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Delayed Discharges and Hospital Type: Evidence from the English NHS*

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Abstract

Delayed discharges of patients from hospital, commonly known as bed-blocking, are a long-standing policy concern. Delays can increase the overall cost of treatment and may worsen patient outcomes. We investigate how delayed discharges vary by hospital type (Acute, Specialist, Mental Health, Teaching) and the extent to which such differences can be explained by demography, case mix, hospital quality, the availability of long-term care, and hospital governance as reflected in whether the hospital has Foundation Trust status, which gives greater autonomy and flexibility in staffing and pay. We use a new panel database of delays in all English NHS hospital Trusts from 2011–12 to 2013–14. Employing count data models, we find that a greater local supply of long-term care (care-home beds) is associated with fewer delays.

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JEL classification numbers: I10, I18.

Hospitals that are Foundation Trusts have fewer delayed discharges and might therefore be used as exemplars of good practice in managing delays. Mental Health Trusts have more delayed discharges than Acute Trusts, but a smaller proportion of them are attributed to the NHS, possibly indicating a relatively greater lack of adequate community care for mental health patients.

Policy points

- Foundation Trusts have fewer delayed discharges and might therefore be used as exemplars of good practice in managing delays.
- Mental Health Trusts incur more delays with a higher proportion outside the control of the NHS. This may indicate unmet need for mental health patients, and possible lack of coordination over provision of social care.
- Greater local provision of long-term care beds in care homes reduces delayed discharges in hospitals, confirming the importance of coordinating health and social care.

I. Introduction

Over 1.2 million bed-days were lost in the National Health Service (NHS) in England in 2013–14 because patients remained in hospital after they were medically ready to be discharged. The annual cost of patients aged 65 and over occupying hospital beds but no longer in need of acute treatment has been estimated at £820 million.[1] Such delayed discharges, often referred to as bed-blocking, are a long-standing policy concern. In the UK, the issue is as old as the NHS. Lowe and McKeown (1949) noted that the creation of the NHS divided the responsibility for health and other forms of care and that the allocation of patients to appropriate care settings began to increase in importance.[2]

Despite subsequent changes in the provision and organisation of health and long-term care (LTC) services, including attempts to improve integration between the sectors,[3] the problem of delayed discharges persists. As the King's Fund has reported,[4] delayed discharges remain an important concern among NHS managers. A recent report of the House of Commons Health Committee

[1] National Audit Office, 2016.

[2] Before the creation of the NHS, Poor Law Authorities were responsible for the social (long-term care) and medical (hospital) needs of people in their area. The difference in cost between caring for an elderly person in hospital and elsewhere may have been small, due to the limited differences between settings in terms of equipment and staff at the time. The National Health Service Act in 1946 specifically set the remit of the new hospital boards created to be providers of hospital care, creating a division of responsibility for the different services.

[3] Glasby, Dickinson and Miller, 2011.

[4] Appleby et al., 2013.

pointed to delayed discharges as one of the reasons for hospital accident and emergency departments missing their access targets.[5]

Concern about delays is also not limited to the UK. In many member countries of the Organisation for Economic Co-operation and Development (OECD), hospital and long-term care provision is frequently divided between different sets of institutions. The funding and organisation of these two sectors often differ, with each acting independently of the other. The separation of responsibilities can lead to delays due to lack of communication and coordination. The supply of long-term care is not controlled by the hospitals. But if a care-home bed is not available when a hospital patient is ready to be transferred, the patient is forced to remain in hospital until a bed becomes free or they are sufficiently recovered to go home. Delays may be the result of poor hospital management and protocols. For example, a patient may have a delayed discharge because a consultant (senior doctor) is not on duty to authorise the discharge or because the patient is waiting for a transfer to non-acute NHS community care.

A growing elderly population, measured both absolutely and as a proportion of the total population,[6] suggests that the problem is likely to become worse because use of health and LTC services is concentrated among the elderly.[7] Bardsley et al. (2012) found that 10 per cent of people aged 75 and over in 2005–06 used both hospital and LTC services in the same year. This demand pressure increases the importance of allocating patients to the appropriate care setting.[8]

The cost of delays in discharging patients from hospital is financial and clinical. Since hospital care is more expensive than care in other settings, a patient who can be appropriately cared for in another setting, such as an LTC institution (residential home or nursing home) or with support in their own home (home care), will be less costly to treat if discharged from hospital. There are also some greater clinical risks to the patient of being in hospital when medically ready to be discharged, including hospital-acquired infection and pressure sores.[9]

Previous research suggests that provision of LTC affects the extent of bed-blocking.[10] But hospitals can also reduce bed-blocking through good discharge planning and communication with LTC providers. For example, an internal analysis of delays in the Sheffield Teaching Trust[11] resulted in

[5]House of Commons Health Committee, 2013.
[6]European Commission Economic Policy Committee, 2009.
[7]de Meijer et al., 2011.
[8]See Kuhn and Nuscheler (2011) for a theoretical analysis.
[9]Health Foundation, 2013.
[10]Fernandez and Forder, 2008; Gaughan, Gravelle and Siciliani, 2015.
[11]Health Foundation, 2013.

changes in procedure, which reduced delays without increasing readmissions – an indication that the prompter discharges were appropriate.

1. Aims and hypotheses

We investigate how delayed discharges vary by type of NHS hospital. NHS hospitals are classified for administrative and regulatory purposes in two main ways. First, depending on their patient group and functions, they are designated as Acute, Specialist, Teaching or Mental Health. Second, depending on their governance structure, they may have Foundation Trust (FT) status, which gives them greater autonomy.

