000	-0.225	0.000	0.338	0.000	0.327	0.000
Male	0.033	0.186	0.027	0.263	-0.155	0.000	-0.146	0.000
Number diagnoses	0.058	0.000	0.069	0.000	0.118	0.000	0.129	0.000
Number procedures	0.051	0.000	0.052	0.000	0.094	0.000	0.099	0.000
Patient transferred	0.538	0.000	0.509	0.000	0.862	0.000	0.909	0.000
Stroke caused by a haemorrhage	-0.060	0.073	-0.080	0.011	0.050	0.051	0.026	0.159
Stroke haemorrhage or infarction	-0.014	0.673	-0.087	0.004	-0.155	0.000	-0.202	0.000
Occluded cerebral vessels no infarction	0.004	0.983	0.083	0.715	-0.279	0.022	-0.192	0.100
Other stroke	-0.467	0.000	-0.497	0.000	-0.660	0.000	-0.672	0.000
1 minor Charlson comorbidity	-0.118	0.000	-0.128	0.000	-0.060	0.000	-0.077	0.000
≥2 minor or ≥1 major Charlson comorbidity	-0.188	0.000	-0.207	0.000	-0.030	0.172	-0.045	0.007
LSOA fifth income deprivation quintile	0.019	0.613	0.022	0.570	0.045	0.074	0.043	0.038
% LSOA pop non white	-0.001	0.610	0.001	0.404	0.002	0.057	0.001	0.067
% LSOA not good SAH	-0.010	0.065	-0.013	0.017	0.007	0.101	0.003	0.336
% LSOA households single pensioner	0.004	0.255	0.004	0.137	-0.002	0.208	-0.001	0.350
London LSOA	0.040	0.747	0.179	0.211	0.051	0.634	-0.126	0.073
LSOA within 10km of Scottish border	1.080	0.000	0.860	0.248	-0.034	0.847	-0.008	0.967
LSOA within 10km of Welsh border	0.018	0.778	0.022	0.828	-0.085	0.538	0.002	0.974
Town and fringe	0.054	0.148	0.040	0.312	-0.042	0.067	-0.039	0.058
Village or hamlet and isolated dwellings	0.018	0.724	0.007	0.879	-0.014	0.623	-0.005	0.817
Beds within 10km second quintile	-0.031	0.481	0.020	0.644	0.034	0.333	-0.026	0.250
Beds within 10km third quintile	-0.074	0.317	-0.052	0.376	0.029	0.596	-0.050	0.094
Beds within 10km fourth quintile	-0.036	0.705	-0.061	0.435	0.076	0.298	-0.111	0.007
Beds within 10km top quintile	-0.176	0.193	-0.196	0.091	0.019	0.853	-0.209	0.001
Price within 10km second quintile	0.026	0.688	-0.013	0.787	-0.066	0.220	-0.024	0.336
Price within 10km third quintile	-0.028	0.706	-0.060	0.279	-0.028	0.625	0.018	0.544
Price within 10km fourth quintile	0.056	0.478	-0.046	0.518	0.008	0.909	-0.016	0.667
Price within 10km top quintile	0.012	0.903	-0.051	0.579	-0.076	0.297	-0.032	0.477
Population within 10km (100000s)	0.064	0.418	0.044	0.598	-0.055	0.351	0.184	0.000
Care home ratings within 10km mean	0.079	0.513	0.122	0.215	-0.096	0.240	-0.073	0.125
Discharged on Tuesday	-0.118	0.001	-0.075	0.044	-0.162	0.000	-0.156	0.000
Discharged on Wednesday	-0.106	0.003	-0.080	0.029	-0.176	0.000	-0.170	0.000
Discharged on Thursday	-0.145	0.000	-0.102	0.006	-0.168	0.000	-0.164	0.000
Discharged on Friday	-0.127	0.001	-0.099	0.006	-0.319	0.000	-0.313	0.000
Discharged on Saturday	-0.217	0.000	-0.223	0.000	-0.456	0.000	-0.423	0.000
Discharged on Sunday	-0.255	0.049	-0.203	0.075	-0.690	0.000	-0.675	0.000
Constant	3.222	0.000	3.069	0.000	1.860	0.000	1.678	0.000
Hospital fixed effect	NO		YES		NO		YES	
R^2	0.251		0.253		0.317		0.337	
Observations	4465		4465		28636		28636	

Notes. OLS regressions; dependent variable: natural logarithm of the length of stay. Coefficients are the proportionate change in length of stay in days from a one unit increase in the explanatory variable

4. Discussion

4.1. Discharge destination

The probability of being discharged to a care home following hospitalisation due to hip fracture and stroke depends critically on patients' severity. Very old patients (over 85 years) have about twice the risk of being discharged to a care home compared to those aged 65-74. Measures of severity, such as the type of primary diagnosis and the number of secondary diagnoses and hospital procedures are also quantitatively and statistically significant. The Charlson comorbidity indices are statistically significant (in the expected direction) for hip fracture but not for stroke. The latter may be explained by multicollinearity with the other proxies of severity and the fact stroke is counted as a Charlson comborbidity for hip fracture patients but not for stroke patients.

For both hip fracture and stroke, male patients are less likely to be discharged to care. This may be because men are more likely to have a spouse or a partner who can provide informal long-term care at home since women have longer life expectancy and tend to be younger than their partners (Wilson and Smallwood, 2008).

Patients living in more income-deprived areas have a smaller probability of being discharged to care, despite local authority subsidies for patients with low income or assets. The reduction in the probability is 1.3 percentage points against an average of 13-14% but is statistically significant only at the 10% level.

Among patients admitted to hospital following a hip fracture, those with greater availability of long-term care beds have a higher probability of a patient being discharged to care. The quantitative effect is sizeable. The probability of being discharged to care is 4 percentage points higher at the highest quintile of beds' availability. Given an average probability of being discharged to care of 14%, this is an increase of over a quarter. We find no association of beds supply with the probability of being discharged to care for stroke patients. Price has no significant association with discharge destination for either hip fracture or stroke patients. The results therefore suggest that it is the supply of beds that drives the choice between being admitted to a care home as opposed to returning to their own home, rather than price differences.

4.2. Length of stay

Patient severity is also a key determinant of patients' length of stay. Patients with more secondary diagnoses and procedures, and who were transferred to a different hospital stay significantly longer. The primary diagnosis is also important and systematic differences in length of stay can be detected. Older patients also tend to stay longer if discharged home but not necessarily if discharged to care. Since the sample of patients discharged to care includes patients who have a higher degree of severity, age may not act as a good proxy of severity. The fact that a patient survived up to a very old age may be a proxy of relatively good health and therefore be associated with lower severity as opposed to higher severity.

More income deprived (hip fracture and stroke) patients stay longer in hospitals but only if discharged to home. These results are consistent with those of Cookson and Laudicella (2011) who also report longer stays for more deprived, elective hip-replacement patients. Since poorer individuals are generally in worse health, income deprivation may also act as a residual proxy of poor health which is not captured by the other variables.

