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Length of stay in care homes

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Executive summary

Care home placements constitute the majority (57%) of net council spending in England on social care for older people. Information about the expected length of stay for people admitted to a care home is important for predicting lifetime costs and for understanding the implications of reforming funding arrangements for social care.

To date there has been very little research able to give us an accurate picture of how long people live in care homes before they die. In this study, we draw on anonymised information about all the residents (11,565 residents in total) that died in Bupa care homes in the period Nov 2008 to May 2010. The availability of this Bupa data has given the opportunity to produce some needed and timely research on the question of length of stay. The results of this study will help to fill some of the gaps in our knowledge on this subject.

Residents of the 305 Bupa homes are largely representative of the England average in relation to age, sex and funding source. Bupa have more people in nursing beds with a higher level of frailty than the average in England, but we are able to re-weight the results to estimate average lengths of stay that more closely reflect the England situation.

In the Bupa sample, the average length of stay was 801 days, but with a considerable tail of long-stayers. Half of residents had died by 462 days. Around 27% of people lived for more than three years, with the longest stayer living for over 20 years. People had a 55% chance of living for the first year after admission, which increased to nearly 70% for the second year before falling back over subsequent years.

Lengths of stay for the Bupa sample and those estimated for England are given in Table One (below). Adjusted figures show a bigger difference between nursing beds and residential beds than the unadjusted figures as they account for people that might have changed from a residential to a nursing bed during their stay in the home.

Length of stay information can be combined with information about the unit (e.g. weekly) costs of a care home placement to calculate expected costs of care for people newly admitted to care homes (see Table One). At £550 per week (before inflation), an 832-day expected stay would cost £65,400. The total cost for around a quarter of people would exceed £94,700 at this weekly rate, and for 10% it would be more than £166,000.

Table 1. Lengths of stay

	Bupa Sample			National average (estimate)		
	Nursing bed	Residential bed	All beds average	All beds average		Cost
	Days	Days	Days	Days	Years	£s
Mean (unadjusted)	790	852	801	832	2.3	£65,400
Mean (adjusted)	762	981	801	909	2.5	£71,400
Median (unadjusted)	451	513	462	493	1.3	£38,700
Median (adjusted)	418	665	462	584	1.6	£45,900
Longest 25% (unadjusted)	1171	1223	1180	1206	3.3	£94,700
Longest 25% (adjusted)	1132	1403	1180	1314	3.6	£103,300
Longest 10% (unadjusted)	2034	2151	2055	2112	5.8	£166,000
Longest 10% (adjusted)	1985	2381	2055	2251	6.2	£176,900

Age (on admission) and sex were strong predictors of differences in length of stay between residents. After adjusting for potential circularity of cause and effect, the study found that lengths of stay are shorter for people in nursing beds rather than residential beds; for LA supported residents compared with self-funders (because it is believed that publicly-supported people are admitted to care homes at a later stage than self-funders, so have shorter lengths of stay), and for non-ambulant compared with ambulant people.

1 Introduction

The majority (57%) of net council spending in England on social care for older people is on care home placements. Information about the expected length of stay for people admitted to a care home is important for predicting lifetime costs and for understanding the implications of reforming funding arrangements for social care. In particular, the evaluation of reform options where people's liability for care costs is limited beyond some threshold will depend critically on length of stay estimates.

Establishing average length of stay is challenging because it requires data about individual residents over a potentially long period (some residents can live for 20 or more years in a care home). Furthermore, in England, routine social care utilisation information is only available at an aggregated, not individual, level.

In this study, we draw on anonymised information about residents in Bupa care homes. Bupa records provide information about individual residents in Bupa care homes, including date of admission and date of death. Bupa is one of the largest care home providers; in this study we have data about residents in 305 Bupa care homes in the UK. Although by definition, the sample of Bupa home residents cannot be entirely representative of all residents in the UK, undertaking a fully randomly sampled, longitudinal study is not feasible. In any case, as described below, there is reason to believe that this sample is reasonably representative. Moreover, as the sample is large and with good variation in the characteristics of residents, we can analyse population sub-groups in the sample to investigate differences in lengths of stay.

This report is structured as follows. After a brief account of previous work in this area, section 2 considers the representativeness of the sample. Section 3 gives the main descriptive results regarding length of stay of residents in the sample. Section 4 has the analysis of the drivers of length of stay, using multivariate analysis. Section 5 is a discussion of the results.

1.1 Previous analysis

Ideally to estimate length of stay and the factors that affect it, we would use a longitudinal or follow-up study. The last major longitudinal study on care homes in England was the 1995/6 PSSRU 42-month study[1]. Some 2,573 people over 65 were recruited from those people newly

[1] Bebbington, A., R. Darton, et al. (2001). Care Homes for Older People: Volume 2 Admissions, Needs and Outcomes. The 1995/96 National Longitudinal Survey of Publicly-Funded Admissions. Canterbury, PSSRU.

admitted to care homes in the last 3 months of 1995. The survey concerned council-supported residents, not self-payers. Initially 46% of people were admitted to a nursing bed and the remainder to residential care beds.

The survey found that 72% of new admissions had died after 42 months. The median length of stay was 19.6 months for all admissions. Median length of stay for people admitted to nursing beds was 11.9 months and for residential beds it was 26.8 months.

In the PSSRU study, average length of stay was predicted at 29.7 months following admission. Because the follow-up period was limited to 42 months, assumptions had to be made about the life expectancy of those relatively few people still alive at this time.

The PSSRU study investigated factors that affect length of stay. Significant factors were:

- Age (older = higher death rate)
- Sex (males = higher death rate)
- ADL need (high need on admission = higher death rate)
- Cognitive functioning (high impairment = higher death rate)
- Bed type (nursing home bed = higher death rate)

This study began some 15 years ago and may not reflect the current situation. Although this study was undertaken after the last substantial reform of social care in the early 1990s, and therefore the policy environment has not changed qualitatively since then, a number of important incremental changes have occurred. The most important is the combined effect of increased eligibility thresholds set by councils and DH performance measures that were aimed to reduce the use of care homes. Over the period, from 2000 to 2008, and despite an aging population, the number of people in council-supported care homes in England has fallen from 200,000 to 172,000. The level of frailty, impairment and need of people newly admitted to care homes now is higher than was the case 10-15 years ago. Consequently, we would expect lengths of stay in care home to be far shorter than was found in the PSSRU study. Notwithstanding this expectation, we would still expect the drivers on length of stay to be similar now as they were when the PSSRU study was conducted.