We focus on hospital type since it is readily observed and many existing NHS policies are defined in terms of hospital type. For example, Specialist hospitals receive top-up payments over and above the standard payments for each patient treated.[12] Mental Health providers have different payment rules from other providers, with a greater proportion of their funding coming from block contracts with local health care budget holders and less varying with the number of patients treated. Teaching hospitals receive additional payments for teaching services. Hospitals with FT status face a less constraining regulatory regime than other hospitals: they do not have to break even each year, they can borrow to invest and they have greater freedom in paying their staff. Hospital types with fewer delays could be used as examples of good practice. Those with more delays could be targeted by specific policy interventions. Moreover, our data on delayed discharges are at hospital rather than individual patient level.

We compare differences in delays across types of provider before and after controlling for a range of factors such as patient demographics, case mix, size and the availability of long-term care. Any remaining differences across hospital types after allowing for these factors may be due to the different types of organisation (due to specialisation or greater autonomy), different services (acute, mental health) or additional responsibilities (such as teaching).

The a priori effect of hospital type on delays is unclear. Foundation Trust status requires that the hospital demonstrates quality of care and financial viability.[13] FT status can be considered a label of good-quality care. Higher quality, driven by more efficient management of patient pathways, may reduce discharge delays but might also attract more severe and complex patients with a higher risk of suffering delay.

[12] Acute NHS hospitals are paid by a prospective payment system with price per patient treated varying with the patient's Health Resource Group (HRG), which is defined by diagnosis and procedure. Similar grouping-with-tariff systems, referred to as Diagnosis Related Group (DRG) payment systems, are used in many other European and OECD countries.

[13] Monitor, 2007 and 2013.

Specialist Trusts may obtain efficiency gains and provide higher quality by focusing on a narrower range of patients, such as those with cardiovascular or orthopaedics conditions. This may lead to fewer delays for these patients. But specialist hospitals may also attract more complex patients who may have more requirements for post-treatment long-term care services, which may take longer to arrange. Teaching Trusts educate medical students as well as treating patients and this reduces the amount of attention that senior staff can devote to patient care once immediate medical needs are met. Teaching hospitals may also attract more complex patients who are more prone to delays.

Mental Health Trusts treat patients with serious mental illness rather than physical health problems. These patients are often managed partly by community facilities such as Crisis Resolution Teams and Home Treatment Teams. Thus they may have better links to community and long-term care than other types of hospital, but their patients may be more difficult to place in suitable facilities outside hospital. There is also concern that mental health services are relatively underfunded. Where this results in insufficient resources in the hospital or provision of community care for mental health conditions, this could increase delayed discharges.

2. Related literature

Forder (2009) investigated the degree of substitution between hospital and LTC services in 8,000 English electoral wards and estimated that a £1 increase in spending on care homes was associated with a £0.35 fall in hospital costs. Fernandez and Forder (2008) and Gaughan, Gravelle and Siciliani (2015) found that English patients living in local authorities with fewer care-home and nursing-home beds were more likely to have a delayed discharge. Hospital readmissions are also higher in local authorities with lower care-home or home-help supply.[14]

Our study contributes to the literature on the substitution between hospital and LTC. The analyses in Fernandez and Forder (2008) and Gaughan, Gravelle and Siciliani (2015) were at local authority level and could not examine the impact of hospital characteristics on hospital delays since patients resident in a local authority are likely to be treated in one of several hospitals. We believe our study is the first that attempts to examine variations in delayed discharges across *hospitals*. It is also relevant for the extensive empirical literature on quality and efficiency differences across hospital types (for-profit versus non-profit, specialised versus non-specialised, etc.) as surveyed in Eggleston et al. (2008).

[14]Fernandez and Forder, 2008.

Section II details the data. Section III provides the methods. Section IV reports descriptive statistics and regression results. Section V discusses potential mechanisms underlying the findings. Section VI concludes.

II. Data

We employ a new database which measures delays at hospital Trust[15] level and includes all NHS hospital Trusts in three financial years – 2011–12, 2012–13 and 2013–14.

1. Dependent variable

Information on hospital delays are reported at hospital, rather than individual patient, level. The 'Acute and Non-Acute Delayed Transfers of Care' data set[16] contains monthly information submitted by Trusts to the Department of Health on the number of delayed transfers of patients, as required by the Community Care (Delayed Discharges etc.) Act 2003.[17] Since the Act only covers delays among adults, specialist children's hospitals are not included in the analysis. We also exclude hospitals specialising in maternity, gynaecology and neonatal care, sometimes referred to as 'women's hospitals', as they serve relatively young patients who are unlikely to require long-term care and who have a negligible number of delayed discharges. We have information on delays for all English Acute and Mental Health Trusts in three financial years.

A delay is defined as occurring when a clinical decision has been made that a patient is ready for discharge from hospital and a multidisciplinary team agrees with this decision. The multidisciplinary team includes 'nursing and other health and social care professionals caring for that patient in an acute setting'.[18] When a delayed discharge occurs, it is attributed to the NHS Trust where the patient was treated, to the local authority where the patient resides or to both. There is a formal dispute procedure for cases where agreement over attribution is not reached between the institutions concerned.

We measure delayed discharges as the total number of bed-days lost per year due to delayed patients. We measure both the total number of delayed days (*Delays*), whether attributed to the NHS or not, and those attributed to the NHS only (*Delays attributed to the NHS*).

[15]Our unit of analysis is the Trust, though many Trusts operate on more than one site.

[16]NHS England, 2014a.

