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Factors associated with hospital deaths in the oldest old:

a cross-sectional study

Abstract

Aims/Objectives
To study associations between the likelihood of hospital death with patient demographics, cause of death and co-morbidities for people aged ≥85 at death who have been previously admitted (within 12 months of death) to hospital.

Methods
A cross-sectional study, using death registration data and hospital episode statistics, for 671,178 England residents who had been admitted to hospital during the year before death and were aged ≥85 at death during 2008-2012. The outcome variable was the likelihood of dying in hospital. Covariates included: gender, age, deprivation, care home residence, cause of death and co-morbidity. Potential associations were explored by multivariable regression analysis.

Results
62% of the sample died in hospital. The likelihood of dying in hospital varies significantly with age, cause of death, deprivation, number of emergency admissions and co-morbidities. People aged over 90 at death are less likely to die in hospital than those aged 85-89 [odds ratio (OR) for aged 90-94 0.99; 95% confidence interval (CI) 0.98-1.00, OR for aged 95 and over 0.91; 95% CI: 0.89-0.92]. Care home residents are significantly less likely to die in hospital (OR 0.34; 95% CI: 0.34-0.35). Having a mention of dementia on the death certificate was significantly associated with a reduction in the likelihood of dying in hospital (OR 0.32; 95% CI: 0.31-0.32).

Conclusions
The likelihood of an older person dying in hospital is significantly associated with a number of socio-demographic factors, such as age and deprivation. Care home residence is significantly associated with a reduction in likelihood of hospital death.

Introduction

The UK population is ageing; a third of people in England now live past the age of 85 [1]. Although in decline, about half of deaths still occur in hospital and the likelihood of dying in hospital increases with age, up to 85 years [2].

In Western cultures, a "good death" is defined by choice over the place of death [3]. Although most people choose to die at home, preferred place of death for older people is highly complex and may change [4]. A hospital death, although more costly in financial terms, is not a negative outcome if it represents the best interests of the individual.

In the final year of life, 89.6% of people access hospital care, with an average of 1.5 emergency admissions ("unpredictable and at short notice because of clinical need" [5]) per person [6]. Those aged ≥84 are most likely to have an emergency admission, with 37.8% of hospital deaths in the over 85s occurring following this [1,7]. Apart from their substantial financial cost, emergency admissions can be disturbing and hazardous for older people.

The current model of palliative care does not cater well for the oldest old, who are frail, with multi-morbidity [8].To provide appropriate end-of-life care, and prevent avoidable hospital admissions, adjustments should be made to accommodate their needs.

We hypothesised that patient demographics, underlying cause of death and co-morbidities would have a differential impact on the likelihood of dying in hospital.

Methods

## Study population, outcome measure and covariates

This was a cross-sectional study, using routinely available, linked Hospital Episode Statistics (HES) and Office for National Statistics (ONS) data on deaths in England of people ≥85 between 1 January 2008 and 31 December 2012 [9]. The outcome variable was the likelihood of hospital death. Socio-demographic covariates potentially associated with hospital death included: gender, age (broadly grouped into: 85-89, 90-94, 95+), deprivation quintiles (assigned to each death using the Income Deprivation Affecting Older People Index for each Lower Super Output Area [1]) and whether or not the person was resident in a care home at the time of death (inferred from the postcode on the death certificate). Underlying cause of death was determined from the death certificate by ONS and coded using the ICD-10 system [10]. For the analysis, this was then categorised as follows: heart disease (I00-I52), cerebrovascular disease (I60-69),

respiratory disease (J00 to J99), cancer (C00 to C97), renal disease (N17-N19) and other (including neurodegenerative diseases and external causes). Co-morbidity was estimated using a modified Charlson Comorbidity Index [11], considering diagnoses recorded on hospital admissions during the last year of life and then categorised as: no comorbidities, minor comorbidities or major comorbidities. Mentions of dementia (F01, F03, G30, R54) or hip fracture (S72) on the death certificate, as underlying, or contributory, cause of death, were also considered as covariates.