2 Data and representativeness

2.1 Data

The analysis reported in this paper uses records of all deaths in Bupa care homes in four six-monthly waves: Nov 08, May 09, Nov 09 and May 10. In this study we focus on:

- Residential and nursing home residents (99% of all recorded deaths)
- Frail Elderly and Dementia residents (as opposed to people with learning disabilities, very young people with physical disabilities, palliative and terminal care patients and others) (84% of all recorded deaths)
- Permanent residents (94% of all recorded deaths)
- Self-funders and council supported residents i.e. not NHS funded patients (72% of all recorded deaths)

This gives records for 11,565 residents that died in the period Nov 08 to May 10. For each of these residents, their actual length of stay was calculated using the date that the person was admitted to the care home. A number of individual level characteristics were also recorded, including: age, sex, bed-type (nursing or residential), funder-type (at death), impairment (in terms of mobility, at death) and client-type (dementia or frail elderly). Using the address of the care home, we also mapped homes onto (lower level) geographic areas in England and thus were able to associate locality characteristics to home residents. This mapping was particularly useful in providing data about the affluence of the area in which the home was located and also about local health indicators. We do not have information on where residents lived prior to their move to the care home, but as many people choose homes that are local to their previous address, we anticipate a good correlation between both the affluence and population health status in the home's locality and the resident's pre-care home address.

2.2 Representativeness

Tables 1 to 4 (below) describe how the Bupa sample compares with the national picture in terms of the distribution of people in care homes by age, sex, bed-type (nursing or residential) and payer-type (self-payer or LA supported).

As regards age, Table 2 shows that the Bupa sample compares very closely with the age distribution available from national DH statistics on supported residents (for 2008) and also the 2005 PSSRU survey of care home admissions undertaken to produce the Relative Needs

Formula (RNF) that allocates funding to councils. The comparison is particularly close for people over 75 who are the great majority of residents. In this comparison LA-supported residents were selected from the Bupa sample.

Table 2. Comparison of age distribution, by bed type

		Res	Nurs	All
People aged 65-74	Bupa	6.1%	9.5%	9.0%
	DH	11.6%	13.9%	12.3%
	PSSRU	7.7%	12.9%	9.5%
People aged 75-84	Bupa	30.2%	38.6%	37.1%
	DH	31.0%	36.0%	32.6%
	PSSRU	37.1%	32.8%	35.6%
People aged 85 and over	Bupa	63.7%	51.9%	53.9%
	DH	57.4%	50.1%	55.0%
	PSSRU	55.3%	54.3%	54.9%

The DH statistics do not give a sex breakdown of residents, but a comparison can be made with the PSSRU survey. Again, we see a very close correspondence between the results – see Table 3, in terms of supported residents.

Table 3. Comparison of sex distribution, by bed type

		Res	Nurs	Total
Female	Bupa	71.9%	67.2%	68.0%
	PSSRU	73.2%	69.2%	71.8%
Male	Bupa	28.1%	32.8%	32.0%
	PSSRU	26.8%	30.8%	28.2%

Where we do see quite marked differences between the Bupa sample and the national picture is in the proportion of residents supported in nursing places as opposed to residential/personal care places. This result suggests that people in the Bupa sample will have higher baseline need than the national care home average, after accounting for age and sex. In the multivariate analysis we can distinguish the implications for length of stay between these bed-types. It is also possible to re-weight the sample to make it compatible with the national picture – see section 5 below.

Table 4. Comparison of bed type distribution

	Res	Nurs
Bupa	17.1%	82.9%
DH	67.2%	32.8%
PSSRU	64.6%	35.4%

An important dimension in this study is the size of any difference in length of stay between self-funded residents and those supported by councils. By and large the Bupa sample corresponds closely with the national picture as we understand it. National data on supported residents is available, but numbers of self-payers residents is not routinely collected data. In this case, we use figures from a CSCI study of self-payers (Forder, 2006). These figures are used in Table 5, and suggest that around 37% of care home residents are (solely) self-funders. In the Bupa sample, around of third of residents are self-funders at death. We would expect there to be a lower proportion of self-funders at death compared to a cross-section of residents because there is a chance that some people who were self-payers on admission would become eligible for state support by the time of their death. This is an issue which we will consider in more depth below.

Table 5. Comparison of funding type distribution

	Self-payers	Supported
Bupa	3,785	7,780
	33%	67%
CSCI (2006)	118	199
	37%	63%

3 Length of stay

Taking the sample as a whole, Table 6 gives the headline numbers. Mean length of stay is 801 days but, as we would expect, there is a significant rightward tail to the distribution. The median length of stay is 462 days, with the maximum being 8725 days (nearly 24 years).

Table 6. Length of stay – descriptive statistics

	Days
Mean	801
Std. Dev.	931
N	11565
Min	1
1st percentile	5
Median	462
99th percentile	4141
Max	8725

A better sense of the distribution can be gained from Figure 1 which shows the proportion of residents in the sample by their length of stay. The long tail is clearly evident. The figure shows that more than 90% of residents have died with lengths of stay of less than 6 years. It also shows that 27% of people live for more than three years in care homes.