[17]The Act allows NHS Trusts to claim reimbursement from local authorities in charge of care home and community care provision in their area, if necessary services are not provided in time for the discharge of an acute patient and this is solely the responsibility of the local authority. A Trust can only claim such reimbursement if it gives at least three days' notice that a patient is likely to require LTC on discharge and at least 24 hours' notice of the discharge (Department of Health, 2003; NHS England, 2010b). Trusts must report all delays that occur, irrespective of whether they are entitled to reimbursement for them.

[18]NHS England, 2010b.

2. Types of Trust

Information on type of Trust is from the National Reporting and Learning System.[19] There are four mutually exclusive types of Trust: Acute Trusts,[20] Acute Specialist Trusts, Acute Teaching Trusts and Mental Health Trusts.[21]

Acute Trusts provide acute hospital care without a specific focus on teaching or a specific type of patient or condition. Acute Teaching Trusts are generally large providers with a wide range of departments, linked to a university and providing training for medical students as well as treating a full range of patients. Acute Specialist Trusts are a regional or national centre for a particular field of medicine, such as cancer or orthopaedics. They treat the most complex cases in a field and are generally small compared with Acute Trusts. Mental Health Trusts provide hospital care to patients with mental health conditions. In this, they are similar to Acute Specialist Trusts, but they are similar in size to Acute Trusts and there are far more Mental Health Trusts than there are Acute Specialists in a specific field.

Trusts of all four types can also have Foundation Trust status,[22] the requirements for which are the same for all Trust types. There were only small changes in the number of Trusts with FT status and in their distribution across the four Trust types over the study period.

3. Control variables

We control for the number of beds in a Trust, taking data from 'Quarterly bed availability and occupancy' submitted to the Department of Health and published by NHS England.[23] The average number of beds is given at Trust level for each quarter of a financial year.[24] We use the average of the sum of the number of available and occupied beds reported for the four quarters of each financial year. To account for potential non-linearity in the relationship between beds and delays, beds are also measured as categorical variables: 200–399, 400–599, 600–799, 800–999, 1,000–1,499 and 1,500+ beds. The base case is 0–199 beds.

We use four Trust-level case-mix variables: the percentages of admissions that are emergencies, for males, patients aged 60–74 and patients aged 75+.[25]

[19]NHS England, 2013.

[20]Within the set of Acute Trusts that are not categorised as Acute Specialist or Acute Teaching, there are three subsets: Small Acute, Medium Acute and Large Acute. Size in this instance is defined by income (HSCIC, 2013c). We ignore these subsets so that size is measured by beds for all Trust types (Acute, Acute Specialist, Acute Teaching and Mental Health Trusts).

[21]Manhaes, Glampson and Pryce, 2013.

[22]Monitor, 2014.

[23]NHS England, 2014b.

[24]NHS England, 2010a.

[25]HSCIC, 2013b.

We include risk-adjusted emergency readmission rates within 28 days of discharge from hospital as a measure of hospital quality.[26] The data are from the Indicator Portal of the Health and Social Care Information Centre (HSCIC) website[27] and are indirectly standardised by age, gender, method of admission, diagnoses and procedures. The denominator for the emergency readmission rate is all patients discharged alive in the year, except those with a primary specialty of mental health or any diagnosis of cancer. The latter are excluded since their readmissions are much less likely to be a signal of poor care and are not used as a performance indicator.[28]

A higher readmission rate might be associated with more delays if it reflects poorer quality of care in the hospital or a greater proportion of patients with unobserved greater morbidity. However, bed-blocking may increase subsequent emergency readmissions if pressure on beds leads to premature discharge or worse care for other patients. We therefore use two-year lags of the emergency readmission rate to reduce simultaneity bias.

If no bed is available in a care home, then a patient may have to remain in hospital despite being clinically ready to be discharged into long-term care. Most patients have to pay, at least in part, for long-term care and so it may take longer to find an LTC bed at a price they can afford if prices are higher. We therefore measure the accessibility of long-term care in the area served by a hospital Trust using data on care-home beds and prices for June 2011.[29] We measure the number of care-home beds and their average price within 10 kilometres[30] of a hospital for care homes whose primary clients are people aged 65+ or with dementia. The primary client group of a care home is the group for which the largest number of beds is registered with the Care Quality Commission, which regulates the sector.

There were eight mergers between Trusts during the study period. We compute annual values for dependent and explanatory variables for Trusts that merged at some point in a year as if they were a single Trust at the start of the year.

[26]Other measures of clinical quality, such as case-mix-adjusted mortality, are not available for all types of Trust.

[27]HSCIC, 2014.

[28]HSCIC, 2013a.

[29]Laing and Buisson, 2010.

[30]The location of a Trust is defined by the postcode of its headquarters. The postcode of the care-home provider defines the location of LTC. Postcodes are mapped to lower super output areas (LSOAs), which have a mean population of 1,500. The straight-line distance between the centroids of LSOAs is used to determine which care homes are within 10km of each Trust.