Patients were excluded from the analysis due to:
- Registered death with no inpatient activity in 12 months before death (unable to calculate Charlson score)
- Incomplete HES data

Figure 1. Flow chart showing how the study sample was defined
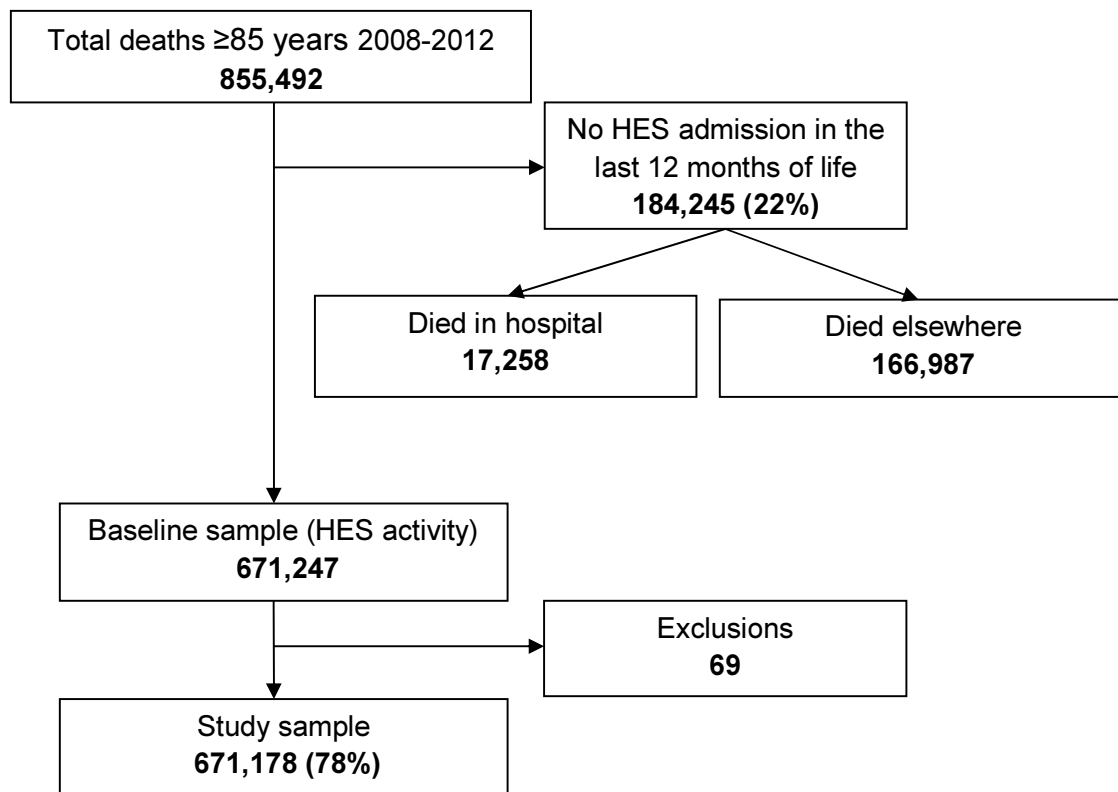
Statistical analysis

Chi-squared tests were carried out to test for associations between place of death (hospital vs. elsewhere) with each of the covariates.

We then undertook multivariable binary logistic regression analysis to estimate odds ratios (OR) with 95% confidence intervals (CI). This modelled the combined effect on the odds of dying in hospital compared to the odds of dying elsewhere, enabling the contribution of each covariate to be assessed, after allowing for the effects of the other covariates.

Results

The study includes adults ≥85 years whose death was registered in England during 2008-2012 (855,492). We excluded those who had no HES activity (22% of this total), i.e. no planned or emergency hospital inpatient admissions in the 12 months prior to death; nearly 10% of these people died in hospital. Deaths were also excluded if data was incomplete (69).

Descriptive statistics are shown in Table 1. The majority of the sample are women (62%) and over half died before the age of 90 (53%). Hospital was the place of death for 62% of the sample. Almost a third of the sample were care home residents at death (31%). Most people had major co-morbidities. Half of the sample had 2 or more emergency hospital admissions in the last 12 months of life (50%) and 85% of people had their first admission (in the last 12 months) in the 100 days prior to death.

The univariable analyses demonstrated statistically significant differences (p < 0.001) in place of death for all variables when considered individually (Table 2).

Results from the multivariable regression model are shown in Table 2. Accounting for potential confounders, dying of a non-malignant disease was associated with an increased likelihood of dying in hospital compared to cancer (Heart disease OR 3.12; 95% CI: 3.07-3.18, Respiratory disease OR 4.54; 95% CI: 4.45-4.62). Mentions on the death certificate of dementia reduced the likelihood of dying in hospital (OR 0.32; 95% CI: 0.31-0.32), whereas a mention of a hip fracture increases the likelihood (OR 2.47; 95% CI: 2.37-2.58). Men have an increased likelihood of dying in hospital (OR 1.03; 95% CI: 1.02-1.04). Increasing age is associated with decreased likelihood of dying in hospital; 90-94 year olds are 1% (OR 0.99; 95% CI: 0.98-1.00) less likely and people over 95 are 9% (OR 0.91; 95% CI: 0.89-0.92) less likely, than their counterparts aged 85-89, to die in hospital. Increasing deprivation is associated with an increase in the likelihood of a hospital death. Care home residents are 66% less likely to die in hospital