Figure 1. Survival of residents – years, censored at 20 years

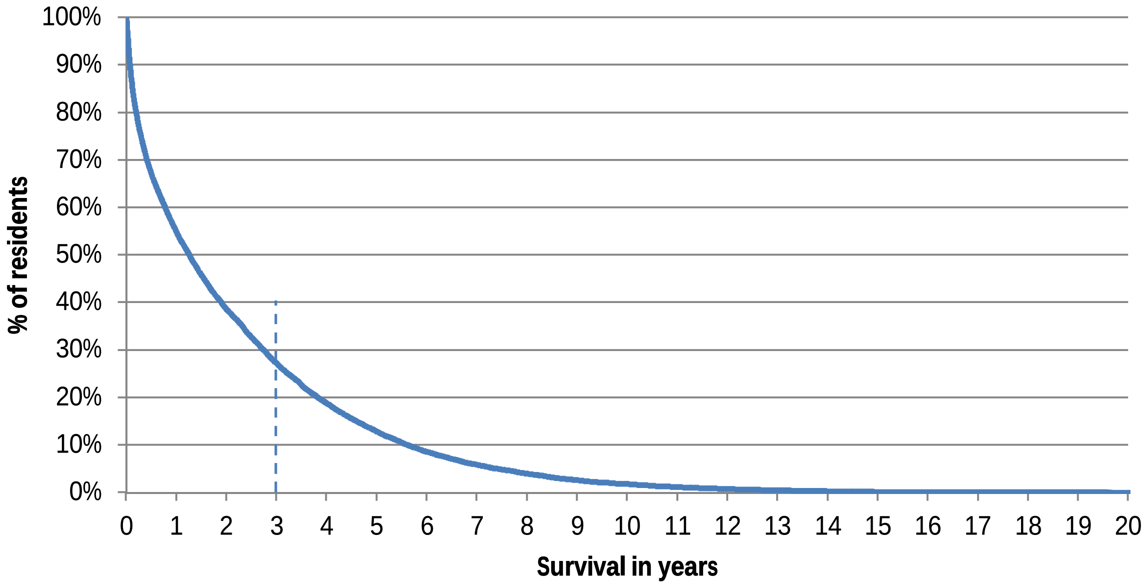


Figure 2 focuses on distribution up to the first six years. The data suggest that 20% of people die very soon after admission but thereafter life expectancy rates improve before falling again.

Figure 2. Survival of residents – months, censored at 72months

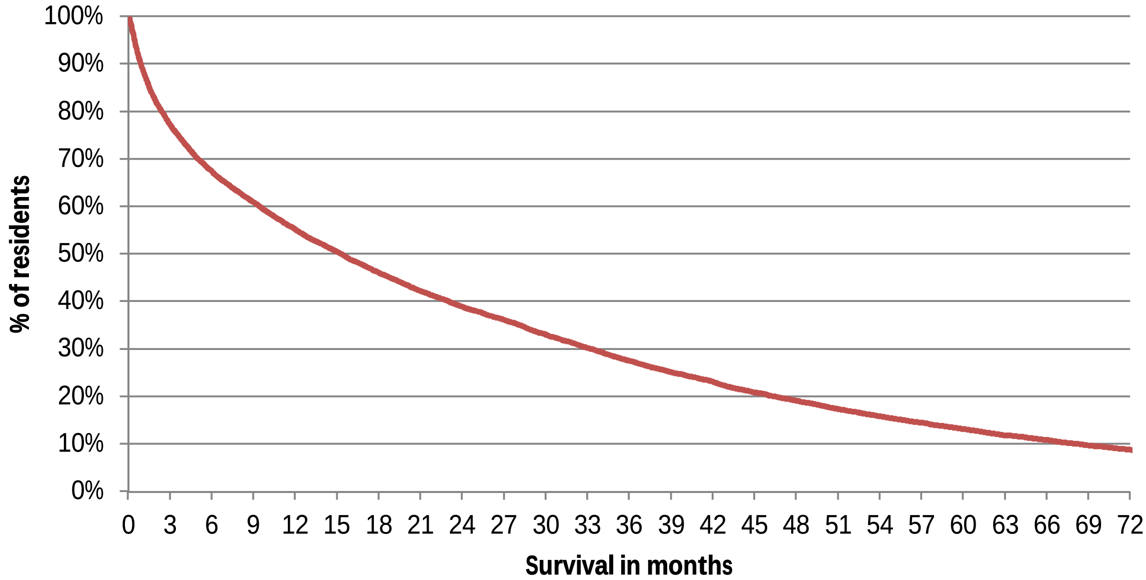


Table 7 reports (unadjusted) mean length of stay by age (at admission) and sex. It shows lower lengths of stay for the oldest, and for men compared to the average. These are unadjusted figures in that they make no account of other factors being correlated with age and sex e.g. that people tend to be frailer the older they are (this adjustment is done in the next section).

Table 7. Mean length of stay (days), by age and sex

	Female	Male
People under 65	2114	1418
People aged 65-74	1465	908
People aged 75-84	1035	649
People aged 85 and over	717	452

An unadjusted comparison of length of stay between people in nursing registered beds and residential/personal care registered beds suggests relatively little difference – see Table 8. The median length of stay is lower in nursing beds, but both the mean and median differences are lower than we might expect. The differences are smaller than the results found in the PSSRU study. Again it is important to be clear that other confounding factors may be at work and to be cautious in the interpretation of raw data. Also, many Bupa homes in this sample have recorded deaths from residents with both registration types. If instead we distinguish residents according to the type of home they are in, we see a greater difference in length of stay. Table 9 gives length of stay statistics where residents are grouped into three categories of home, as listed. Residents dying in homes with relatively low proportions of residents with nursing bed placements have a longer mean length of stay than residents in homes with a high proportion of resident deaths in nursing beds.