III. Methods

Since days of delay are non-negative, are integer-valued and have a right-skewed distribution, we estimate negative binomial count data models in which the mean number of days of delay, μ_{it}, is given by

$$(1) \qquad \ln \mu_{it} = \beta_0 + \mathbf{H}_i' \boldsymbol{\beta}_1 + \beta_2 F_{it} + \beta_3 \ln b_{it} + \mathbf{x}_{it}' \boldsymbol{\beta}_4 + v_t.$$

$\mathbf{H}_i$ is a vector of dummy variables for hospital types (Specialist, Teaching, Mental Health) with Acute as the baseline type. F_{it} is a dummy variable for the hospital having Foundation Trust status. No hospital changed its type over the period but three became FTs, so F_{it} does vary over time. $\mathbf{x}_{it}$ is a vector of covariates. v_t are year dummies. The coefficients β are the proportionate changes in the number of days of delay from a one-unit change in the explanatory variable if it is continuous or from a change from 0 to 1 for a dummy variable such as hospital type. We enter the logarithms of LTC beds and prices in the models so that their coefficients are the percentage change in delays associated with a 1 per cent increase in beds or prices.

b_{it} is the number of beds in the hospital. We estimate equation 1 with beds as an exposure term, i.e. with $\beta_3 = 1$. This is equivalent to standardising the dependent variable for the hospital size. We could have used the number of patients (rather than beds) as the exposure term, but this raises concerns about simultaneity if hospitals with more delayed discharges admit fewer patients because no beds are available. We therefore, as in Propper, Burgess and Green (2004) and Kolstad and Kowalski (2012), use beds to measure hospital size.

To allow for the possibility that the number of delays is not proportional to hospital size, with larger hospitals being better or worse at managing delays, we also include in $\mathbf{x}_{it}$ a vector of bed size categories (200–399 etc., as listed in Section II.3) with unconstrained coefficients.

We use the NB2 negative binomial model[31] in which the variance is a quadratic function of the mean. The main alternative count model, the Poisson, assumes that the variance is equal to the mean and we find that this strong assumption does not hold in our data.

We estimate five versions of equation 1 for all delays and then for delays due to the NHS. The first version includes only the hospital type categories. We then allow for hospital size by adding beds as an exposure term and the bed size categories. Next we add the number and price of local care-home beds and then the case-mix and readmission variables. These models are estimated with robust standard errors clustered at Trust level. Our fifth model includes time-invariant random hospital effects.

[31] Cameron and Trivedi, 1986.

Finally, we estimate three models as robustness checks for our main findings. The first of these includes interactions of FT status and hospital type. The second excludes Mental Health Trusts from the sample. Both of these models investigate whether the effect of FT status is consistent across Trust types. The third robustness check includes a variable for Trusts with another Trust in the same local authority and an interaction of this variable with FT status. This model is included to consider whether LTC providers prefer caring for patients discharged from a Foundation Trust and so affect the number of delays from FTs.

IV. Results

1. Descriptive statistics

The average Trust has around 6,000 bed-days lost due to delays, of which 4,000 are attributed to the NHS. Delays increased by 3.8 per cent per year, from 5,742 days in 2011–12 to 6,182 days in 2013–14. Delays due solely to the NHS increased more quickly than delays due to other institutions and rose from 64 per cent to 69 per cent of all delays over the period.

Figure 1 shows the distribution of the number of days of delay across Trusts in 2013–14. The distribution is right-skewed, with a small proportion

FIGURE 1

Days of delay, 2013–14

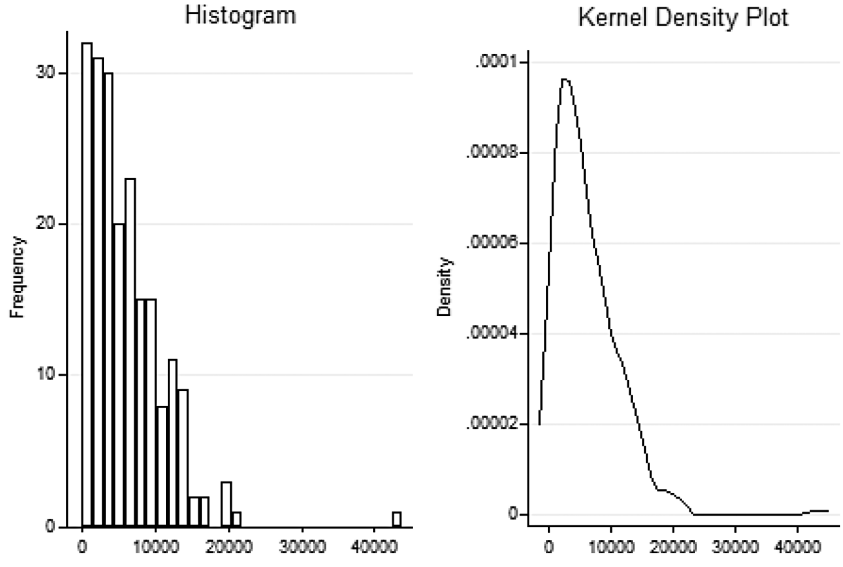
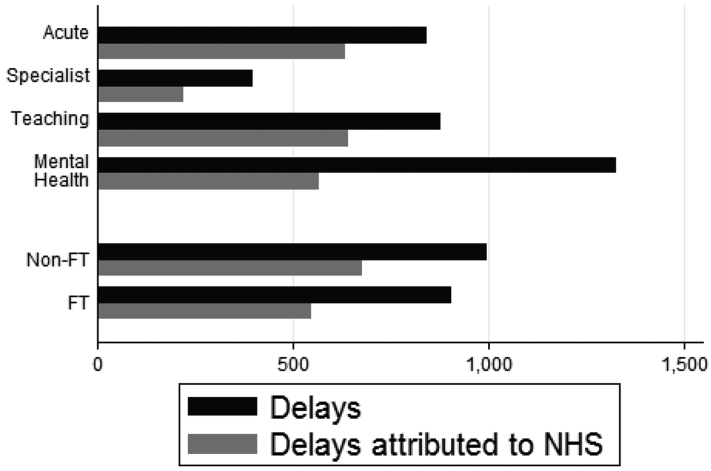


FIGURE 2

Days of delay per 100 beds, by Trust type (2011–12 to 2013–14)



of providers having a large number of delays. The distributions are similar for the other years.

