Title: End-of-life care costs and place of death across health and social care sectors

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Abstract

Objectives: This study explores the relationship between end-of-life care costs and place of death across different health and social care sectors.

Methods: We used a linked local government and health data of East London residents (n=4,661) aged 50 or over, deceased between 2016 and 2020. Individuals who died in hospital were matched to those who died elsewhere according to a wide range of demographic, socio-economic and health factors. We reported mean health care costs and 95% confidence intervals (CIs) by care sectors over the 12-month period before death. Subgroup analyses were conducted to investigate if the role of place of death differs according to long-term conditions and age.

Results: We found that mean difference in total cost between hospital and non-hospital decedents was £4,565 (95% CI £3,132 – £6,046). Hospital decedents were associated with higher hospital cost (£5,196, £4,499 – £5,905), higher mental health care cost (£283, £78 – £892) and lower social care cost (-£838, -£1,209 – -£472), compared to individuals who died elsewhere. Sub-group analysis shows that the association between place of death and health care costs differs by age and long-term conditions, including cancer, mental health and cardiovascular diseases.

Conclusion: This study suggests that trajectories of end-of-life healthcare costs vary by place of death in a differential way across health and social care sectors. High hospital burden for cancer patients may be alleviated by strengthening health care provision in less cost-intensive settings, such as community and social care.

Key Messages Box

1. What is already known on this topic
   - Health care costs rise significantly as individuals approach the end of life.
   - End-of-life care models increasingly factor in patients' preferences for place of death.
2. What this study adds
   - Trajectories of end-of-life healthcare costs vary by place of death across health and social care sectors.
   - The association between place of death and health care costs differs by age and long-term conditions.
3. How this study might affect research, practice, or policy
   - End-of-life care planning should take a whole-system perspective to help align patients' preferences for place of death with policy makers' objective of maximising resource allocation.
   - End-of-life care planning may target patients for whom non-elective hospital burden may be alleviated by strengthening health care provision in less cost-intensive sectors.

Conflict of Interest
Authors have no conflict of interest to disclose.

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Contributorship Statement
JW: analysis, interpretation, drafting and review; JS: design, dataset construction, interpretation and review; MG: design, interpretation, drafting and review.

1. Introduction

Health care costs tend to rise sharply as individuals approach the end of life [1-3]. The spike in end-of-life (EoL) care costs partly reflects the 'red herring' hypothesis that proximity to death, rather than age, is the key driver to the overall health care costs [4]. Patterns of EoL care costs, nevertheless, may vary across health and social care sectors. For example, the sharp increase in EoL care cost was evident for hospital care but not for social care in the UK [5]. A study investigating secondary health care in Scotland found that EoL service use and the associated costs increased sharply for inpatient care but not for outpatient care or day case [6]. A study exploring health and social care in east London found steep increases in EoL costs for acute settings (emergency department care, planned and unplanned hospital care) but not for non-acute settings (outpatient care, primary care and social care) [7]. These heterogeneous trajectories of EoL costs across settings of care suggest that taking the whole-system perspective may help optimise health care planning at the end of life.

Previous studies have shown that, when given the choice, patients prefer dying in their usual place of residence (home, care home or religious establishment) compared to dying in hospital [8-10]. Nevertheless, half of the deaths in England still occurred in hospitals [11]. The National Institute for Health and Care Excellence (NICE) has included place of death (PoD) as one of the quality indicators for EoL health care [12]. Patients with advance care planning in place were associated with lower rates of hospital death and lower health care costs overall [13, 14]. The extent to which health service use at the end of life is related to PoD is unknown. Those who die in hospital tend to be associated with higher costs than those who die elsewhere due to high hospital care costs. However, this might just reflect differences in care needs or treatment intensity, and it is unclear whether health care costs are driven by PoD once these differences are accounted for.

Understanding service use across different sectors may be key to optimise resource allocation and care provision at the end of life [15]. For example, many studies have documented hospital care costs being the largest contributor to EoL care costs [7, 16, 17]. With good community support, some of the hospital burden could be directed to community-based services [6]. Nevertheless, most published studies have not considered the impacts on EoL health care planning on health care costs across different settings.

In addition, long-term conditions play an important role in EoL health care planning due to heterogeneous care pathways. Chronic conditions typically lead to high health care costs in hospital versus other sectors [18], but it is unclear the extent to which this relationship differs according to place of death. Moreover, EoL health care costs may vary largely across long-term conditions themselves, but this is yet not well understood [19].