Table 8. Mean and median length of stay (days), by bed-type

	Mean	Median
Residential	805	479
Nursing	800	457

Table 9. Mean and median length of stay (days), by home level bed-type

	Mean	Median	N
< 20% resident deaths are nursing places	1041	770	214
20% to 80% resident deaths are nursing places	820	433	2,679
> 80% resident deaths are nursing places	789	463	8,672
Total	801	462	11,565

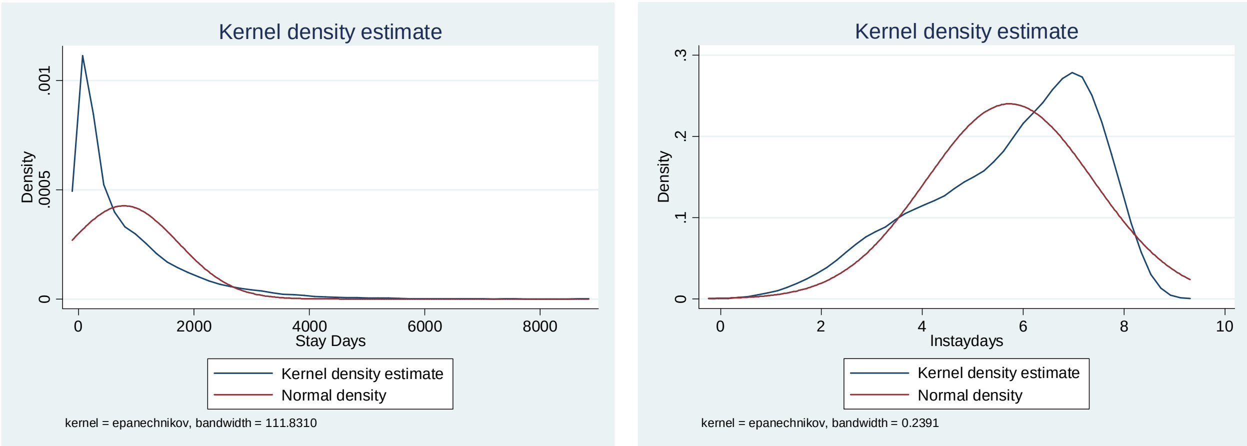
4 Factors affecting length of stay

Age and sex are two important factors that are associated with different lengths of stay. Furthermore, we would expect bed-type to have an impact and also need characteristics (such as having dementia), and funding characteristics will affect length of stay. Home location will also likely have an important bearing.

Many of these factors are likely to have a joint effect (in that they are correlated with each other). In order to distinguish between the independent effects – which is important for modelling policy implications – we can use a multivariate approach. Two multivariate methods are used. First, we use a parametric approach where we estimate factors associated with the mean value of length of stay. The flexibility of this approach is a key advantage but it relies on us making assumptions about how length of stay is distributed in the resident population.

As is clear from Figure 1, this distribution is far from the normal distribution. Rather, the distribution in Figure 1 appears to be exponential. A (natural) logarithmic transformation of the length of stay dependent variable, therefore, is more likely to be normally distributed and this can be seen in Figure 3 (the log version is the chart on the right).

Figure 3. Distribution of length of stay.



There is danger that the results of analyses in this case are being determined by the assumptions and not the data. With survival data, an important feature that can help us minimise our reliance on distributional assumptions is that events occur at given times and can be ordered. This ordering is the basis for the second approach, semi-parametric analysis, and specifically the estimation of a Cox Proportional Hazards model. In analysis of survival data, the 'hazard rate' is the rate at which people are dying at any particular point in time.

The impact of different factors, e.g. the resident's sex, are modelled on the assumption that the hazard rates for different types of person remain in constant ratio to one another. In the main this assumption seems reasonable for the factors considered in the analysis with the possible exception of bed-type. People admitted to nursing homes have particularly high mortality rates in the first few months.

4.1 Results

The following analyses seek to determine how length of stay differs according to a number of individual resident factors – age, sex, condition and bed-type – and also locality factors. The latter were constructed by mapping homes according to their postcode. In this estimation we restrict our attention to English addresses.

Table 10 has the results (of a base and a variant parametric model). The tables show the impact or difference made to length of stay by the listed factor in terms of both the number of days in the home and also as a percentage of the sample average length of stay. Also shown in the table is the statistical likelihood that the factor has a real impact (is ‘significant’).

As expected, age and sex are highly significant factors. For every year residents are older than the sample average age (of 85 years) on admission, their estimated length of stay is around 35 days less than the average. Men are estimated to live for 420 days less than women (about half the average length-of-stay). People in nursing beds lived around 200 days less than people in residential beds. This is a far more significant difference when compared to the crude (bivariate) results above, showing that a range of length-of-stay factors are also correlated with bed-type.

The locality factors were found to have relatively marginal effects in the base model. However, pension credit uptake – an indicator of low income – is significant in the variant model. This result suggests that people in homes in poorer areas have lower lengths of stay than people in homes in more affluent areas. There are a number of possible explanations. First and foremost, homes in poorer areas are more likely to have supported residents rather than self-payers and it is believed that publicly-supported people are admitted to care homes at a later stage than self-funders (so have shorter lengths of stay). Second, there is a well-established association between low-income areas and higher needs, which means that residents in poorer areas are more likely to be frailer on admission than people in wealthier areas.

Table 10. Estimation of factors affecting length of stay (reduced-form model)

	Base model			Variant model		
Factors	**impact (difference)**		**Significance**	**impact (difference)**		**Significance**
	Days	**%**	**Prob (of not sig)**	**Days**	**%**	**Prob (of not sig)**
Individual level factors						
Age on admission (+1 over mean age)	-35.2	-4.5%	< 0.001	-35.2	-4.5%	< 0.001
Male (cf female)	-424.2	-54.0%	< 0.001	-423.9	-53.9%	< 0.001
Dementia patient (cf frail older people)	-24.0	-3.1%	0.423	-25.3	-3.2%	0.396
Nursing bed (cf residential bed)	-206.5	-26.3%	< 0.001	-208.3	-26.5%	< 0.001
Locality factors						
Locality employment ranking (+10%)	-3.6	-0.5%	0.531			
Locality income ranking/score (+10%)	8.3	1.1%	0.125			
Attendance Allow.uptake rate (+10%)	-10.3	-1.3%	0.038			
Pen Credit uptake rate (+10%)	1.6	0.2%	0.764	-7.7	-1.0%	0.001
N	9576			9576		
Specification (RESET)	0.54		0.653	0.55		0.650
Heteroscedasticity	1.92		0.165	1.88		0.170
F	53.66		< 0.001	65.32		< 0.001

OLS model with log depvar (stay days)

To explore the sensitivity of the results to different assumptions about (error) distribution we also estimate the model assuming a Poisson distribution (using GLM). The Poisson expresses the probability of a number of events occurring in a fixed period of time, with an exponential basis and so is well suited to time to death problems. The results are in Table 11.