Without accounting for size, total delays are largest in Teaching Trusts and smallest in Specialist Trusts. Acute and Mental Health Trusts have similar numbers of days of delay. However, Teaching Trusts are larger hospitals while Acute Specialist and Mental Health providers tend to be smaller. Figure 2 shows days of delay per 100 beds for the different types of Trust and by FT status. Mental Health Trusts have the highest number of days of delay per bed, around 50 per cent more than Acute and Teaching Trusts. Specialist Trusts have the smallest number of days of delay per bed. Mental Health Trusts have a much smaller proportion of delays that are attributed to the NHS (44 per cent versus over 55 per cent for Specialist and 70 per cent for Acute and Teaching Trusts).

Figure 2 also indicates that there are fewer days of delay per 100 beds in Trusts with FT status than in non-FT Trusts, particularly for delays attributed to the NHS. Overall, delays per 100 beds are 9 per cent smaller and delays attributed to the NHS are 19 per cent smaller in Foundation Trusts.

As Table 1 shows, 57 per cent of Trusts are Acute (i.e. non-teaching, non-specialist hospitals), 13 per cent are Acute Teaching Trusts and 25 per cent are Mental Health Trusts. Only 6 per cent are Specialist Trusts. FT status applies to 63 per cent of Trusts. On average, Trusts have 643 beds. Around 22 per cent of patients admitted to hospital are aged 75+ and around 40 per cent are admitted as emergencies. The standardised readmission rate is 9 per cent on average. The average Trust has about 3,100 care-home beds within 10 kilometres of

TABLE 1

Descriptive statistics

	Mean	*Standard deviation*	*Observations*	*Minimum*	*Maximum*
Days of delay					
All Trusts	5,997	5,294	614	0	43,899
Acute Trusts	5,654	4,050	349	97	18,363
Acute Specialist Trusts	613	632	36	0	2,427
Acute Teaching Trusts	9,820	9,067	78	291	43,899
Mental Health Trusts	6,096	4,396	151	228	23,641
Foundation Trusts	5,488	4,737	385	0	23,641
Days of delay attributed to NHS					
All Trusts	4,002	3,869	614	0	25,494
Acute Trusts	4,262	3,415	349	33	17,297
Acute Specialist Trusts	348	491	36	0	2,115
Acute Teaching Trusts	7,071	6,034	78	161	25,494
Mental Health Trusts	2,688	2,321	151	23	12,528
Foundation Trusts	3,494	3,526	385	0	17,297
Trust type					
Acute Trust	0.568	0.496	614	0	1
Acute Specialist Trust	0.059	0.235	614	0	1
Acute Teaching Trust	0.127	0.333	614	0	1
Mental Health Trust	0.246	0.431	614	0	1
Foundation Trust	0.627	0.484	614	0	1
Covariates					
Hospital beds	642.8	352.3	614	7.532	2,165
Care-home beds	3,129	2,182	614	118	7,496
Care-home price/week (£)	550.3	90.79	614	414.4	722.1
% patients aged 60–74	20.60	6.319	614	0.977	47.00
% patients aged 75+	21.96	8.833	614	0	60.36
% male patients	45.73	5.843	614	1.554	77.35
% emergency admissions	39.78	14.75	614	0	97.73
Standardised readmission rate (%)	8.622	4.832	614	0	17.10

Note: Sample is 614 Trusts (208, 203 and 203 for 2011–12, 2012–13 and 2013–14 respectively). Mean, standard deviation, observations, minimum and maximum are over three years. 'Days of delay' is total days of delay experienced by all delayed patients during a year. 'Days of delay attributed to NHS' is total days of delay experienced by delayed patients during a year attributed to the NHS. 'Hospital beds' is the annual average daily number of available or occupied beds. 'Care-home beds' is the number of beds in care homes within 10km of the Trust's headquarters in 2011 whose primary clients are patients aged 65+ or with dementia. 'Care-home price/week' is the average weekly price in care homes within 10km of the Trust's headquarters in 2011 whose primary clients are patients aged 65+ or with dementia. 'Standardised readmission rate' is the annual indirectly standardised rate of emergency readmission within 28 days, lagged by two years.

TABLE 2

Number of Foundation Trusts, by type and year

	2011–12		2012–13		2013–14	
	Non-FT	*FT*	*Non-FT*	*FT*	*Non-FT*	*FT*
Acute Trusts	54	65	50	65	48	67
Acute Specialist Trusts	1	11	1	11	1	11
Acute Teaching Trusts	11	15	10	16	10	16
Mental Health Trusts	15	36	14	36	14	36
Total	81	127	75	128	73	130

the Trust headquarters. Within the same radius, the average price for a week's stay in a care home is £550.

Table 2 presents the number of Trusts with and without FT status. The highest proportion of Foundation Trusts is amongst Acute Specialist Trusts: 11 out of the 12 Specialist Trusts have FT status. Mental Health Trusts and Acute Teaching Trusts also have high FT rates, of 72 per cent and 60 per cent respectively. Acute Trusts with no additional responsibilities, such as teaching, have the lowest FT rate, of 56 per cent.

2. Regression results

Table 3 reports results for models with total bed-days lost as the dependent variable. Model 1 includes only year and Trust type dummy variables, with 2011–12 and Acute Trusts as the baseline categories. In model 2, we add a hospital beds exposure term with a coefficient equal to 1, which standardises delays by beds, and we also add bed size categories. Model 3 adds measures of LTC availability (beds and prices) and model 4 also has case-mix and quality (emergency readmission) variables. Model 5 includes the same explanatory variables as model 4 but allows for unobserved random hospital effects.