This paper addresses these gaps in the literature by exploring the association between PoD and EoL health care costs across different care sectors. We assess whether differences in EoL health care costs according to PoD are determined by key individual characteristics, including age and long-term conditions.

2. Methods

In this paper, we matched hospital and non-hospital decedents from a large cross-sectional dataset to explore the relationship between PoD and EoL care costs across health and social care sectors.

2.1. Data

We used a dataset which links local government, health providers and commissioners in London Borough of Barking and Dagenham (B&D). This dataset contains information of health service use across five sectors: primary care, hospital, social care, community health care and mental health care. We obtained social care activities from the B&D council, community and mental health activities from the North East London NHS Foundation Trust, and primary care activities, hospital activities and health-related factors from the local Clinical Commissioning Group [15]. B&D has around 212,000 residents which are more ethnically diverse and with higher levels of deprivation than the rest of the UK [20]. Our data covers around 201,000 residents of B&D. In this study, we focus on residents who died between 1st April 2016 and 31st March 2020 (n=5,001). The dataset included month and year of death from the GP record. We set these to the end of the month to ensure we included all health activity in the days preceding death. We excluded those under the age of 50 (n=340) because younger people are more likely to die from unnatural causes, such as accidents and suicides.

2.2. Place of death

We used the hospital discharge method to identify whether the decedents died in hospital or elsewhere. The hospital discharge variable indicated whether the patient was: 1) discharged on clinical advice or with clinical consent, 2) discharged him/herself or was discharged by a relative or advocate, 3) discharged by mental health review tribunal, Home Secretary or Court, or 4) deceased. We have checked the month of discharge for those who were indicated as 'deceased' to ensure that their GP record for months of death were correct. We created a dummy variable about hospital decedents taking the value 1 if hospital discharge indicated 'deceased', or 0 otherwise.

2.3. Health care costs

The endpoint of interest in our analysis is healthcare costs. In general, we applied top-down gross-costing methods by assigning costs to each service use across five sectors [21]. Primary care service use included GP visits, non-GP visits and prescriptions and were costed by assigning a unit cost taken from the Unit Cost Health and Social Care [22]. Hospital costs were calculated based on the Healthcare Resource Group (HRG) national tariff [23]. Social care costs were calculated by using the weekly billed costs of each care package provided by the local government. Community health and mental health care costs were from the patient level costing data of North East London NHS Foundation Trust, a local health provider [15]. Detailed costing methods were reported in the online Supplementary Information.

2.4. Demographic and socio-economic variables

The dataset included rich information about patient characteristics. These included age, gender, ethnicity, smoking status, body mass indices (BMI), and diagnosis of long-term conditions. These variables were obtained from the primary care records. This dataset also contains information of indices of multiple deprivation (IMD) from the national dataset.

2.4. Statistical analysis

We matched hospital decedents to non-hospital decedents based on their characteristics 12 months before they died by using a genetic matching approach [24]. This matching approach is a generalisation of both propensity score matching and Mahalanobis matching; it optimises the post-matching balance by iteratively checking the covariate balance to minimise the weighted Mahalanobis distance for each matched pair, and it has been shown to exhibit good balance properties with cost data [25].The matching covariates considered in this paper included age, gender, ethnicity, IMD, smoking status, BMI, the financial year when the decedent died, long-term conditions categorised by the International Classification of Disease 10th Revision (ICD-10) and propensity scores estimated by logistic regressions.

Firstly, we calculated mean differences in costs between the two comparison groups in the final year of life by each care sectors. 95% confidence intervals (CIs) were obtained via non-parametric bootstrap. Following Austin and Small [26], we sampled matched pairs without replacement, and considered biased-corrected CIs derived from 10,000 bootstrap samples. Secondly, we reported cost trajectories by focusing on the mean monthly costs over the last 12 months of life across different care sectors. Scatter plots with locally weighted fitted curves were generated to visualise healthcare cost trajectories [27]. The dataset included the month but not the day of death, and hence the costs associated with last calendar month of life may be somewhat shrunk because patients may die before

the end of the month. Thirdly, we conducted subgroup analysis by using generalised linear models (GLM) to investigate whether the relationship between EoL care costs and PoD differed according to key patient characteristics, such as age and long-term conditions.