Within a given hospital, hip fracture patients who have higher availability of long-term care beds in their area of residence experience a shorter hospital length of stay. The results are consistent with the argument that hospital discharge decisions are constrained by long-term care beds supply. Patients cannot be discharged quickly when a bed in a nursing home is not easily available. Moreover, when prices are high in the long-term care sector patients take more time to search for the appropriate place and this further increases hospital length of stay. Beds and prices play no role in determined patient's length of stay if they are discharged home.

For stroke patients, we find that it is only at the highest quintile that long term care beds reduce hospital length of stay. We do not detect a price effect. The differences in results between stoke and hip fracture may be explained by stroke being a more impairing condition. The demand for long term care for stroke patients may therefore be more inelastic.

In contrast to the results for hip fracture, we find that higher availability of beds also reduces length of stay for patients discharged home, which is unexpected. The effect of long-term care beds availability on length of stay is around 20% for both patients discharged home and to care, and is also identified at lower beds quintiles for patients who are discharged home. Recall however that the average length of stay for patients discharged to care is about double than for those discharged home (62 versus 20 days) and therefore a 20% shorter length of stay translates into a much larger reduction in length of stay for patients discharged to care than those discharged home.

Table 6. Results summary: coefficient on beds and price quintiles

	Hip fracture			***Stroke***		
	Probability of discharge to care home	Length of stay		Probability of discharge to care home	Length of stay	
		Patients discharged to care home	Patients discharged home		Patients discharged to care home	Patients discharged home
Beds quintiles						
Sign	all positive	all negative	2 negative, 2 positive	all positive	1 positive, 3 negative	all negative
Gradient	yes, positive	yes, negative	no	no	no	yes
Statistically significant?	2 at 10%	2 at 5%	none	none	1 negative at 10%	1 at 10%, 2 at 1%
Price quintiles						
Sign	3 negative, 1 positive	1 negative, 3 positive	all negative	all positive	all negative	1 positive, 3 negative
Gradient	no	no	no	yes	no	no
Statistically significant?	no	1 positive at 5%, 1 positive at 10%	1 at 5%, 1 at 10%	no	no	no

Note. Coefficients are from the linear models with hospital fixed effects

5. Concluding remarks

Our results suggest that patients' illness severity plays a key role in determining both the demand for formal long-term care and hospital's length of stay. But economic variables also matter for hip fracture patients. A greater availability of long-term care beds is associated with a higher probability of being discharged to care. Moreover, higher long term care supply and lower prices also are associated with shorter hospital length stay for patients discharged to nursing or care home. The effect can be quantitatively large, and of the order of 20-30% shorter length of stay for patients with most availability (at the highest bed quintiles).

The results are substantially different for patients with stroke who appear less responsive to the availability of care and residential homes: the probability of being discharged to a longer term care provider is not associated with beds availability, and hospital length of stay is not associated with price (in contrast to hip fracture patients). Beds availability only reduces hospital length of stay at the highest quintile for patients discharged to care, and, counter-intuitively also those discharged home (again, in contrast to hip fracture patients). The differences between stoke and hip fracture may be because stroke is a more impairing condition.

In summary, we find evidence consistent with the 'bed-blocking' hypothesis but mainly for hip fracture patients. Hospital care is more expensive than long term care for patients ready to be discharged. The study suggests that for hip fracture patients an expansion of the long-term care sector can reduce hospitals' costs through reductions in length of stay.

However, our study has used cross-sectional data on patients admitted for two conditions so that care must be exercised in drawing policy conclusions. We have found associations between care home beds supply and discharge destination and length of stay for hip fracture patients but, despite the inclusion of a rich set of covariates, we cannot rule out the possibility that the observed association is due to unobserved factors correlated with discharge destination and length of stay and with beds supply. For example, it is possible that areas have more care home beds because of location decisions by care home providers being influenced by the local population's propensity to use care homes.

This research has focussed on two specific conditions, hip fracture and stroke. This approach has the advantage of removing sources of heterogeneity but does not allow testing of the effect of availability of long term care on the hospital sector as a whole. Hospital Episodes Statistics data do not identify which patients have delayed discharges and for what reason: the relevant field in HES is poorly coded. In future work, we will make use of the Monthly Situation Report on Acute and Non-Acute Delayed Transfers of Care. This dataset provides detailed information on total delayed discharges, i.e. patients that were ready to be discharged from the hospital but they were not. We will use this dataset to investigate the determinants of delayed discharges across the hospital sector as a whole using a range of variables which capture the supply of long term care across different local authorities. The dataset is a panel and so may allow us to separate out supply and demand factors more clearly in order to identify the effect of care home accessibility more precisely.

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Appendix A Data

A patient is defined as admitted from home if their admission code is “usual place of residence, including no fixed abode” (admisorc = 19) or admission from a “temporary place of residence when usually resident elsewhere, for example, hotels and residential educational establishments” (admisorc = 29).

Each HES record covers a single finished consultant episode (FCE) during which the patient was continuously under the care of a single consultant (senior hospital doctor). We linked FCEs into continuous inpatient stays (CIPS) to allow for changes of consultant, including those involving transfers to other hospitals. We combined FCEs into CIPS using the methodology described in Castelli et al. (2008) and Cookson and Laudicella (2009). We included patients whose CIPS finished in the financial year 1 April 2008 to 31 March 2009 and started between 1 April 2007 and 31 March 2009.

Hip fracture patients are those with a HES primary diagnosis ICD10 code of S72.0 (fracture of neck of femur or unspecified femur fracture), S72.1 (pertrochanteric fracture), where the fracture occurs between the protrusions of the femur beneath the ball of the hip joint or S72.2 (subtrochanteric fracture), where the fracture occurs beneath the protrusions of the hip joint but above the shaft of the femur (Jarman et al., 2004).

Stroke patients are those with primary diagnosis ICD10 codes were I60-2 (intracerebral haemorrhage) where the stroke was caused by bleeding from vessels supplying blood to the brain, I63 (cerebral infarction) where the supply of blood to the brain is restricted or blocked entirely, I64 (unspecified stroke) where the cause of stroke is not defined, I66 (occluded cerebral vessel) where the flow of blood in cerebral vessels was restricted but not fully blocked or I67.2, I69.8 or R47.0 (other form of stroke) where stroke is diagnosed but the type does not clearly fit into any other category.

Appendix B Sensitivity Analyses

Tables B1 and B2 are for hip and stroke patients and compare logit and probit discharge destination models with the linear probability model, and also compare random and fixed effects specifications. For hip fracture patients (Table B1), we find that estimating models for the probability of being discharged to a care home with a probit or a logit model shows highly significant positive effects of beds supply and prices when no fixed or random effects are included, which is in line with results in Table 3. When we allow for hospital random effects, we find a significant positive gradient on beds supply with a clear gradient and lower p-values than with the OLS fixed effects, as expected. The results with logit fixed effects are similar in terms of the beds gradient to those from the OLS fixed effects model but with slightly higher p-values.