In all models, we find that there is overdispersion, rejecting the Poisson specification relative to the negative binomial model. The goodness-of-fit measures (AIC and BIC) broadly indicate that additional variables improve the explanatory power of the models, though the AIC indicates that the improvement from adding all the case-mix and readmission controls (model 4 versus model 3) is small. The BIC, which has a stronger penalty for additional explanatory variables, suggests a deterioration in model performance when the case-mix and readmission variables are added, even though one of them is statistically significant.

Foundation Trust status is associated with 14–15 per cent fewer bed-days lost after standardising for beds and controlling for long-term care, case mix

TABLE 3

Days of delay

	Model 1: Hospital type only		Model 2: Model 1 plus exposure and size categories		Model 3: Model 2 plus care-home beds and prices		Model 4: Model 3 plus case mix and readmissions		Model 5: Model 4 with random hospital effects	
	Coefficient	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*
Acute Specialist Trust	–2.177***	0.000	–0.727**	0.045	–0.625	0.138	–0.620	0.187	0.0397	0.886
Acute Teaching Trust	0.540***	0.002	0.0967	0.602	0.122	0.430	0.121	0.430	–0.138	0.344
Mental Health Trust	0.0981	0.394	0.481***	0.000	0.615***	0.000	0.457**	0.015	0.205	0.218
Foundation Trust	–0.128	0.196	–0.125	0.118	–0.163**	0.039	–0.147*	0.065	–0.329***	0.000
2012–13	0.0523*	0.084	0.0438	0.154	0.0351	0.273	0.0256	0.434	0.0210	0.539
2013–14	0.0545	0.174	0.0563	0.175	0.0492	0.243	0.0418	0.344	0.0428	0.224
Hospital beds 200–399			–0.0266	0.931	–0.234	0.534	–0.353	0.350	–0.255	0.239
Hospital beds 400–599			–0.0601	0.850	–0.181	0.636	–0.335	0.377	–0.319	0.152
Hospital beds 600–799			–0.0106	0.974	–0.0819	0.833	–0.215	0.580	–0.274	0.232
Hospital beds 800–999			–0.0246	0.940	–0.0430	0.912	–0.172	0.663	–0.175	0.447
Hospital beds 1,000–1,499			0.0428	0.897	0.0119	0.976	–0.121	0.756	–0.159	0.501
Hospital beds 1,500+			–0.426	0.259	–0.306	0.465	–0.407	0.323	–0.687**	0.029
Ln care-home beds					–0.270***	0.000	–0.266***	0.000	–0.288***	0.000
Ln care-home price/week					0.166	0.530	0.214	0.438	0.417*	0.081
% patients aged 60–74							–0.0126	0.495	–0.0405***	0.000
% patients aged 75+							0.0127**	0.026	0.0221***	0.000
% male patients							0.0150	0.105	0.0146**	0.021
% emergency admissions							0.00136	0.685	0.00254	0.352

(*Continued*)

TABLE 3

Continued

	Model 1: Hospital type only		Model 2: Model 1 plus exposure and size categories		Model 3: Model 2 plus care-home beds and prices		Model 4: Model 3 plus case mix and readmissions		Model 5: Model 4 with random hospital effects	
	Coefficient	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*
Standardised readmission rate							–0.000471	0.973	–0.00121	0.872
Constant	8.676***	0.000	2.192***	0.000	3.298**	0.047	2.359	0.254	–4.782***	0.007
Ln alpha	–0.401***	0.000	–0.712***	0.000	–0.790***	0.000	–0.806***	0.000		
Ln r									1.150***	0.000
Ln s									7.406***	0.000
Exposure			Ln beds in Trust		Ln beds in Trust		Ln beds in Trust		Ln beds in Trust	
AIC	11,747.9		11,539.1		11,489.4		11,488.3		11,183.7	
BIC	11,783.2		11,601.0		11,560.1		11,581.1		11,280.9	
Standard errors	Cluster		Cluster		Cluster		Cluster		OIM	

Note: Negative binomial models: models 1 to 4 are pooled; model 5 is random effects. Dependent variable is total days of delay experienced by all delayed patients during a year. Coefficients are proportionate changes in days of delay from a one-unit increase in the explanatory variable. Standardised readmission rate is lagged by two years. Exposure term has a coefficient of 1. Ln alpha is the log of overdispersion. Ln r and ln s are shape parameters of the beta(r,s) distribution of random effects. AIC is the Akaike Information Criterion. BIC is the Bayesian Information Criterion. 'Cluster' indicates robust standard errors clustered at Trust level. 'OIM' indicates observed information matrix standard errors. Observations: 614 (208, 203 and 203 for 2011–12, 2012–13 and 2013–14 respectively). $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

and readmission rates (models 3 and 4).[32] After controlling for unobserved heterogeneity (model 5), the difference is even larger (28 per cent).

Once bed numbers are allowed for, Teaching Trusts have similar delays to Acute Trusts. Specialist Trusts have around 52 per cent fewer delays per bed than Acute Trusts (model 2) but the difference is not statistically significant, even at 10 per cent, once long-term care availability has been controlled for (models 3 to 5).

Mental Health Trusts are associated with 58–85 per cent more delayed days after accounting for size (models 2 to 4). However, this effect is smaller and insignificant after controlling for unobserved heterogeneity (model 5).