Some socio-demographic variables had missing data, including ethnicity (n = 967), IMD quintile (n = 9), BMI category (n = 391), and smoking (n = 2,318). We used multiple imputation to address the missing data and followed recent methodological guidance on how to appropriately combine multiple imputation with both matching [28] and non-parametric bootstrap [29]. We examined the intracluster correlation coefficient (ICC) of total health care costs across different GP practices. The low ICC (0.0025) ensures that a standard multiple imputation may yield acceptable type I error rates [30]. Following methodological guidelines [31], we assumed that data was missing at random. Descriptive statistics for samples before and after imputation can be found in the online Supplementary Information. All analyses were performed using R version 4.4.2.

3. Results

3.1. Main results

Our sample contains 4,661 decedents, with 1,810 died in hospital and 2,851 died elsewhere. After matching, we have 1,810 pairs of hospital and non-hospital decedents. Balance between the two comparison groups according to key prognostic factors is presented in Table 1. The descriptive statistics prior to matching and overlap of the propensity scores between comparison groups are presented in the online Supplementary Information.

Table 1. Balance between covariates within the matched sample

	Hospital decedents (n = 1,810)		**Non-hospital decedents (n = 1,810)**		**Absolute standardised mean differences**
Variable	**N**	**percentage**	**n**	**percentage**	
Age					
50-64	196	10.83%	196	10.83%	<0.0001
65-74	300	16.57%	300	16.57%	<0.0001
75-84	565	31.22%	565	31.22%	<0.0001
85+	749	41.38%	749	41.38%	<0.0001
Gender					
Male	874	48.29%	874	48.29%	<0.0001
Female	936	51.71%	936	51.71%	<0.0001

Ethnicity					
White	744	41.10%	788	43.54%	0.0494
Black	76	4.20%	76	4.20%	<0.0001
Asian	124	6.85%	114	6.30%	0.0219
Mixed	849	46.91%	823	45.47%	0.0288
Other	17	0.94%	9	0.50%	0.0458
IMD quintiles					
1 (most deprived)	973	53.76%	994	54.92%	0.0233
2	637	35.19%	658	36.35%	0.0243
3+	200	11.05%	158	8.73%	0.0778
BMI					
Underweight	187	10.33%	182	10.06%	0.0091
Healthy	688	38.01%	719	39.72%	0.0353
Overweight	528	29.17%	537	29.67%	0.0109
Obese	320	17.68%	310	17.13%	0.0145
Morbidly obese	87	4.81%	62	3.43%	0.0646
Smoking					
Ex-smoker	708	39.12%	647	35.75%	0.0691
Non-smoker	791	43.70%	866	47.85%	0.0835
Smoker	311	17.18%	297	16.41%	0.0205
Financial year					
2016/2017	431	23.81%	425	23.48%	0.0078
2017/2018	488	26.96%	460	25.41%	0.0349
2018/2019	484	26.74%	460	25.41%	0.0300
2019/2020	407	22.49%	465	25.69%	0.0768
Long-term conditions					
Mental health	382	21.10%	474	26.19%	0.1245
Cancer	380	20.99%	422	23.31%	0.0570
Other diseases	1565	86.46%	1480	81.77%	0.1287
Respiratory disease	568	31.38%	470	25.97%	0.1167
Cardiovascular disease	1367	75.52%	1281	70.77%	0.1105
Endocrine, nutritional and metabolic diseases	691	38.18%	591	32.65%	0.1137
Nervous system	49	2.71%	41	2.27%	0.0272

Mean differences in health care costs in the last year of life between hospital and non-hospital decedents are reported in Table 2. Mean differences in EoL costs in the last 3 months of life are reported in the online Supplementary Information. The total health care cost for hospital decedents was £4,565 (95% CI £3,132, £6,046) higher than for non-hospital decedents. This was largely driven by differences in non-elective (non-planned) hospital costs, £4,690 (95% CI £4,070, £5,380). Hospital decedents were associated with higher costs in mental health care (£283; 95% CI £78, £892) but differences were relatively small. Hospital decedents had lower social care costs (-£838; 95% CI -

£1,209, -£472) and community care costs (-£186; 95% CI -£1,125, £709), although uncertainty in the latter was much larger.