Analogous results are obtained for stroke patients in Table B2 when comparing alternative models of the discharge destination with the linear probability models. Models without any hospital (fixed or random) effects have significant positive effects of beds supply on discharge destination but adding random hospital effects tends to increase p-values (reducing the significance of effects). Models with hospital fixed effects show no gradient and have high p-values which are consistent with results in Table 3.

Hausman tests generally support specifications with hospital fixed compared to those with random effects, both for modelling discharge destination models and length of stay (see Table B3). The test fails to reject the null that the random-effects model is unbiased only in the case of the linear discharge destination model for hip fracture patients. In this model the results for the random and fixed effects discharge destination models are similar (if they were not the random effects model would be rejected by the Hausman test) but with the more precise estimates permitted by a random effects specification, an additional beds-supply quintile is now significant.

With continuous measures of beds and price and a quadratic specification (Table B4) increasing beds supply increases the probability of discharge to a care home for hip fracture patients but at a decreasing rate. The marginal effect is significant at the mean at 10% level (0.012 with p-value of 0.084). There is again no effect of price. For stroke patients neither the effect of beds supply or price is significant.

Increasing the size of the catchment area for the calculation of the supply variables (Tables B5 and B6) tends to reduce the significance of the estimated association beds supply with the probability of discharge to a care home. This may be because variation in local supply variables is measured less precisely with larger catchment (ie catchment areas of 20 or 30 kms may be too large). The mean price per week is relatively stable across different radii, ranging from £521.85 to £523.21 and the standard deviation around those means falls from £93.05 at 10km to £77.38 at 30km. The absolute number of beds and its standard deviation naturally rises respectively from 2.31 to 12.98 and from 1.79 to 891 as radius increases from 10km to 30km. However, the coefficient of variation (standard deviation divided by the mean), falls from 77.49% at 10km to 68.64% at 30km. The reduced evidence of association in models with larger catchment areas also supports the plausible argument that any effect of beds supply declines with distance: patients are less sensitive to beds supply the further away the beds. This was suggested by the results from the quadratic specification (Table B4).

Tables B7 and B8 present results for different specifications of the models for length of stay. In Table B7 we pool patients who are discharged to care homes with those discharged to their own home. We include a dummy variable for those discharged to a care home. As expected the coefficient on this variable is positive and highly significant suggesting that patients discharged to a care home are more severe (respectively with a higher length of stay or 32% for hip fracture and 95% for stroke). There is little sign of a gradient in the effect of beds supply for hip fracture patients but there is a clear negative gradient for stroke patients. Clearly, these results are due to pooling the coefficients obtained in Tables 4 and 5 where we note that patients discharged home constitute the largest group.

In Table B8 we report estimates of separate models for those discharged to care homes and to their own home (as for Tables 4 and 5) but including the inverse Mills ratio from a Heckman selection procedure to allow for unobservable factors affecting the propensity to be discharged to a care home. In the models for hip fracture patients, the coefficient on the Mills ratio is positive in the model of length of stay for those discharged to care and negative in the model of length of stay for those discharged to their home. In neither case are beds or price variables significant. These may be due to multicollinearity between unobservables (captured by the Mills ratio) and beds/prices. For stroke patients the Mills ratio is insignificant in both regressions and the results are similar to OLS results in Table 5.

Table B9 employs duration analysis to investigate the determinants of length of stay. With a Cox regression the coefficients reported are the proportionate effect of a variable on the hazard rate, ie the probability that a patient is discharged on a particular day given that she has not yet been discharged. An increase in the hazard rate reduces the expected length of stay. Thus a variable with a positive coefficient is one that *reduces* the length of stay. For example, the coefficient on the number of diagnoses is negative, indicating that patients with more diagnoses have a longer expected length of stay. The effect of beds supply is to reduce length of stay for patients discharged to a care home (all coefficients on the quintile dummies are positive) and there is a clear gradient. Higher prices by contrast reduce the hazard rate and increase length of stay for these patients. Beds supply also reduces length of stay for stroke patients discharged to their home. These results are therefore similar to those from the linear models.

Tables B10 and B11 report results from models which additionally include a measure of the supply of community care in the local authority in which the patient lives. An increase in the number of people receiving some form of local authority care at home makes it less likely that hip fracture patients are discharged to a care home but has no effect for stroke patients. The number of people receiving some form of local authority care at home increases the length of stay of stroke patients discharged to care but has no effect on the length of stay of those discharged to home or for the length of stay of hip fracture patients. Note that since most patients in a given hospital are from the same LA, there may not be sufficient variation in this variable to capture variation in community care.

We also investigated whether the effect of beds supply or price varied with the income deprivation of patients (results not reported). We estimated models in which we interacted a dummy for being in the most income deprived quintile with the beds supply and price. For the discharge destination models these interaction terms were almost always insignificant and there was little difference between the effects of the beds supply and price quintiles for the most income deprived LSOAs compared with the less deprived. Among hip fracture patients, the sum of main effect and interaction were positive and significant for the fourth and fifth beds quintiles. For the length of stay models the interaction terms were generally insignificant for hip fracture patients. The only exception was the fifth price quintile, which is suggests that most income-deprived patients stay in hospital an additional 30% longer when facing the highest prices. It therefore suggests that poor patients with hip fracture are more affected by high prices. Among stroke patients, the interaction terms between deprivations and supply variables are not significant in the length of stay model of patients discharged to care. However, for patients discharged home, we find unexpectedly that income-deprived patients have a longer length of stay when prices are at in the top three quintiles.