Table 11. Estimation of factors affecting length of stay – Poisson regression

	Base model			Alt model		
Factors	impact (difference)		Significance	impact (difference)		Significance
	Days	%	Prob	Days	%	Prob
Individual level factors						
Age on admission (+1 over mean age)	-30.8	-3.9%	< 0.001	-30.5	-3.9%	< 0.001
Male (cf female)	-372.9	-47.4%	< 0.001	-373.0	-47.4%	< 0.001
Dementia patient (cf frail older people)	-120.8	-15.4%	< 0.001	-118.5	-15.1%	< 0.001
Nursing bed (cf residential bed)	-62.5	-7.9%	0.009			
Nursing home				-259.3	-33.0%	< 0.001
Locality factors						
Pen Credit uptake rate (+10%)	-2.8	-0.4%	0.097	-3.2	-0.4%	0.051
N	9576.0			9576.0		

The results are generally in line with those above. The main difference is that the effect of bed-type is less strongly estimated in the Poisson regression. There is a possibility that bed-type might change during the course of a person's stay in a care home; a person starting out in a residential bed might deteriorate to the point that they are moved to a nursing bed within the home. Their length of stay (measured from first admission) would not change and therefore a part of the duration of stay spent under a residential bed classification would be associated with the bed-type classification at death, i.e. a nursing place. The problem is one of cause-and-effect. We want to measure the effect of being in a nursing place on length of stay. But in the data we also potentially have the effect on bed-type caused by a person living for a longer time than might be expected, becoming very frail and therefore moving to a nursing bed. This potential circularity of cause-and-effect means that if we try to estimate the effect of being in a nursing place on length of stay directly, the estimate could be biased.

A strategy to address this problem is to use the home level average of bed-type rather than the individual resident classification. The rationale is that the home level average is less likely to be causally affected by an individual person's length of stay. But at the same time, there will be a high correlation between the home level average and an individual person's bed-type, thus allowing us to see how (home average) bed-type causally affects length-of-stay.

In Table 11, we include results from this alternative model specification that includes the home level average of nursing-bed rate rather than the individual person bed-type. This home-level variable shows a stronger effect: 259 days less for people in nursing homes (where all beds are nursing beds) compared with people in residential care homes (where all beds are residential beds).

This strategy does not, however, give us an (unbiased) estimate of the effect of a nursing bed placement for an individual. A way to estimate this effect is to first estimate for individual people whether they are in a nursing bed or a residential bed on the basis of factors that would not be affected by that individual's length of stay. Then we use the estimated bed-type as a predictor of length of stay (see Appendix for details). The results of this analysis are given in Table 12. As we expect, in this case length of stay for people in nursing beds compared to residential beds is significantly shorter than in the above estimations (at 218 days less rather than 63 days less).

Table 12. Estimation of factors affecting length of stay – Poisson regression, with estimated bed-type

Factors	Impact (difference)		Significance
	Days	%	Prob
Individual level factors			
Age on admission (+1 over mean age)	-31.4	-4.0%	< 0.001
Male (cf female)	-371.1	-47.2%	< 0.001
Dementia patient (cf frail older people)	-127.2	-16.2%	< 0.001
Nursing bed (cf residential bed)	-218.2*	-27.8%	< 0.001
Locality factors			
Pen Credit uptake rate (+10%)	-4.4	-0.6%	0.011
N	9576		

** Predicted value*

Thus far we have focused on the factors that might affect a person's mean length of stay. The mean value is particularly useful for planning purposes because, along with a unit cost, it gives us the expected lifetime cost of a person newly admitted into a care home. Nonetheless, further insight can be gained by also considering the median value and other (quantile) points on the distribution, not least because there is a long tail on the distribution. In particular, we can use a statistical model to illuminate how much factors like a person's age and gender affect the median value (i.e. 50th percentile) of length of stay. Table 13 has the results, which, by and large, mirror those of the mean value regression. This result is encouraging because it suggests that the mean value regressions are accounting for, to a reasonable extent, the extreme skewness of length of stay in the sample. Similar regressions for the 75th and 90th percentiles were undertaken (results available from the authors) which showed lesser proportional differences between nursing places and residential places. This result might be expected if the greatest survival difference between nursing and residential care placements occur in the early period after admission.

Table 13. Estimation of factors affecting median length of stay

Factors	Impact on median		Significance
	Days	%	Prob
Individual level factors			
Age on admission (+1 over mean age)	-21.7	-5.0%	< 0.001
Male (cf female)	-255.3	-58.6%	< 0.001
Dementia patient (cf frail older people)	-43.0	-9.9%	0.049
Nursing bed (cf residential bed)	-61.7	-14.1%	0.015
Locality factors			
Pen Credit uptake rate (+10%)	-4.7	-1.1%	0.004
N	9576		

As well as requiring fewer assumptions about the distribution of length of stay in the sample, Cox regressions are useful in allowing us to directly estimate year-on-year survival probabilities, that is, the chance that a person will survive from one particular year to the next. Table 14 has the results of the base model (the counterpart to the parametric estimation of the base model in Table 10). The table lists the relative hazard rate, that is, the difference in risk-of-death at any given time associated with the change in the listed factor; for example, people that are 86 years old at admission have a risk-of-death that is 3.7% higher than people of the sample average age of 85. Similarly, males are estimated to be 51.8% more likely to die at any given time than females.

The results are generally in line with those above, particular the Poisson regression. As before, we also estimate an alternative model specification that includes the home level average of nursing-bed rate rather than the individual person bed-type. This home-level variable shows a stronger effect: 134.1% compared with 109.2%.