(OR 0.34; 95% CI: 0.34-0.35). Compared to people with no co-morbidities, those with minor co-morbidities are 13% more likely to die in hospital (OR 1.13; 95% CI: 1.10-1.15) and those with major co-morbidities were 25% more likely (OR 1.25; 95% CI: 1.23-1.27). Having emergency admissions in the last year of life increases the likelihood of hospital death. People without emergency admissions were 82% less likely to die in hospital than those who had been admitted once (OR 0.18; 95% CI: 0.18-0.19). The likelihood of hospital death increases with the frequency of emergency admissions.

Table 1. Descriptive data for study sample (N=671,178)

	n	(%)
Sex		
Female	417,105	(62.2)
Age at death (years)		
85-89	358,106	(53.4)
90-94	217,620	(32.4)
≥ 95	95,452	(14.2)
Place of death		
In hospital	414,960	(61.8)
Underlying cause of death		
Cancer (C00-C97)	114,887	(17.1)
Heart disease (I00-I52)	142,957	(21.3)
Renal disease (N17-N19)	5,516	(0.8)
Respiratory disease (J00-J99)	121,892	(18.2)
Cerebrovascular disease (I60-I69)	76,946	(11.5)
Other (including dementia)	208,980	(31.1)
National income quartile (1=least deprived)		
1	115,120	(17.2)
2	147,913	(22.0)
3	153,540	(22.9)
4	145,312	(21.7)
5	109,293	(16.3)
Resident in care home		
Yes	199,621	(30.9)
Co-morbidity group (Charlson score)		
No co-morbidities (0)	119,778	(18.5)
Minor co-morbidities (1-5)	72,924	(11.3)
Major co-morbidities (>5)	454,313	(70.2)
Dementia mentioned on death certificate		
Yes	210,598	(31.4)
Hip fracture mentioned on death certificate		
Yes	17,661	(2.6)
No. of emergency admissions in last 12 months of life		
0	23,787	(3.5)
1	312,646	(46.6)
2	175,862	(26.2)
3	85,732	(12.8)
4	39,307	(5.9)
5	17,973	(2.7)
6	8,103	(1.2)
7+	7,768	(1.2)
Timing of first admission in 12 months before death		
6-12 months	53,067	(7.9)
100 days-6 months	49,250	(7.3)
30-100 days	159,645	(23.8)
0-30 days	409,216	(61.0)

Table 2. Results of univariable analysis and multivariable regression

	Univariable analysis	Multivariable regression model		
	Died in hospital (%)	OR	95% CI	p value
Underlying cause of death				
Cancer (C00-C97)	44.2	1.00		
Heart disease (I00-I52)	66.4	3.12	3.07 – 3.18	<0.001
Renal disease (N17-N19)	64.1	4.05	3.81 – 4.31	<0.001
Respiratory disease (J00-J99)	72.1	4.54	4.45 – 4.62	<0.001
Cerebrovascular disease (I60-I69)	66.6	4.09	4.01 – 4.18	<0.001
Other (including dementia)	60.6	4.30	4.23 – 4.38	<0.001
(Dementia (F01, F03, G30, R54))	36.6	Category not included in the model		
Sex				
Female	60.3	1.00		
Male	64.3	1.03	1.02 – 1.04	<0.001
Age at death (years)				
85-89	63.9	1.00		
90-94	61.1	0.99	0.98 – 1.00	<0.1
≥ 95	55.5	0.91	0.89 – 0.92	<0.001
National income quintile (1=least deprived)				
1	59.4	1.00		
2	59.4	1.05	1.03 – 1.07	<0.001
3	61.3	1.15	1.13 – 1.17	<0.001
4	63.2	1.25	1.23 – 1.27	<0.001
5	66.4	1.40	1.37 – 1.42	<0.001
Resident in care home				
No	69.8	1.00		
Yes	43.7	0.34	0.34 – 0.35	<0.001
Dementia mentioned on death certificate				
No	69.7	1.00		
Yes	44.6	0.32	0.31 – 0.32	<0.001
Hip fracture mentioned on death certificate				
No	61.3	1.00		
Yes	80.7	2.47	2.37 – 2.58	<0.001
Co-morbidity group (Charlson score)				
No co-morbidities (0)	54.0	1.00		
Minor co-morbidities (1)	55.3	1.13	1.10 – 1.15	<0.001
Major co-morbidities (>1)	65.1	1.25	1.23 – 1.27	<0.001
Number of emergency admissions in last year of life				
0	23.0	0.18	0.18 – 0.19	<0.001
1	60.9	1.00	-	-
2	64.1	1.12	1.10 – 1.13	<0.001
3	66.1	1.20	1.18 – 1.22	<0.001
4	67.1	1.23	1.20 – 1.26	<0.001
5	68.4	1.27	1.23 – 1.32	<0.001
6	68.6	1.26	1.20 – 1.33	<0.001
7	71.0	1.37	1.30 – 1.44	<0.001