Table B 1. Discharge destination hip fracture: logit and probit specifications

	Logit		FE Logit*		RE Logit		RE OLS		Probit		RE Probit	
Variable	b	p	b	p	b	p	b	p	b	p	b	p
Age 75-84	0.029	0.000	0.833	0.000	0.032	0.000	0.061	0.000	0.031	0.000	0.035	0.000
Age 85plus	0.045	0.000	1.272	0.000	0.049	0.000	0.114	0.000	0.050	0.000	0.056	0.000
Male	-0.006	0.006	-0.144	0.006	-0.006	0.012	-0.016	0.003	-0.006	0.006	-0.007	0.013
Number diagnoses	0.003	0.000	0.085	0.000	0.003	0.000	0.011	0.000	0.004	0.000	0.004	0.000
Number procedures	0.001	0.090	0.039	0.004	0.001	0.008	0.005	0.002	0.001	0.085	0.002	0.012
Patient transferred	0.001	0.782	0.045	0.647	0.002	0.588	0.005	0.649	0.001	0.776	0.003	0.434
Pertrochanteric fracture	0.000	0.815	0.010	0.839	0.000	0.874	0.000	0.955	-0.001	0.770	0.000	0.896
Subtrochanteric fracture	0.005	0.300	0.069	0.571	0.003	0.580	0.005	0.741	0.005	0.297	0.003	0.652
1 minor Charlson comorbidity	0.009	0.000	0.303	0.000	0.012	0.000	0.030	0.000	0.011	0.000	0.014	0.000
≥1 minor or ≥2 major Charlson comorbidity	0.007	0.004	0.193	0.002	0.008	0.003	0.019	0.009	0.008	0.005	0.009	0.003
LSOA in fifth income deprivation quintile	-0.001	0.760	-0.120	0.095	-0.004	0.139	-0.013	0.113	-0.001	0.784	-0.005	0.162
% LSOA pop non white	0.000	0.370	0.002	0.508	0.000	0.476	0.000	0.492	0.000	0.294	0.000	0.434
% LSOA not good SAH	0.000	0.383	-0.001	0.949	0.000	0.845	0.000	0.717	0.000	0.379	0.000	0.907
% LSOA households single pensioner	0.000	0.165	0.004	0.322	0.000	0.313	0.001	0.220	0.000	0.162	0.000	0.306
London LSOA	-0.015	0.003	-0.279	0.236	-0.014	0.106	-0.042	0.062	-0.018	0.003	-0.016	0.118
LSOA within 10km of Scottish border	0.033	0.199	0.004	0.995	0.002	0.936	-0.006	0.950	0.038	0.226	0.003	0.918
LSOA within 10km of Welsh border	0.020	0.001	-0.012	0.954	0.004	0.651	0.014	0.592	0.024	0.002	0.004	0.656
Town and fringe	-0.004	0.151	-0.086	0.258	-0.003	0.276	-0.008	0.347	-0.005	0.133	-0.004	0.231
Village or hamlet and isolated dwellings	-0.005	0.160	-0.133	0.114	-0.005	0.134	-0.011	0.201	-0.006	0.133	-0.006	0.129
Beds within 10km second quintile	0.009	0.000	0.082	0.304	0.004	0.148	0.011	0.187	0.010	0.000	0.005	0.171
Beds within 10km third quintile	0.014	0.000	0.193	0.070	0.008	0.020	0.023	0.040	0.016	0.000	0.009	0.020
Beds within 10km fourth quintile	0.009	0.008	0.225	0.131	0.009	0.046	0.029	0.057	0.010	0.007	0.011	0.058
Beds within 10km top quintile	0.015	0.003	0.353	0.104	0.015	0.024	0.047	0.039	0.017	0.004	0.017	0.034
Price within 10km second quintile	0.012	0.000	-0.128	0.141	-0.002	0.457	-0.005	0.554	0.014	0.000	-0.003	0.465
Price within 10km third quintile	0.013	0.000	-0.153	0.149	-0.003	0.427	-0.006	0.553	0.015	0.000	-0.004	0.396
Price within 10km fourth quintile	0.011	0.000	0.017	0.901	0.002	0.672	0.006	0.639	0.012	0.000	0.002	0.740
Price within 10km top quintile	0.009	0.005	-0.059	0.723	-0.002	0.778	-0.007	0.656	0.010	0.006	-0.003	0.691
Population within 10km (100000s)	0.004	0.270	0.117	0.455	0.002	0.680	0.007	0.661	0.005	0.267	0.003	0.647
Care home ratings within 10km mean	0.000	0.974	-0.004	0.981	0.000	0.984	-0.003	0.873	0.000	0.997	0.001	0.944
Constant							-0.028	0.625				
Pseudo R^2	0.043		0.047		0.044		0.031		0.043		0.044	
Observations	21959		21959		21959		21959		21959		21959	

*For the FE logit model we report coefficients, not marginal effects as in other models.

Table B 2. Discharge destination stroke patients: logit and probit specifications

	Logit		FE Logit*		RE Logit		RE OLS		Probit		RE Probit	
Variable	b	p	b	p	b	p	b	p	b	p	b	p
Age 75-84	0.040	0.000	0.730	0.000	0.042	0.000	0.055	0.000	0.043	0.000	0.044	0.000
Age 85plus	0.071	0.000	1.263	0.000	0.073	0.000	0.126	0.000	0.079	0.000	0.081	0.000
Male	-0.024	0.000	-0.427	0.000	-0.024	0.000	-0.043	0.000	-0.027	0.000	-0.028	0.000
Number diagnoses	0.007	0.000	0.143	0.000	0.008	0.000	0.018	0.000	0.008	0.000	0.009	0.000
Number procedures	0.002	0.026	0.018	0.070	0.001	0.052	0.002	0.034	0.002	0.003	0.001	0.061
Patient transferred	0.010	0.070	0.255	0.000	0.014	0.000	0.028	0.000	0.013	0.000	0.019	0.000
Stroke caused by a haemorrhage	0.007	0.023	0.118	0.019	0.007	0.018	0.014	0.013	0.008	0.008	0.008	0.012
Stroke not from haemorrhage or infarction	-0.009	0.019	-0.190	0.000	-0.010	0.000	-0.018	0.000	-0.010	0.000	-0.012	0.000
Occluded cerebral vessels no infarction	0.002	0.889	0.099	0.770	0.003	0.864	0.005	0.878	0.001	0.943	0.005	0.803
Other stroke	-0.045	0.000	-0.837	0.000	-0.048	0.000	-0.074	0.000	-0.048	0.000	-0.051	0.000
1 minor Charlson comorbidity	0.005	0.028	0.064	0.126	0.004	0.090	0.003	0.534	0.006	0.025	0.004	0.104
≥1 minor or ≥2 major Charlson comorbidity	0.004	0.214	0.061	0.185	0.003	0.182	0.000	0.942	0.004	0.135	0.004	0.150
LSOA in fifth income deprivation quintile	-0.003	0.426	-0.115	0.055	-0.006	0.085	-0.011	0.073	-0.002	0.499	-0.006	0.126
% LSOA pop non white	0.000	0.502	-0.002	0.438	0.000	0.404	0.000	0.303	0.000	0.256	0.000	0.376
% LSOA not good SAH	0.001	0.010	0.033	0.000	0.002	0.000	0.004	0.000	0.002	0.001	0.002	0.000
% LSOA households single pensioner	0.000	0.336	-0.008	0.049	0.000	0.052	-0.001	0.055	0.000	0.182	0.000	0.053
London LSOA	0.004	0.741	-0.228	0.259	-0.017	0.083	-0.032	0.059	0.004	0.536	-0.021	0.063
LSOA within 10km of Scottish border	-0.079	0.201	-1.537	0.156	-0.088	0.159	-0.070	0.269	-0.082	0.162	-0.090	0.146
LSOA within 10km of Welsh border	0.009	0.144	0.208	0.216	0.010	0.291	0.019	0.285	0.010	0.239	0.010	0.364
Town and fringe	-0.003	0.304	-0.045	0.459	-0.003	0.424	-0.004	0.538	-0.004	0.260	-0.004	0.358
Village or hamlet and isolated dwellings	-0.004	0.350	-0.045	0.515	-0.003	0.473	-0.004	0.550	-0.004	0.339	-0.003	0.497
Beds within 10km second quintile	0.009	0.029	0.026	0.686	0.003	0.382	0.005	0.417	0.011	0.001	0.004	0.298
Beds within 10km third quintile	0.005	0.386	-0.109	0.217	-0.004	0.461	-0.007	0.413	0.006	0.131	-0.004	0.467
Beds within 10km fourth quintile	0.022	0.001	0.172	0.151	0.013	0.014	0.025	0.032	0.026	0.000	0.015	0.016
Beds within 10km top quintile	0.021	0.065	0.150	0.398	0.013	0.143	0.020	0.233	0.024	0.001	0.014	0.145
Price within 10km second quintile	0.000	0.945	0.007	0.926	0.000	0.913	-0.001	0.940	-0.001	0.821	0.000	0.918
Price within 10km third quintile	0.001	0.804	0.096	0.262	0.004	0.377	0.007	0.367	0.001	0.665	0.005	0.307
Price within 10km fourth quintile	0.004	0.558	0.159	0.140	0.007	0.181	0.013	0.169	0.004	0.296	0.008	0.156
Price within 10km top quintile	0.005	0.444	0.155	0.254	0.005	0.399	0.012	0.308	0.006	0.197	0.006	0.402
Population within 10km (100000s)	-0.016	0.035	0.103	0.410	-0.002	0.733	-0.003	0.798	-0.018	0.000	-0.002	0.823
Care home ratings within 10km mean	-0.013	0.183	-0.013	0.927	-0.003	0.697	-0.004	0.795	-0.015	0.021	-0.003	0.728
Constant							-0.039	0.373				
Pseudo R^2	0.088		0.097		0.092		0.070		0.089		0.094	
Observations	33101		33101		33101		33101		33101		33101	