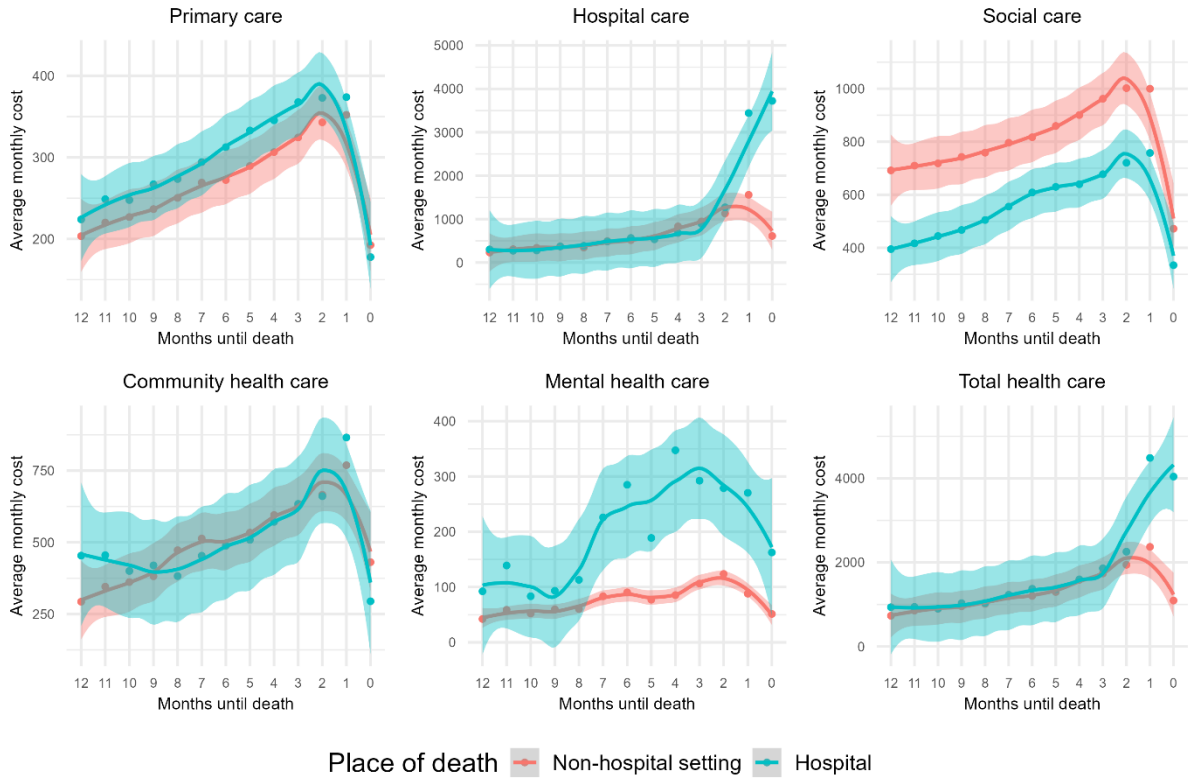
Table 2. Mean costs in the final year of life by settings of care

Setting of care	Hospital decedents (n = 1,810)	Non-hospital decedents (n = 1,810)	Mean differences [95% CI]
Primary care	£3,860	£3,750	£111 [-£162 £380]
GP	£182	£167	-£15 [-£28 -£2]
Non-GP	£32	£31	£1 [-£2 £4]
Prescription	£3,661	£3,537	£124 [-£147 £391]
Hospital	£12,874	£7,678	£5,196 [£4,499 £5,905]
Accident & Emergency	£593	£442	£151 [£116 £185]
Elective care	£811	£523	£288 [£110 £463]
Non-elective care	£11,099	£6,409	£4,690 [£4,070 £5,308]
Outpatient	£372	£304	£67 [£30 £109]
Community health care	£4,993	£5,179	-£186 [-£1,125 £709]
Mental health care	£502	£219	£283 [£78 £892]
Social care	£1,241	£2,080	-£838 [-£1,209 -£472]
Total health care cost	£23,470	£18,905	£4,565 [£3,132 £6,046]

Figure 1 shows monthly cost trajectories over the last 12 months of life. Total health care costs for both groups steadily increased with proximity to death (with CIs overlapping to a large extent), except in the last 3 months, where costs for hospital decedents spiked. This pattern reflects closely the trajectories of hospital costs for both groups. Mental health care costs rose somewhat over time for hospital decedents but remained fairly unchanged for non-hospital decedents. Non-hospital

decedents had consistently higher social care costs over the last 12 months of life compared to hospital decedents.