Discussion

In this study we present estimates of the likelihood of dying in hospital for people aged ≥85 years in England and the associated factors. Our analysis demonstrates that, although hospital death rates are falling, the majority (62%) of older people still die in hospital.

Patients dying of non-malignant disease are more likely to die in hospital compared to patients dying of cancer. Care of patients with non-malignant disease is significantly different from cancer patients, due to prognostication difficulties, variable disease trajectories and lower preference for dying at home [6]. Hospital-based palliative care teams should account for this in their provision.

The majority of care home residents now have a dementia diagnosis [12,13]. Those within our sample (31%) were 66% less likely to die in hospital (OR 0.34). Having dementia on the death certificate is associated with a reduction in the likelihood of dying in hospital (OR 0.32), independent of care home residence. This supports previous findings, suggesting that hospital death is less likely for people with dementia or cognitive impairment [4,14]. Although hospital admission can be traumatic for someone with severe dementia, people with cognitive impairment should not be discriminated against in appropriate decisions to admit.

The presence of a family carer is an important determining factor in home death and being married is significantly associated with dying at home or in a hospice for people with dementia [14]. It is postulated that this would have a disproportionate effect on women, who are more likely to be widowed and less likely to die at home [3]. However, our data shows that men are more likely to die in hospital, although the effect size is small (OR 1.03) and may not be of clinical significance. Non-UK studies have failed to show any association between gender and dying in hospital, although one US study also found a significant association (OR 1.07) between male gender and hospital death.

Previous studies have concluded that increasing age is associated with a reduction in hospital deaths and our analysis supports this [4,15]. Despite this, over half of the people in our sample aged ≥ 95 died in hospital.

The odds of a hospital death are highest in the most deprived quintile. Areas with high levels of deprivation are more likely to have higher proportions of limited health literacy (*"the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make basic health decisions"* [16]) than the general population [17], potentially leading to difficulties in achieving a home death.

Patients in our sample were more likely to die in hospital the more co-morbidities they had. These findings correlate with evidence from a Canadian study, that co-morbidity is

associated with increased likelihood of hospital death [18]. Irrespective of other diagnoses, our results suggest that a mention of hip fracture anywhere on the death certificate is associated with an increased likelihood of dying in hospital (OR 2.47).

Increasing frequency in emergency hospital admissions 12 months prior to death is associated with an increased likelihood of dying in hospital. Clinicians could use the opportunity of hospital admission to offer older patients a discussion about future care.

Strengths and limitations

The results of this study are supported by its large sample size. However, HES and ONS data suffers from a degree of inaccuracy in coding and incomplete records [19]. Historically, dementia has been under-diagnosed and under-reported on death certificates [20].

The sample excluded people with no admissions in the 12 months prior to death (22%), as no HES data was available. This may introduce selection bias and it can be seen from Figure 1 that only 9.4% of this group died in hospital, compared to 62% of the final sample. For completeness we would need further information about how this subset of people differed from the study sample.

Calculation of the Charlson score followed the Imperial College methodology, described by the Health and Social Care Information Centre [11] and this relies on accurate coding within the HES data set. This may be influenced by factors, including length of admission where fewer underlying comorbidities may be identified within short admissions.

Our sample only contains people who have already died and therefore the results cannot be used to predict which older people are more likely to die in hospital. We cannot know, for example, if a hospital admission is in the last six months of someone's life until their death. However, there are certain associations, such as deprivation level and care home residence, which are informative and may be used to direct care.

Conclusions

Most older people die in hospital, although the majority of those resident in a care home will die in their usual place of residence. Patients in deprived areas who want to die at home may need more support in order to accomplish this. Many older people die within six months of a hospital admission and this is an (often missed) opportunity to discuss future care.

Acknowledgements

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