*For the FE logit model we report model coefficients, not marginal effects. In all other cases we report marginal effects.

Table B 3 Fixed versus random effects models: Hausman tests

	Hausman test statistic	p value
Discharge destination models		
Linear pr.ty model, stroke patients	61.7	p < 0.0001
Linear pr.ty model, hip fracture patients	27.9	p = 0.5233
Logit, stroke patients	123.8	p < 0.0001
Logit, hip fracture patients	30.5	p = 0.3910
LoS models		
Hip fracture patients discharged to care	252.4	p < 0.0001
Hip fracture patients discharged to home	64.5	p = 0.017
Stroke patients discharged to care	63.9	p = 0.0039
Stroke patients discharged to home	151.6	p < 0.0001

Table B 4. Discharge destination with quadratic supply

	FE OLS			
	Hip Fracture		Stroke	
Variable	b	p	b	p
Age 75-84	0.062	0.000	0.054	0.000
Age 85plus	0.114	0.000	0.125	0.000
Male	-0.016	0.003	-0.043	0.000
Number diagnoses	0.011	0.000	0.018	0.000
Number procedures	0.005	0.002	0.002	0.042
Patient transferred	0.006	0.620	0.030	0.000
Pertrochanteric fracture	0.000	0.931		
Subtrochanteric fracture	0.005	0.744		
Stroke caused by a haemorrhage			0.014	0.014
Stroke not haemorrhage or infarction			-0.019	0.000
Occluded cerebral vessels no infarction			0.011	0.763
Other stroke			-0.074	0.000
1 minor Charlson comorbidity	0.031	0.000	0.002	0.667
≥2 minor or ≥1 major Charlson comorbidity	0.019	0.009	-0.001	0.907
LSOA in fifth income deprivation quintile	-0.013	0.109	-0.012	0.056
% LSOA pop non white	0.000	0.496	0.000	0.391
% LSOA not good SAH	0.000	0.689	0.003	0.000
% LSOA households single pensioner	0.001	0.207	-0.001	0.077
London LSOA	-0.028	0.274	-0.019	0.376
LSOA within 10km of Scottish border	-0.011	0.904	-0.067	0.288
LSOA within 10km of Welsh border	-0.001	0.957	0.025	0.191
Town and fringe	-0.006	0.472	-0.001	0.856
Village or hamlet and isolated dwellings	-0.010	0.241	0.000	0.982
Beds within 10km	0.015	0.091	0.010	0.127
Beds within 10km squared	-0.001	0.558	-0.001	0.304
Price within 10km	0.001	0.226	0.000	0.815
Price within 10km squared	0.000	0.198	0.000	0.993
Population within 10km (100000s)	0.000	0.994	0.004	0.821
Care home ratings within 10km mean	-0.005	0.805	0.001	0.935
Constant	-0.172	0.194	-0.104	0.319
Overall R^2	0.031		0.068	
Observations	21959		33101	

Table B 5. Discharge destination with 20km catchment area (fixed effects)

	Hip Fracture		Stroke	
Variable	b	p	b	p
Age 75-84	0.061	0.000	0.054	0.000
Age 85plus	0.114	0.000	0.125	0.000
Male	-0.016	0.003	-0.042	0.000
Number diagnoses	0.010	0.000	0.018	0.000
Number procedures	0.005	0.002	0.002	0.046
Patient transferred	0.006	0.621	0.030	0.000
Pertrochanteric fracture	0.001	0.909		
Subtrochanteric fracture	0.004	0.780		
Stroke caused by a haemorrhage			0.013	0.015
Stroke not haemorrhage or infarction			-0.019	0.000
Occluded cerebral vessels no infarction			0.012	0.734
Other stroke			-0.075	0.000
1 minor Charlson comorbidity	0.031	0.000	0.002	0.657
≥2 minor or ≥1 major Charlson comorbidity	0.019	0.007	-0.001	0.895
LSOA in fifth income deprivation quintile	-0.013	0.106	-0.012	0.058
% LSOA pop non white	0.000	0.694	0.000	0.334
% LSOA not good SAH	0.000	0.718	0.003	0.001
% LSOA households single pensioner	0.001	0.224	-0.001	0.093
London LSOA	-0.021	0.399	-0.032	0.143
LSOA within 20km of Scottish border	0.084	0.070	-0.003	0.945
LSOA within 20km of Welsh border	0.024	0.340	0.010	0.573
Town and fringe	-0.007	0.388	-0.005	0.441
Village or hamlet and isolated dwellings	-0.010	0.227	-0.004	0.533
Beds within 20km second quintile	-0.001	0.916	-0.005	0.531
Beds within 20km third quintile	0.000	0.991	-0.021	0.034
Beds within 20km fourth quintile	-0.020	0.190	-0.021	0.098
Beds within 20km top quintile	-0.071	0.002	0.003	0.874
Price within 20km second quintile	0.000	0.992	-0.020	0.033
Price within 20km third quintile	-0.001	0.950	-0.014	0.215
Price within 20km fourth quintile	0.014	0.435	-0.028	0.051
Price within 20km top quintile	0.039	0.093	-0.012	0.538
Population within 20km (100000s)	0.054	0.000	0.017	0.080
Care home ratings within 20km mean	-0.090	0.024	-0.015	0.609
Constant	0.227	0.065	0.023	0.804
Overall R^2	0.029		0.067	
Observations	21959		33101	