Figure 1. Mean monthly costs in the final year of life



3.2. Subgroup Analysis

Table 3 reports subgroup analysis according to long-term conditions. Amongst non-hospital decedents, those with other conditions including respiratory and cardiovascular diseases had a significantly higher total health care cost (by £6,757), compared to those with no long-term conditions (reference category). This difference was mostly driven by primary care, hospital and community care costs. In addition, non-hospital decedents with cancer were associated with lower primary (-£502) and social care (-£1,552) costs but higher hospital costs (£3,256) compared to those with no long-term conditions.

Differences in total health care costs between hospital and non-hospital decedents did not differ according to long-term conditions. However, we identified some important interactions within specific sectors, especially for cancer patients. For example, primary care costs were lower for cancer patients if they died in hospital (-£749), compared to individuals with no long-term conditions (£135). In

addition, hospital costs were lower (-£1,857) amongst cancer patients who died in hospital, compared to hospital decedents with no long-term conditions (£6,240).

Table 4 reports interactions between PoD and age categories. Amongst non-hospital decedents, those aged 65-74, 75-84 and 85 or above had much higher total health care costs at the end of life (£3,846, £4,600 and £5,497, respectively) compared to those under the age of 65 (reference category). These higher costs were mainly driven by their higher costs in primary and community care.

Amongst decedents aged 65 or below, dying in hospital was associated with a much higher total health care cost (£12,801), compared to dying elsewhere. This difference is over twice as large the overall difference in total costs between hospital and non-hospital decedents across all age categories (£4,565, Table2). The relative differences in total health care costs between hospital and non-hospital decedents are much lower for all age categories over 65s, compared to those under 65s.

Table 3. Health care costs (£GBP) for patient subgroups defined according to long-term conditions. The reference group is non-hospital decedents without any long-term condition.

	Primary care	**Hospital**	**Community health care**	**Mental health care**	**Social care**	**Total health care**
Hospital death	134.94	6240.00***	753.73	1456.61	101.49	8686.76***
	(223.67)	(777.98)	(743.92)	(1200.74)	(642.68)	(1862.81)
Cancer	-502.00**	3255.98***	368.30	-74.42	-1551.97***	1495.90
	(195.15)	(574.50)	(742.77)	(46.80)	(209.69)	(1148.66)
Mental health	200.01	-901.42*	-425.20	135.46**	2124.02***	1132.87
	(205.39)	(460.51)	(710.75)	(59.35)	(432.78)	(1128.09)
Other diseases	2032.64***	2020.85***	2954.00***	-24.55	-225.95	6756.98***
	(168.94)	(476.19)	(505.84)	(59.95)	(408.68)	(998.68)
Hospital death × Cancer	-748.77***	-1856.83**	356.53	-157.57	359.38	-2047.27
	(283.10)	(849.08)	(1069.76)	(360.89)	(271.12)	(1704.60)
Hospital death × Mental health	480.92	-224.91	1228.75	287.19	-855.67	916.28
	(338.10)	(941.52)	(1006.04)	(312.18)	(566.22)	(1696.51)
Hospital death × Other diseases	362.02	-10.57	-1035.42	-1363.61	-603.47	-2651.05
	(254.14)	(818.46)	(843.32)	(1110.82)	(632.04)	(1885.49)
Constant	1686.17***	4547.78***	2145.69***	193.52***	1811.36***	10384.53***
	(144.65)	(423.72)	(406.44)	(51.09)	(404.62)	(900.59)
Adjusted R squared	0.0488	0.0894	0.0041	0.0046	0.0321	0.0307

Number of decedents in each subgroup: cancer (n = 802), mental health (n = 856), other diseases (n = 3,045), hospital decedents with cancer (n = 380), hospital decedents with mental health diseases (n = 382), hospital decedents with other diseases (n = 1,565).
Standard errors are in parentheses
* p<0.10 ** p<0.05 *** p<0.01

Table 4. Health care costs (£GBP) for patient subgroups defined according to age. The reference group is non-hospital decedents aged 65 or below.