The availability of long-term care beds is consistently associated with fewer delays. We use the logarithms of LTC beds and prices in the models, so their coefficients are the percentage change in delays associated with a 1 per cent increase in beds or prices. Thus the results in models 3 to 5 suggest that a 1 per cent increase in long-term care beds is associated with 0.27–0.29 per cent fewer delays. Higher prices for long-term care beds are positively associated with delays but the coefficient is at most weakly significant (model 5).

Trusts with a higher percentage of patients aged 75+ have more delays (models 4 and 5). Treating one unit (i.e. 1 per cent) more patients in this age category is associated with 1–2 per cent more delays. A higher proportion of male patients is also positively associated with more delays, though the association is statistically significant only in the random effects model (5). Given that the models condition on age and that men have shorter disability-free life expectancy, this variable may capture a greater likelihood of non-acute health problems that make it more difficult to discharge male patients.

To capture economies or diseconomies of scale, we include hospital bed number categories with the omitted category being fewer than 200 beds. Since we also include beds as an exposure term with a coefficient of unity, the generally negative coefficients on the bed number categories imply that delays increase less than proportionately with beds. However, the coefficients are only statistically significant in the random effects specification (model 5) and only for the largest size category (1,500 or more).

[32] When the explanatory variable is continuous (for example, the percentage of patients aged 75 or over), the percentage change in the dependent variable from a one-unit change in the explanatory variable is $100 \times [\exp(\text{coefficient}) - 1]$. For dummy variables (for example, Specialist Trust status), the percentage change from changing from Acute to Specialist status is computed as $100 \times [\exp(\text{coefficient}) - 1]$. When the explanatory variable is the logarithm of a continuous variable (for example, the logarithm of the number of care-home beds), the percentage change in the dependent variable from a 1 per cent change in the explanatory variable is the coefficient.

3. NHS delays

Table 4 provides the results for delays attributed to the NHS. Unlike the Table 3 results for all delays, Mental Health Trusts do not differ significantly from Acute Trusts after accounting for size, long-term care, case-mix and readmissions variables. As in Table 3 for all delays, there are no significant differences between other Trust types and Acute Trusts after controlling for long-term care. A 1 per cent increase in long-term care beds is associated with 0.23–0.27 per cent fewer NHS delays, a similar result to that for all delays.

The effect of FT status is again negative, statistically significant and large in magnitude. Foundation Trusts incur 17–20 per cent fewer delays after accounting for size, long-term care, case mix and readmission rates in models 3 and 4. Allowing for unobserved heterogeneity (model 5) again increases the size of the effect (to 32 per cent).

4. Interaction of FT status and Trust type

Models 1 to 5 assume that having Foundation Trust status has the same implications for all types of Trust. We also estimated specifications similar to models 4 and 5 but with the addition of interactions between FT status and Trust type. The results are reported in Table A in the online appendix. They are broadly in line with those in Tables 3 and 4 and do not suggest that the association between FT status and delays varies by type of Trust. There is a large positive and highly significant coefficient on the interaction of Specialist Trust and Foundation Trust for NHS days of delay, but this is driven by the only Specialist Trust that does not have FT status and which had a very small number of delays attributed to the NHS in the study period. All other interactions between Foundation Trust status and Trust type are statistically insignificant at the 5 per cent level.

5. Models for all Acute Trusts

The patients in Mental Health Trusts are very different from those in the three types of Acute Trust in being younger, requiring different types of treatment and having much longer lengths of stay. Mental Health Trusts also have a smaller proportion of their revenue from prospective prices per patient treated, relying more on funding from block contracts negotiated with local health budget holders, and so they may have a smaller financial incentive to discharge patients. Clinical readiness for discharge is also less easy to define than for acute patients with physical conditions.

We therefore re-estimate models 4 and 5 after excluding Mental Health Trusts. The results are in Table B in the online appendix. We find that the effects associated with being a Foundation Trust and with being located in an

TABLE 4

Days of delay attributed to NHS

	Model 1: Hospital type only		Model 2: Model 1 plus exposure and size categories		Model 3: Model 2 plus care-home beds and prices		Model 4: Model 3 plus case mix and readmissions		Model 5: Model 4 with random hospital effects	
	Coefficient	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*
Acute Specialist Trust	–2.429***	0.000	–0.717	0.104	–0.503	0.364	–0.723	0.241	–0.172	0.599
Acute Teaching Trust	0.491***	0.003	0.0524	0.784	0.106	0.520	0.0694	0.689	–0.0250	0.874
Mental Health Trust	–0.433***	0.001	–0.0493	0.626	0.0868	0.432	–0.326	0.174	–0.200	0.312
Foundation Trust	–0.171	0.125	–0.171*	0.064	–0.229**	0.013	–0.190**	0.040	–0.393***	0.000
2012–13	0.0967***	0.004	0.109***	0.002	0.0984***	0.007	0.0856**	0.021	0.0535	0.169
2013–14	0.122**	0.011	0.151***	0.002	0.148***	0.003	0.145***	0.005	0.0976**	0.014
Hospital beds 200–399			0.253	0.483	0.128	0.774	–0.0183	0.966	0.253	0.344
Hospital beds 400–599			0.213	0.559	0.190	0.678	0.0184	0.967	0.0581	0.831
Hospital beds 600–799			0.371	0.321	0.372	0.421	0.216	0.632	0.198	0.477
Hospital beds 800–999			0.266	0.480	0.304	0.512	0.152	0.738	0.204	0.469
Hospital beds 1,000–1,499			0.325	0.391	0.342	0.456	0.203	0.653	0.220	0.439
Hospital beds 1,500+			–0.0256	0.953	0.0914	0.852	0.00967	0.984	–0.418	0.257
Ln care-home beds					–0.256***	0.000	–0.230***	0.004	–0.272***	0.000
Ln care-home price/week					–0.141	0.667	0.00136	0.997	–0.0180	0.944
% patients aged 60–74							–0.0152	0.495	–0.0379***	0.002
% patients aged 75+							0.0187***	0.001	0.0287***	0.000
% male patients							0.0331**	0.023	0.0156**	0.031
% emergency admissions							0.00164	0.715	0.00362	0.250