Table B 6. Discharge destination with 30km Catchment Area

	Hip Fracture		Stroke	
Variable	b	p	b	p
Age 75-84	0.061	0.000	0.054	0.000
Age 85plus	0.114	0.000	0.125	0.000
Male	-0.016	0.003	-0.043	0.000
Number diagnoses	0.010	0.000	0.018	0.000
Number procedures	0.005	0.002	0.002	0.037
Patient transferred	0.002	0.853	0.030	0.000
Pertrochanteric fracture	0.001	0.814		
Subtrochanteric fracture	0.003	0.812		
Stroke caused by a haemorrhage			0.013	0.017
Stroke not haemorrhage or infarction			-0.019	0.000
Occluded cerebral vessels no infarction			0.011	0.768
Other stroke			-0.075	0.000
1 minor Charlson comorbidity	0.030	0.000	0.002	0.660
≥2 minor or ≥1 major Charlson comorbidity	0.018	0.010	-0.001	0.919
LSOA in fifth income deprivation quintile	-0.013	0.102	-0.012	0.055
% LSOA pop non white	0.000	0.151	0.000	0.547
% LSOA not good SAH	0.000	0.702	0.003	0.000
% LSOA households single pensioner	0.000	0.404	-0.001	0.073
London LSOA	0.019	0.475	-0.011	0.633
LSOA within 30km of Scottish border	-0.007	0.876	-0.001	0.977
LSOA within 30km of Welsh border	-0.023	0.296	0.004	0.789
Town and fringe	-0.012	0.124	-0.004	0.494
Village or hamlet and isolated dwellings	-0.017	0.048	-0.004	0.576
Beds within 30km second quintile	0.006	0.590	0.026	0.005
Beds within 30km third quintile	0.031	0.056	0.011	0.398
Beds within 30km fourth quintile	0.010	0.659	-0.011	0.555
Beds within 30km top quintile	0.018	0.601	-0.008	0.768
Price within 30km second quintile	0.032	0.006	0.025	0.008
Price within 30km third quintile	0.016	0.288	0.012	0.341
Price within 30km fourth quintile	0.031	0.095	-0.009	0.582
Price within 30km top quintile	0.114	0.000	0.002	0.925
Population within 30km (100000s)	-0.009	0.070	0.003	0.393
Care home ratings within 30km mean	-0.145	0.006	-0.018	0.657
Constant	0.399	0.011	-0.012	0.924
Overall R^2	0.025		0.068	
Observations	21959		33101	

Table B 7. Length of stay: discharged home and to care pooled

	Hip Fracture		Stroke	
	b	p	b	p
Age 75-84	0.196	0.000	0.152	0.000
Age 85plus	0.296	0.000	0.273	0.000
Male	0.015	0.116	-0.132	0.000
Number diagnoses	0.082	0.000	0.117	0.000
Number procedures	0.080	0.000	0.091	0.000
Patient transferred	0.868	0.000	0.870	0.000
Pertrochanteric fracture	-0.010	0.338		
Subtrochanteric fracture	0.094	0.000		
Stroke caused by a haemorrhage			0.016	0.325
Stroke not haemorrhage or infarction			-0.190	0.000
Occluded cerebral vessels no infarction			-0.170	0.111
Other stroke			-0.654	0.000
1 minor Charlson comorbidity	-0.026	0.006	-0.072	0.000
≥2 minor or ≥1 major Charlson comorbidity	-0.078	0.000	-0.051	0.001
LSOA in fifth income deprivation quintile	0.063	0.000	0.040	0.032
% LSOA pop non white	0.001	0.197	0.001	0.033
% LSOA not good SAH	-0.006	0.001	0.001	0.688
% LSOA households single pensioner	0.004	0.000	-0.001	0.529
London LSOA	-0.018	0.690	-0.097	0.133
LSOA within 10km of Scottish border	0.192	0.222	-0.017	0.926
LSOA within 10km of Welsh border	-0.151	0.001	-0.011	0.842
Town and fringe	0.002	0.913	-0.033	0.083
Village or hamlet and isolated dwellings	-0.061	0.000	-0.002	0.941
Beds within 10km second quintile	-0.018	0.223	-0.013	0.518
Beds within 10km third quintile	0.004	0.829	-0.051	0.061
Beds within 10km fourth quintile	-0.026	0.365	-0.108	0.004
Beds within 10km top quintile	-0.070	0.101	-0.214	0.000
Price within 10km second quintile	-0.024	0.147	-0.024	0.288
Price within 10km third quintile	-0.036	0.079	0.009	0.732
Price within 10km fourth quintile	0.001	0.973	-0.021	0.533
Price within 10km top quintile	0.019	0.543	-0.038	0.362
Population within 10km (100000s)	0.066	0.032	0.177	0.000
Care home ratings within 10km mean	0.049	0.151	-0.049	0.267
Discharged on Tuesday	-0.080	0.000	-0.147	0.000
Discharged on Wednesday	-0.099	0.000	-0.156	0.000
Discharged on Thursday	-0.089	0.000	-0.153	0.000
Discharged on Friday	-0.122	0.000	-0.290	0.000
Discharged on Saturday	-0.188	0.000	-0.390	0.000
Discharged on Sunday	-0.154	0.000	-0.634	0.000
Discharged to Care Home	0.314	0.000	0.950	0.000
Constant	1.738	0.000	1.709	0.000
Overall R^2	0.322		0.387	
Observations	21959		33101	