	Primary care	Hospital	Community health care	Mental health care	Social care	Total health care
Hospital death	874.28**	8245.45***	2021.72**	1197.18	461.91	12800.53***
	(378.64)	(1176.02)	(1010.64)	(1311.61)	(606.05)	(2252.10)
Age 65-74	678.02**	940.35	2476.48**	-139.15	-110.13	3845.57**
	(334.98)	(957.21)	(1080.30)	(182.46)	(440.59)	(1800.98)
Age 75-84	1346.18***	194.98	2796.80***	-169.06	430.93	4599.82***
	(310.58)	(836.84)	(802.06)	(176.06)	(440.59)	(1532.14)
Age 85+	1289.44***	-106.55	2652.44***	-170.37	1832.18***	5497.13***
	(280.59)	(797.14)	(718.96)	(174.74)	(464.94)	(1431.05)
Hospital death × Age 65-74	-484.61	-2578.06*	-2394.39	-934.23	-770.31	-7161.60**
	(511.17)	(1506.71)	(1543.36)	(1343.62)	(665.34)	(2883.64)
Hospital death × Age 75-84	-641.85	-2210.53*	-2397.95*	-1071.08	-657.90	-6979.32***
	(465.54)	(1325.23)	(1284.99)	(1313.35)	(682.90)	(2597.19)
Hospital death × Age 85+	-252.29	-3067.53**	-1285.38	-988.84	-1780.68**	-7374.72***
	(438.95)	(1271.02)	(1198.50)	(1317.49)	(694.94)	(2496.49)
Constant	2217.38***	6550.63***	2154.52***	337.91*	946.56**	12207.00***
	(244.77)	(731.38)	(542.39)	(173.39)	(368.42)	(1213.54)
Adjusted R squared	0.0102	0.0780	0.0014	0.0020	0.0130	0.0233

Number of decedents in each subgroup: 65-74 (n = 600), 75-84 (n = 1,130), 85+ (n = 1,498), hospital decedents aged 65-74 (n = 300), hospital decedents aged 75-84 (n = 565), hospital decedents aged 85+ (n = 749).
Standard errors are in parentheses
* p<0.10 ** p<0.05 *** p<0.01

4. Discussion

4.1. Main findings

Patterns of EoL health care costs seem to vary by PoD, in a differential way across health care sectors. Hospital decedents are associated with higher mean hospital and mental health care costs but less social care costs, compared to non-hospital decedents, in their final year of lives. Non-elective hospital care was the major contributor to the overall differences in mean total costs between hospital and non-hospital decedents. The association between place of death and health care costs differ according to subgroups defined by age and certain long-term conditions, such as cancer and mental health. Higher difference in total health care costs by PoD were found for those under 65s compared to the overall age categories. This may be related to the higher probability of under-65s being admitted to hospital (and dying) due to acute events. In addition, we found that dying in hospital was associated with a much lower total health care cost for the oldest old, mostly due to their smaller hospital care utilisation preceding death.

This is the first study to assess the relationship between place of death and EoL care costs across five different sectors. Our study adds to a previous paper that assessed the impact of advance care planning (which includes place of death) on hospital admissions for patients within a single hospice in South West of England [16]. The study found that, irrespective of advance care planning, mean annual costs in hospital was £11,299 for hospital decedents and £7,730 for non-hospital decedents, which were in line with our estimations for hospital care costs. Our study suggests that health care costs also differed according to PoD across other health care sectors, such as mental health and social care.

Jayatunga and colleagues [7] matched decedents and survivors in east London to compare their patterns of cost across hospital, primary and social care sectors. They found a sharp increase in unplanned hospital care costs and a decrease in social care costs for decedents in their final 12 months of life. Our study adds to this work in two different ways: 1) we assessed health care cost patterns across other sectors, including mental health and community care, and found that they both steadily increase with proximity to death, except for the last 2-3 months of life where they somewhat fall perhaps due to increased hospital admissions; 2) we reported patterns of health care costs by PoD, which suggests that, the spike in hospital care costs at the EoL is associated only with individuals who actually die in hospital. This spike in the last 3 months of life is the main driver of the overall difference in annual costs between hospital and non-hospital decedents. In addition, we found that both primary and social care costs increase with proximity to death, but PoD seems to be only associated with social care costs.