Table 14. Cox regression of factors affecting length of stay – risk of death

	Base model		Alt model	
Factors	%	Prob	%	Prob
Individual level factors				
Age on admission (+1 over mean age)	103.7%	< 0.001	103.7%	< 0.001
Male (cf female)	151.8%	< 0.001	151.6%	< 0.001
Nursing bed (cf residential bed)	109.2%	0.001		
Nursing home (cf residential home)			134.1%	< 0.001
Dementia patient (cf frail older people)	114.8%	< 0.001	114.6%	< 0.001
Locality factors				
Locality employment ranking (+10%)	100.7%	0.126	100.6%	0.14
Locality income ranking (+10%)	99.1%	0.032	99.2%	0.034
Att Allowance uptake rate (+10%)	100.5%	0.049	100.5%	0.044
N	9576		9576	
LR Chi	905.08	< 0.001	912.3	< 0.001

The results of the Cox regression can be used to estimate the impact of different factors on the probability of *survival*. Table 15 reports how people's probability of surviving their first year in the home differs from the chance of living for a second year and then a third year. On average, residents have a 54.5% chance of living for one year; thereafter the probability of living for a further year (conditional on surviving to this point) increases to 69.2%, then falls slightly for year three to 68.6%. In other words, if people survive the immediate period after admission their chance of death thereafter falls somewhat.

In line with the results in Table 14, individual level factors are associated with a change in the probability of remaining alive. For example, it was estimated that men have a 44.5% chance of living for at least one year, but women have a 58.7% chance (the difference in the probability is compounded over time). Table 16 has the results from the alternative model, including the home type effect. The differences in probabilities can be seen graphically in Figure 4.

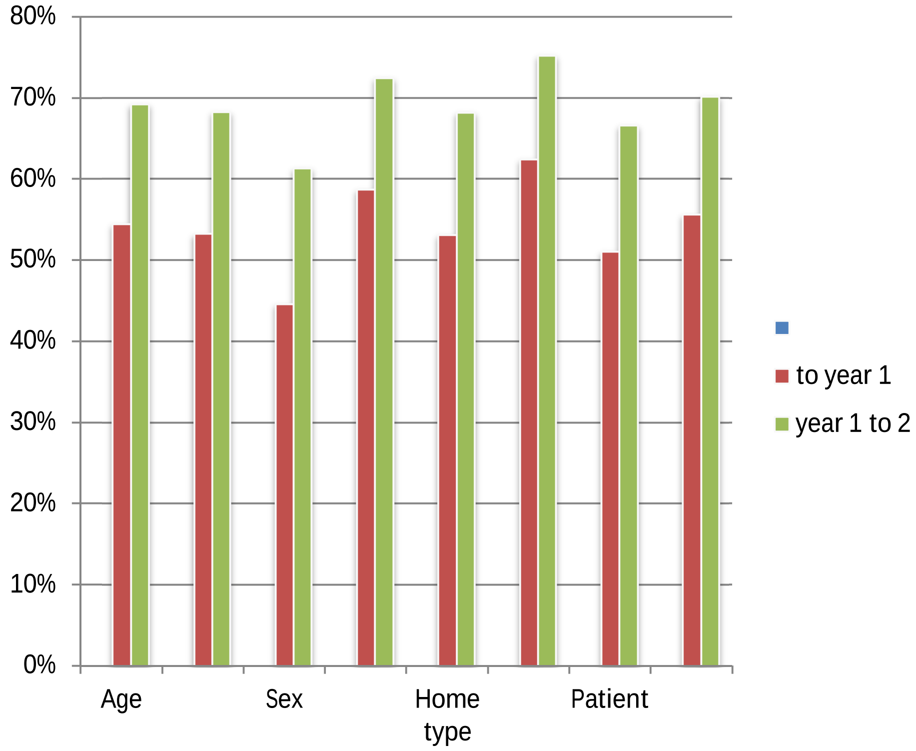
Table 15. Probabilities of survival (from Cox regressionof base model)

		Admission to year 1	year 1 to 2	year 2 to 3
Sample average		0.545	0.692	0.686
Age	Mean (85.0)	0.545	0.692	0.686
	Mean + 1	0.532	0.683	0.676
Sex	male	0.445	0.613	0.605
	Female	0.587	0.724	0.718
Bed type	Nursing	0.539	0.688	0.682
	Res	0.568	0.710	0.704
Patient	dementia	0.510	0.666	0.659
	Frail elderly	0.556	0.701	0.695

Table 16. Probabilities of survival (from Cox regression of alt model)

		Admission to year 1	year 1 to 2	year 2 to 3
Sample average		0.545	0.692	0.686
Age	Mean (85.0)	0.545	0.692	0.686
	Mean + 1	0.532	0.683	0.676
Sex	male	0.446	0.613	0.606
	Female	0.587	0.724	0.718
Home type	Nursing	0.531	0.682	0.675
	Res	0.624	0.752	0.746
Patient	dementia	0.511	0.666	0.659
	Frail elderly	0.556	0.701	0.695

Figure 4. Probabilities of survival (from Cox regression alt model)



4.2 Payer type

Our hypotheses about income effects (see above) can be further explored by using data about resident's funding source. For the sample we have funding type at the time of death: whether publicly-supported or a self-payer. Other things being equal we would expect self-payers at admission to have longer lengths of stay than supported people (for the reasons outlined above). However, it is possible that some people who began as self-payers would after a time become eligible for council support and therefore switch their payer type at the time of death. Moreover, we would theorise that this switching possibility should increase in accordance with the length of time people stay in a care home. So being a self-payer ought to increase length of stay on the one hand, but high lengths of stay might reduce the chance of someone remaining a self-payer. This potential circularity of cause-and-effect means that if we try to estimate the effect of being a self-payer on length of stay directly it would be biased.

A way around this problem is to find explanatory factors (predictors) for being a self-payer that are not themselves affected by how long an individual stays in a home. This is where locality factors are useful; in particular we use locality employment and income rankings taken from deprivation indexes, and the rate of pension credit uptake as predictors for the self-payer variable. In these analyses the estimated value of the self-payer variable (from its predictors) is used rather than the actual value.

Table 17 has the results. Age, sex, bed-type and patient type have very similar estimated effect as the (reduced-form) results above. Being a self-payer is associated with higher length of stay, other things equal compared with supported residents. Tests confirm that the predicted value of self-payer is well identified and circular (endogenous) as expected.