Table B 8. Length of stay with Heckman selection correction

	Hip Fracture				Stroke			
	Care		Home		Care		Home	
Variable	b	p	b	p	b	p	b	p
Age 75-84	0.475	0.065	0.229	0.000	-0.726	0.007	0.272	0.000
Age 85plus	0.753	0.055	0.351	0.000	-1.379	0.003	0.576	0.000
Male	-0.005	0.928	0.003	0.769	0.419	0.011	-0.231	0.000
Number diagnoses	0.133	0.000	0.084	0.000	-0.062	0.244	0.164	0.000
Number procedures	0.097	0.000	0.082	0.000	0.037	0.012	0.104	0.000
Patient transferred	0.899	0.000	0.873	0.000	0.232	0.078	0.983	0.000
Pertrochanteric fracture	-0.031	0.416	-0.005	0.619				
Subtrochanteric fracture	0.064	0.495	0.118	0.000				
Stroke caused by a haemorrhage					-0.193	0.014	0.054	0.019
Stroke not haemorrhage or infarction					0.088	0.340	-0.239	0.000
Occluded cerebral vessels no infarction					-0.048	0.915	-0.165	0.258
Other stroke					0.246	0.464	-0.816	0.000
1 minor Charlson comorbidity	0.167	0.108	-0.029	0.009	-0.187	0.002	-0.072	0.000
≥2 minor ≥1 major Charlson comorbidity	-0.035	0.656	-0.068	0.000	-0.274	0.000	-0.040	0.052
LSOA fifth income deprivation quintile	-0.032	0.618	0.071	0.000	0.118	0.172	0.022	0.388
% LSOA pop non white	0.001	0.791	0.001	0.106	0.003	0.346	0.001	0.328
% LSOA not good SAH	-0.006	0.382	-0.008	0.000	-0.043	0.008	0.010	0.012
% LSOA households single pensioner	0.000	0.985	0.005	0.000	0.011	0.061	-0.003	0.089
London LSOA	-0.306	0.124	-0.027	0.564	0.404	0.165	-0.181	0.040
LSOA within 10km of Scottish border	0.461	0.373	0.098	0.569	2.152	0.116	-0.154	0.541
LSOA within 10km of Welsh border	-0.225	0.178	-0.141	0.007	-0.150	0.507	0.039	0.624
Town and fringe	-0.037	0.562	-0.002	0.871	0.086	0.295	-0.047	0.068
Village hamlet and isolated dwellings	-0.173	0.024	-0.052	0.002	0.045	0.614	-0.012	0.682
Beds within 10km second quintile	-0.009	0.889	-0.010	0.540	-0.009	0.912	-0.019	0.486
Beds within 10km third quintile	0.033	0.746	0.018	0.424	0.050	0.683	-0.073	0.052
Beds within 10km fourth quintile	-0.112	0.392	0.014	0.651	-0.210	0.208	-0.077	0.133
Beds within 10km top quintile	-0.155	0.426	-0.011	0.814	-0.320	0.175	-0.182	0.016
Price within 10km second quintile	-0.078	0.311	-0.033	0.064	-0.022	0.813	-0.020	0.510
Price within 10km third quintile	-0.075	0.435	-0.048	0.026	-0.159	0.173	0.042	0.249
Price within 10km fourth quintile	0.164	0.115	-0.029	0.277	-0.202	0.187	0.022	0.634
Price within 10km top quintile	0.138	0.293	-0.012	0.720	-0.194	0.302	0.006	0.923
Population within 10km (100000s)	0.297	0.023	0.053	0.100	-0.070	0.682	0.209	0.000
Care home ratings within 10km mean	0.138	0.326	0.030	0.402	0.132	0.488	-0.071	0.237
Discharged on Tuesday	-0.086	0.029	-0.076	0.000	-0.075	0.156	-0.156	0.000
Discharged on Wednesday	-0.176	0.000	-0.082	0.000	-0.080	0.123	-0.169	0.000
Discharged on Thursday	-0.113	0.004	-0.086	0.000	-0.100	0.057	-0.163	0.000
Discharged on Friday	-0.141	0.000	-0.116	0.000	-0.096	0.064	-0.314	0.000
Discharged on Saturday	-0.158	0.008	-0.189	0.000	-0.216	0.009	-0.420	0.000
Discharged on Sunday	-0.202	0.043	-0.134	0.000	-0.211	0.176	-0.670	0.000
Constant	-0.711	0.671	2.090	0.000	7.596	0.000	1.408	0.000
Lambda (Mills Ratio)	1.203	0.100	-0.208	0.046	-2.164	0.012	-1.291	0.000
Observations	21959		21959		33101		33101	

Table B 9. Length of stay: Cox regression with hospital fixed effects

	Hip Fracture				Stroke			
	Care		Home		Care		Home	
Variable	b	p	b	p	b	p	b	p
Age 75-84	-0.001	0.994	-0.316	0.000	0.233	0.000	-0.104	0.000
Age 85plus	-0.076	0.311	-0.490	0.000	0.517	0.000	-0.208	0.000
Male	-0.075	0.124	-0.046	0.009	-0.008	0.810	0.114	0.000
Number diagnoses	-0.127	0.000	-0.130	0.000	-0.094	0.000	-0.120	0.000
Number procedures	-0.102	0.000	-0.106	0.000	-0.064	0.000	-0.078	0.000
Patient transferred	-1.367	0.000	-1.229	0.000	-0.910	0.000	-0.937	0.000
Pertrochanteric fracture	0.028	0.540	-0.012	0.506				
Subtrochanteric fracture	-0.106	0.324	-0.180	0.000				
Stroke caused by a haemorrhage					0.094	0.033	-0.084	0.000
Stroke haemorrhage or infarction					0.097	0.024	0.177	0.000
Occluded cerebral vessels no infarction					-0.068	0.834	0.038	0.747
Other stroke					0.484	0.000	0.600	0.000
1 minor Charlson comorbidity	-0.050	0.263	-0.007	0.699	0.165	0.000	0.091	0.000
≥2 minor or ≥1 major Charlson comorbidity	0.160	0.006	0.065	0.005	0.251	0.000	0.074	0.000
LSOA in fifth income deprivation quintile	0.011	0.866	-0.086	0.001	0.003	0.955	-0.034	0.102
% LSOA pop non white	0.002	0.423	-0.001	0.287	-0.002	0.315	-0.001	0.077
% LSOA not good SAH	-0.004	0.645	0.007	0.042	0.011	0.135	-0.002	0.603
% LSOA households single pensioner	0.009	0.021	-0.006	0.000	0.000	0.967	0.001	0.425
London LSOA	0.248	0.268	0.006	0.941	0.019	0.925	0.108	0.146
LSOA within 10km of Scottish border	-0.450	0.458	-0.041	0.890	-1.023	0.316	0.089	0.654
LSOA within 10km of Welsh border	0.269	0.176	0.285	0.002	-0.058	0.685	0.017	0.804
Town and fringe	-0.023	0.749	0.002	0.938	-0.118	0.038	0.042	0.050
Village or hamlet and isolated dwellings	0.172	0.028	0.098	0.001	-0.018	0.779	-0.012	0.616
Beds within 10km second quintile	0.053	0.488	0.022	0.427	-0.018	0.759	0.007	0.756
Beds within 10km third quintile	0.200	0.045	-0.006	0.879	0.007	0.929	0.018	0.565
Beds within 10km fourth quintile	0.294	0.037	0.000	0.993	0.092	0.416	0.107	0.010
Beds within 10km top quintile	0.510	0.012	0.047	0.551	0.259	0.125	0.211	0.001
Price within 10km second quintile	0.002	0.981	0.030	0.330	-0.001	0.990	0.017	0.485
Price within 10km third quintile	0.022	0.832	0.050	0.182	0.006	0.940	0.008	0.781
Price within 10km fourth quintile	-0.267	0.043	0.010	0.828	-0.076	0.454	0.014	0.701
Price within 10km top quintile	-0.242	0.142	-0.034	0.556	-0.112	0.388	-0.005	0.910
Population within 10km (100000s)	-0.328	0.029	-0.069	0.235	-0.041	0.743	-0.181	0.000
Care home ratings within 10km mean	-0.181	0.314	-0.094	0.133	-0.051	0.721	0.097	0.047
Discharged on Tuesday	0.145	0.026	0.119	0.000	0.030	0.560	0.151	0.000
Discharged on Wednesday	0.235	0.000	0.136	0.000	0.076	0.138	0.156	0.000
Discharged on Thursday	0.134	0.037	0.112	0.000	0.104	0.046	0.153	0.000
Discharged on Friday	0.197	0.002	0.163	0.000	0.101	0.045	0.299	0.000
Discharged on Saturday	0.258	0.007	0.312	0.000	0.292	0.000	0.341	0.000
Discharged on Sunday	-0.028	0.858	0.197	0.001	0.149	0.350	0.535	0.000
Pseudo R^2	0.032		0.020		0.032		0.019	
Observations	3175		18784		4465		28636	

Table B 10. Discharge destination: models with local authority care supply measure