Focusing on a single public hospital in Singapore, Kaur and colleagues [19] explored how EoL hospital care costs varied across long-term conditions, but did not compared costs according to place of death. The study suggested that decedents with cardiovascular and respiratory-related conditions were associated with higher hospital cost compared to those with cancer. We found that hospital cost for decedents with 'other diseases' (which includes cardiovascular and respiratory conditions) (£6,569) was higher compared to those without long-term conditions (£4,548) partially due to the higher number of hospital admission and longer hospitalisation, but lower compared to those with cancer (£7,804). This partly reflects that cancer care were mostly managed by hospital oncology team in the UK [32]; however, in Singapore, cancer patients tend to have lesser acute care utilisation compared to non-cancer patients [33]. Our findings further show that decedents with 'other diseases' incur higher primary and community care costs than those with cancer and mental health, but lower mental health and social care costs than decedents with mental health.

This study also adds more generally to the vast literature exploring the determinants of health care costs at the end of life. Previous studies suggest that hospital care costs depend on proximity to death, whereas non-hospital care costs are more independently driven by age [4, 34, 35]. By exploring EoL care costs by PoD, our study finds that hospital care costs are strongly linked to proximity to death only for those who die in hospital, but not for those dying elsewhere. Our subgroup analyses suggest that health care costs in primary, community and social health care costs depend more on age (Table 4) than proximity to death (Figure 1).

4.2. Limitations

This study has a few limitations. Firstly, the findings from this paper may not directly generalise to other geographical areas in England. Our sample was drawn from B&D, where the population is more ethnically diverse and with higher levels of deprivation than the rest of the country [20]. Secondly, whilst we matched hospital and non-hospital decedents according to key determinants of costs, we did not account for disease severity or treatment intensity. This might have led to the cost differences between hospital and non-hospital decedents being somewhat overestimated as disease severity is positively associated with hospital admission [36]. Furthermore, beyond long-term conditions, we did not distinguish other long term health needs such as mobility disabilities or sight loss. Thirdly, we lack the information of cause of death, potentially influencing how we identified the patterns of health care costs [37]. To reduce this bias, we have excluded decedents under the age of 50 and considered the diagnosis of long-term conditions whilst matching. Nevertheless, we understand the patterns might still be different if we knew the cause of death. Fourthly, our dataset does not cover informal care sector, which constitutes an important part of EoL health care [10]. Lastly, our study did not

include palliative care, which is likely to be an important element for advance care planning. We are currently in discussion with local hospices and the hospice at home provider to link hospice care records with our dataset, which would provide an interesting avenue for further research.

4.3. Policy implications

Understanding the relationship between PoD and EoL care costs across multiple care sectors is important to inform the design of EoL care models, such as the Advance Care Planning [38]. This study suggests that EoL care planning may target subgroups of patients for whom non-elective hospital burden can be alleviated by strengthening health care provision in less cost-intensive settings. For example, our results suggest dying in hospital is associated with higher hospital cost for non-cancer patients, for whom acute care might be avoided by monitoring and supporting more closely in non-hospital care settings. In addition, amongst non-hospital decedents, cancer patients had somewhat higher hospital compared to non-cancer patients. Given that the disease trajectory of cancer patients tend to be more predictable [39], there may be opportunities to shift some of the non-elective hospital care costs to other settings, such as community and home-based palliative care. In many cases, it will not be practically feasible to meet patients' preferences for dying in a non-hospital setting, and hence no efficiency gains can be made of. However, taking a broad whole-system perspective in EoL health care planning can help optimise resource allocation whenever feasible, while improving quality of life by meeting patients' preferences at the end-of-life [40]. This should be supported through early discussions between patient and a multidisciplinary team, including general practitioners, community care teams and social workers [13, 41, 42].

5. Conclusion

This study finds that end-of-life care costs are associated with place of death, with non-elective hospital care costs contributing the most to total health care expenditure. Cost trajectories are heterogenous across different health and social care sectors. Hospital decedents are associated with higher hospital costs and mental health care costs, and lower social care costs compared to non-hospital decedents. The association between place of death and health care costs differs according to subgroups defined by age and certain long-term conditions, such as cancer and mental health. End-of-life care planning should take a whole-system perspective to help align patients' preferences for place of death with policy makers' objective of maximising resource allocation. We suggest that the high hospital burden may be alleviated by strengthening health care provision in less cost-intensive settings, such as community and social care, particularly for cancer patient subgroups.

6. References

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