Table 17. IV Estimation of factors affecting length of stay

Factors	impact (difference)		Significance
	Days	%	Prob (of not being sig)
Individual level factors			
Self-payer (cf LA supported resident)	273.2	34.8%	0.001
Age on admission (+1 over mean age)	-37.2	-4.7%	< 0.001
Male (cf female)	-425.8	-54.2%	< 0.001
Dementia patient (cf frail older people)	-8.7	-1.1%	0.778
Nursing bed (cf residential bed)	-196.4	-25.0%	< 0.001
N	9576		< 0.001
Underidentification test (Anderson canon. corr. LM statistic):	1083.7		0.653
Weak identification test (Cragg-Donald Wald F statistic)	406.9		< 10% max IV size
Sargan statistic (overidentification test of all instruments)	2.0		0.374
Endogeneity test of endogenous regressors:	4.9		0.027
F	72.7		< 0.001

We can also estimate the impact of being a self-payer on the risk of death using a Cox regressionin this way (as with the estimation in Table 17 above, and using the same instruments)[2]. This estimation suggests that at any given time, self-payers are 20% less likely to die than supported residents – see Table 18. This result translates in a (cumulative) survival curve for self-payers compared with supported residents as given in Figure 5.

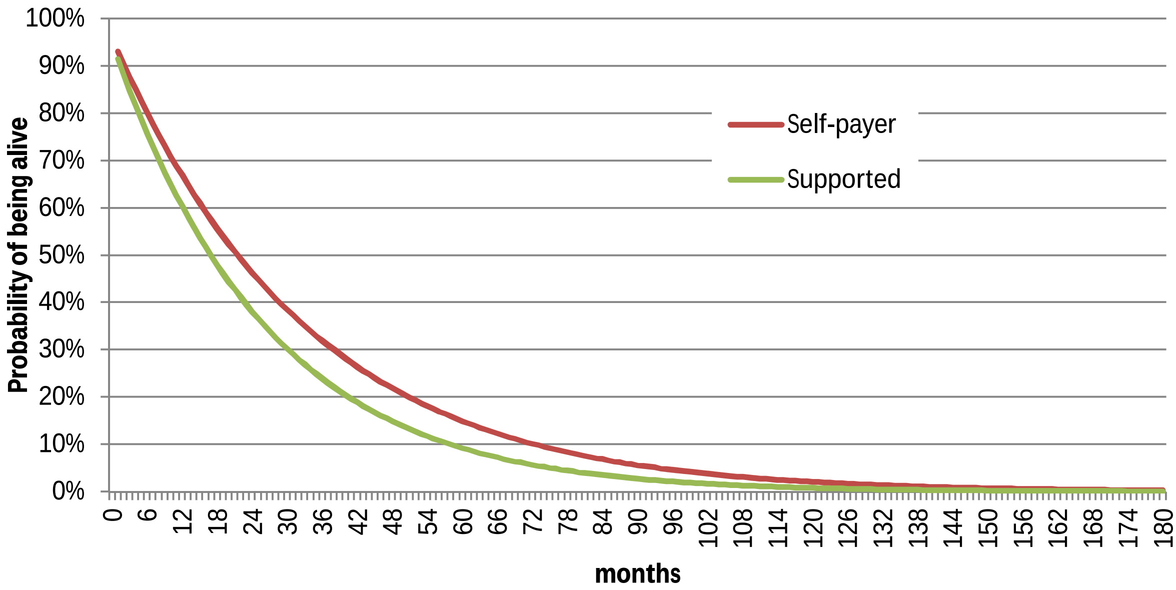
[2] Note that the standard errors on the (predicted) self-pay variable do not take into account the stochastic nature of this predicted variable, and therefore are likely to slightly over-estimate its significance.

Table 18. Cox regression with predicted self-pay – risk of death

Factors	impact	Significance
	Risk ratio	Prob
Individual level factors		
Self-payer (cf LA supported resident) (predicted)	79.8%	< 0.001*
Age on admission (+1 over mean age)	103.9%	< 0.001
Male (cf female)	152.1%	< 0.001
Dementia patient (cf frail older people)	113.2%	< 0.001
Nursing bed (cf residential bed)	108.9%	0.002
N	9576	
LR chi2	906.31	< 0.001

** Unadjusted values*

Figure 5. Life expectancy, by payer type



4.3 Need indicators

We would expect that a person's severity of condition or need level at admission will have a strong bearing on life expectancy. Sicker or frailer people are more likely to die at any given time than more healthy people. In the data three level classification of the severity of need or morbidity is available, in terms of people's mobility. Mobility is known to be a robust activities-of-daily-living (ADL) related indicator of need. In Bupa's records, this classification of need is continuously updated and so the recorded value in the data is at, or near to, the time of death. As such, we might expect need severity at time of death to be positively related to length of stay: if a resident lives another year, they are more likely to have increased severity of need by the end of that year. In other words, as with payer type, need/morbidity will be partly 'caused' by continued survival as well as itself being a causal factor for mortality. As before, we can address this problem by using an estimated value for need/morbidity, based on external predictors, rather than the actual value.[3] The results are in Table 19 – in particular, bed-bound/non-ambulant people are likely to survive for 560 days less than ambulant residents in this estimation.

Table 19. IV regression of length of stay (with endogenous need)

	Impact (difference)		Significance
	Days	%	Prob
High level need: non ambulant	-556.1	-70.7%	0.01
age at admission (mean + 1)	-36.3	-4.6%	< 0.001
Male	-452.5	-57.6%	< 0.001
Dementia	-99.6	-12.7%	0.027
N	9576.0		
F	64.9		< 0.001
Underidentification test (Anderson canon. corr. LM statistic):	1425.92		< 0.001
Weak identification test (Cragg-Donald Wald F statistic):	637.012		< 10% max IV size
Hansen J statistic (overidentification test)	5.664		0.226
Endogeneity test of endogenous regressors:	7.893		0.005

Depvar: log of length of stay

5 Summary and discussion

The topic of survival rates and length of stay in care homes is under-researched. The last major English longitudinal study was completed 10 years ago. Consequently, in developing policy and modelling the impact of social care, we have had little concrete data to work with. Collecting and analysing reliable data on this subject is clearly costly given the potential for some people to

[3] Finding predictors in this case is challenging; here we use rates of attendance allowance uptake in the home locality and also the home average of bed-type i.e. the home type indicator, nursing or residential. We would expect that people in homes that predominantly have nursing registered beds would have people with higher level of need/morbidity for each length of stay than predominantly residential bedded homes.

survive many years in a care home, but this information is self-evidently valuable for planners and policy makers charged to make ever more efficient use of scare social care resources.