	Hip Fracture		Stroke	
	b	p	b	p
Age 75-84	0.062	0.000	0.054	0.000
Age 85plus	0.114	0.000	0.125	0.000
Male	-0.016	0.004	-0.043	0.000
Number diagnoses	0.011	0.000	0.018	0.000
Number procedures	0.005	0.002	0.002	0.042
Patient transferred	0.005	0.693	0.029	0.000
Pertrochanteric fracture	0.001	0.890		
Subtrochanteric fracture	0.004	0.794		
Stroke caused by a haemorrhage			0.014	0.014
Stroke not haemorrhage or infarction			-0.019	0.000
Occluded cerebral vessels no infarction			0.009	0.792
Other stroke			-0.075	0.000
1 minor Charlson comorbidity	0.031	0.000	0.002	0.623
≥2 minor ≥1 major Charlson comorb	0.019	0.009	-0.001	0.912
LSOA fifth income deprivation quintile	-0.014	0.084	-0.012	0.058
% LSOA pop non white	0.000	0.571	0.000	0.314
% LSOA not good SAH	0.000	0.677	0.004	0.000
% LSOA households single pensioner	0.001	0.206	-0.001	0.052
London LSOA	-0.059	0.025	-0.021	0.355
LSOA within 10km of Scottish border	-0.012	0.891	-0.069	0.273
LSOA within 10km of Welsh border	-0.006	0.811	0.025	0.191
Town and fringe	-0.006	0.435	-0.004	0.574
Village hamlet and isolated dwellings	-0.010	0.264	-0.004	0.574
Beds within 10km second quintile	0.007	0.384	0.002	0.722
Beds within 10km third quintile	0.017	0.152	-0.011	0.241
Beds within 10km fourth quintile	0.019	0.233	0.020	0.118
Beds within 10km top quintile	0.036	0.141	0.015	0.404
Price within 10km second quintile	-0.008	0.383	0.001	0.848
Price within 10km third quintile	-0.011	0.334	0.011	0.212
Price within 10km fourth quintile	0.009	0.535	0.018	0.108
Price within 10km top quintile	-0.002	0.890	0.020	0.163
Population within 10km (100000s)	0.012	0.490	0.011	0.381
Care home ratings within 10km mean	-0.007	0.716	0.001	0.933
000s in LA receiving comm care	-0.002	0.002	0.000	0.404
Constant	0.010	0.870	-0.068	0.144
Observations	21959		33101	
r2	0.033		0.074	

Table B 11. Length of stay: models with local authority care supply measure

	Hip Fracture				Stroke			
	Discharged to Care		Discharged Home		Discharged to Care		Discharged Home	
	b	p	b	p	b	p	b	p
Age 75-84	0.065	0.173	0.209	0.000	-0.074	0.031	0.160	0.000
Age 85plus	0.120	0.011	0.315	0.000	-0.225	0.000	0.327	0.000
Male	0.067	0.027	0.008	0.427	0.026	0.275	-0.146	0.000
Number diagnoses	0.089	0.000	0.081	0.000	0.069	0.000	0.129	0.000
Number procedures	0.077	0.000	0.080	0.000	0.052	0.000	0.099	0.000
Patient transferred	0.855	0.000	0.870	0.000	0.507	0.000	0.909	0.000
Pertrochanteric fracture	-0.036	0.219	-0.005	0.612				
Subtrochanteric fracture	0.035	0.611	0.117	0.000				
Stroke caused by a haemorrhage					-0.079	0.012	0.026	0.158
Stroke haemorrhage or infarction					-0.087	0.004	-0.202	0.000
Occluded cerebral no infarction					0.084	0.712	-0.192	0.100
Other stroke					-0.494	0.000	-0.672	0.000
1 minor Charlson comorbidity	0.009	0.748	-0.039	0.000	-0.129	0.000	-0.077	0.000
≥2 minor/≥1 major Charlson comorb	-0.136	0.000	-0.074	0.000	-0.207	0.000	-0.045	0.007
LSOA 5th income deprivation quint	0.023	0.579	0.075	0.000	0.027	0.491	0.043	0.039
% LSOA pop non white	0.000	0.822	0.001	0.135	0.001	0.384	0.001	0.068
% LSOA not good SAH	-0.006	0.285	-0.008	0.000	-0.013	0.016	0.003	0.337
% LSOA h'hold single pensioner	-0.002	0.331	0.005	0.000	0.004	0.135	-0.001	0.349
London LSOA	-0.177	0.260	-0.022	0.650	0.257	0.081	-0.135	0.068
LSOA 10km Scottish border	0.448	0.251	0.099	0.560	0.867	0.244	-0.008	0.968
LSOA 10km of Welsh border	-0.223	0.071	-0.141	0.006	0.036	0.724	0.001	0.987
Town and fringe	0.008	0.855	0.000	0.983	0.034	0.392	-0.039	0.061
Village or hamlet, isolated dwellings	-0.105	0.035	-0.048	0.003	0.000	0.996	-0.005	0.827
Beds within 10km second quintile	-0.049	0.298	-0.012	0.435	0.022	0.608	-0.026	0.242
Beds within 10km third quintile	-0.064	0.316	0.011	0.616	-0.045	0.444	-0.052	0.087
Beds within 10km fourth quintile	-0.215	0.017	0.006	0.839	-0.047	0.555	-0.113	0.006
Beds within 10km top quintile	-0.318	0.014	-0.022	0.621	-0.185	0.110	-0.211	0.001
Price 10km second quintile	-0.015	0.767	-0.029	0.094	-0.018	0.700	-0.023	0.354
Price 10km third quintile	0.006	0.924	-0.044	0.040	-0.061	0.269	0.018	0.540
Price 10km fourth quintile	0.161	0.051	-0.030	0.260	-0.047	0.503	-0.015	0.686
Price 10km top quintile	0.175	0.083	-0.010	0.767	-0.056	0.540	-0.032	0.486
Population within 10km (100000s)	0.230	0.019	0.048	0.131	0.051	0.540	0.184	0.000
Care home ratings 10km mean	0.127	0.262	0.030	0.396	0.119	0.226	-0.073	0.126
000s LA receiving comm care	0.000	0.896	0.000	0.821	0.007	0.030	-0.001	0.698
Discharged on Tuesday	-0.087	0.035	-0.076	0.000	-0.075	0.043	-0.156	0.000
Discharged on Wednesday	-0.175	0.000	-0.082	0.000	-0.081	0.027	-0.170	0.000
Discharged on Thursday	-0.110	0.007	-0.086	0.000	-0.102	0.006	-0.164	0.000
Discharged on Friday	-0.141	0.001	-0.116	0.000	-0.099	0.006	-0.313	0.000
Discharged on Saturday	-0.154	0.011	-0.189	0.000	-0.223	0.000	-0.423	0.000
Discharged on Sunday	-0.197	0.042	-0.135	0.000	-0.208	0.068	-0.675	0.000
Constant	1.971	0.000	1.786	0.000	2.989	0.000	1.686	0.000
Observations	3175		18784		4465		28636	
r2	0.305		0.311		0.254		0.337	