Although the relevant data is, in theory, available from the record systems of councils, few attempts have been made to extract it systematically. Where attempts have been made, the results are often small-scale and unrepresentative of the England picture as a whole.

This study uses data extracted from the record systems of Bupa care homes. As one of the UK's largest care home providers, a key advantage of this approach is that a very large sample was available for analysis. In the study, even focusing on the subset of permanent, frail elderly or people living with dementia in nursing and residential care homes, a sample in excess of 10,000 cases was achieved. Moreover, as a retrospective study, data were collected on people who had died so that the complete (length of) stay (uncensored) could be analysed. The potential limitation with approach is that the sample, although large and being drawn from over 300 care homes, may not necessarily be representative of the England average. In fact, using comparisons of age, sex, funder-type and bed-type, the Bupa sample appear to be largely representative on the whole, with the exception that Bupa concentrates more on nursing care placements rather than residential care (personal care) homes. It is nonetheless possible to re-weight the results to more closely reflect the balance between residential and nursing placements in care homes across England.

In the Bupa sample, the average length of stay was 801 days, but with a considerable tail of long-stayers. Half of residents were dead by 462 days. Around 27% of people had lived for more than three years, with the longest stayer living for over 20 years. On average, people had a 55% chance of surviving for the first year after admission. The chance of living another year then increased to nearly 70% before falling back gradually over subsequent years.

Age (on admission) and sex were strong predictors as expected. This analysis also considered the effect of bed-type (nursing or residential), funder-type (LA supported or self-pay) and need level. The nature of the data meant that these three factors were only available as recorded at the time of death of the resident. Since it is possible that these three factors could change during a person's stay in the care home, and indeed with the likelihood of their changing being affected by how long the person survives, a potential circularity of cause and effect needed to be understood and overcome. A number of external, mainly home-locality based factors were used for this purpose. Having done so, it was estimated that self-payers have lengths of stay around a third longer than LA-supported people and people who are bed-bound (at the highest level of need) had lengths of stay around 70% shorter than ambulatory people.

Without adjustment, people in nursing beds have lengths of stays that average around 8% shorter than those in residential beds. However, further analysis did suggest a cause-and-effect circularity issue. After adjusting for this issue, the analysis suggests that length of stay is 25% shorter for nursing bed occupants.

These results can be used to produce a re-weighted estimate of average and median length of stay that might better reflect the England average – see Table 20. Using the un-adjusted figure, the national average length of stay would be re-calculated to be 832 days rather than 801 (a 4% difference). Using the adjusted figures, the national average would be 909 days, a rather bigger difference, but still only 13% above the Bupa sample average. The median, longest 25% of stayers and the longest 10% can also be re-weighted to the national average[4]

Table 20. Lengths of stay - re-weighting for bed-type

	Bupa Sample			**National average (estimate)**		
	Nursing bed	Residential bed	All beds average	All beds average		Cost
	Days	Days	Days	Days	Years	£s
Mean (unadjusted)	790	852	801	832	2.3	£65,400
Mean (adjusted)	762	981	801	909	2.5	£71,400
Median (unadjusted)	451	513	462	493	1.3	£38,700
Median (adjusted)	418	665	462	584	1.6	£45,900
Longest 25% (unadjusted)	1171	1223	1180	1206	3.3	£94,700
Longest 25% (adjusted)	1132	1403	1180	1314	3.6	£103,300
Longest 10% (unadjusted)	2034	2151	2055	2112	5.8	£166,000
Longest 10% (adjusted)	1985	2381	2055	2251	6.2	£176,900

Length of stay information can be combined with information about the unit (e.g. weekly) costs of a care home placement to calculate expected costs of care for people newly admitted to care homes. For example, at £550 per week (before inflation), an 832 day expected stay would cost £65,400. The total cost for around a quarter of people will exceed £94,700 at this weekly rate, and for 10% it will be more than £166,000. Where estimates are available about the risk of

[4] Using estimates from the quantile regressions.

needing a care home placement in any given year from, say, the age of 65, this information can be used to assess expected lifetime costs of care. These estimates can be made using the PSSRU microsimulation model, analysis that has been commissioned by Bupa (available separately).

This study benefits from a large sample of people with completed stays and therefore suffers no problems of censoring. However, it is also important to re-iterate the limitations. First, this is a sample of people in Bupa care homes and even after re-weighting may not reflect the actual national average. Second, when estimating the impact on length of stay of various factors, we ideally would use data on these factors collected at time of admission and therefore unaffected by the person's subsequent stay in the home. In this study, some of the factors were only available as recorded at time of death; statistical techniques were used to address this issue but this does mean further uncertainty associated with our estimates.

Overall, the availability of this Bupa data has given the opportunity to produce some needed and timely research on the question of length of stay. There is very little research on this question (in England), particularly up-to-date analysis and this study has attempted to fill the gap in our knowledge.

6 Appendix

Table 21. 2SLS estimation with endogenous bed-type

Factors	impact (difference)		Significance
	Days	**%**	**Prob**
Individual level factors			
Nursing place (cf res place) [predicted]	-450.4	-57.3%	< 0.001
Age on admission (+1 over mean age)	-36.4	-4.6%	< 0.001
Male (cf female)	-420.8	-53.5%	< 0.001
Dementia patient (cf frail older people)	-37.1	-4.7%	0.218
Locality factors			
Pen Credit uptake rate (+10%)	-10.3	-1.3%	< 0.001
N	9576		
Underidentification test (Anderson canon. corr. LM statistic):	1740.456		< 0.001
Weak identification test (Cragg-Donald Wald F statistic):	531.097		< 10% max IV size
Sargan statistic (overidentification test of all instruments):	5.039		0.169
Endogeneity test of endogenous regressors:	10.865		< 0.001
F	72.0		< 0.001

Depvar: Ln (length of stay); 2SLS