(*Continued*)

TABLE 4

Continued

	Model 1: Hospital type only		Model 2: Model 1 plus exposure and size categories		Model 3: Model 2 plus care-home beds and prices		Model 4: Model 3 plus case mix and readmissions		Model 5: Model 4 with random hospital effects	
	Coefficient	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*	*Coefficient*	*p-value*
Standardised readmission rate							–0.0127	0.425	–0.00231	0.803
Constant	8.378***	0.000	1.569***	0.000	4.431**	0.028	1.997	0.471	–3.033	0.114
Ln alpha	–0.162*	0.100	–0.416***	0.000	–0.460***	0.000	–0.492***	0.000		
Ln r									0.892***	0.000
Ln s									6.906***	0.000
Exposure			Ln beds in Trust		Ln beds in Trust		Ln beds in Trust		Ln beds in Trust	
AIC	11,251.8		11,079.9		11,052.7		11,040.6		10,692.7	
BIC	11,287.2		11,141.7		11,123.5		11,133.4		10,790.0	
Standard errors	Cluster		Cluster		Cluster		Cluster		OIM	

Note: Negative binomial models: models 1 to 4 are pooled; model 5 is random effects. Dependent variable is total days of delay in year attributed to NHS. Coefficients are proportionate changes in days of delay from a one-unit increase in the explanatory variable. Standardised readmission rate is lagged by two years. Exposure term has a coefficient of 1. Ln alpha is the log of overdispersion. Ln r and ln s are shape parameters of the beta(r,s) distribution of random effects. AIC is the Akaike Information Criterion. BIC is the Bayesian Information Criterion. 'Cluster' indicates robust standard errors clustered at Trust level. 'OIM' indicates observed information matrix standard errors. Observations: 614 (208, 203 and 203 for 2011–12, 2012–13 and 2013–14 respectively). $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

area with more care-home beds have even larger negative coefficients than in the models including Mental Health Trusts.

6. Relationship between LTC and FT status

Another potential explanation for the lower rate of delays in Foundation Trusts is that providers of long-term care may be more willing to accept patients discharged from Trusts with FT status. Care homes may believe that FTs provide better care so patients discharged by an FT are healthier and thus less costly to manage. If FT patients have a lower risk of readmission or death, this will also reduce the transaction costs associated with refilling places in the care home. This effect on delays arising from decisions by care homes will be stronger when care homes operate in markets with more than one hospital. We therefore add to model 5 an indicator for the hospital being located in a local authority with at least one other hospital and its interaction with FT status. The results are reported in Table C in the online appendix. Neither variable is significant, although the interaction of the competition indicator and FT status is indeed negative.

V. Discussion

The size of a Trust is a key determinant of bed-days lost due to delayed discharge and Trust type is strongly correlated with size. Specialist Trusts, and to a lesser extent Mental Health Trusts, tend to be smaller than Acute Trusts, and Teaching Trusts tend to be larger. When we do not standardise for beds, Specialist hospitals have about a tenth of the delays of Acute Trusts, and Teaching hospitals have 72 per cent more delays.

We generally do not find evidence of scale economies or of a non-linear relationship between delays and size, as captured by categories of number of beds. Hospitals with a large number of beds tend to have proportionally fewer overall delays (and higher NHS delays) but the differences are not statistically significant.

Hospital Trusts that have Foundation Trust status have 14–28 per cent fewer bed-days lost due to delayed discharge of patients. Our finding that FTs have better performance than Trusts without FT status is in line with other studies. For example, Verzulli, Jacobs and Goddard (2011) found that FTs have lower hospital infection rates. All NHS hospital Trusts are not-for-profit public sector organisations, but those that have FT status have greater freedom from central control. In particular, they do not have to break even each year, can borrow to finance investment, have fewer limits on the amount of income they can generate from treating private patients, and are not constrained by national agreements on pay and conditions. Their ability to more easily retain financial surpluses implies that they have stronger incentives

to contain costs and possibly to compete more aggressively to attract demand. The greater autonomy also implies that if FTs end up with a surplus, they can reinvest it in better systems, including IT systems, for handling discharges (i.e. better management, which can keep costs down) and use it to hire more trained and qualified staff to improve quality. NHS hospital Trusts of all types (Acute, Specialist, Teaching, Mental Health) can apply to become Foundation Trusts but must demonstrate that they meet quality, management and financial requirements.[33] Thus our finding of fewer delays in Foundation Trusts may be because Trusts that are successful in applying for FT status are inherently of higher quality or because their governance structure allows them greater autonomy which permits them to achieve higher quality and thus fewer delays. Because only three hospital Trusts became Foundation Trusts over the period covered by our data, we cannot distinguish between these explanations.

Despite this, policymakers may be able to use Foundation Trusts as examples of good practice, which can be identified by on-site investigations of FTs that have a lower-than-expected number of delays. The fact that the association between FT status and delays was similar across all hospital types suggests that lessons from further investigation of FTs may hold for all types of Trust.

After accounting for size, patient characteristics and long-term care availability, we find that although Mental Health Trusts and Acute Trusts have similar delays attributed to the NHS, Mental Health Trusts incur more delays in total. This suggests that delays in Mental Health Trusts are more likely to be due to non-NHS social care factors. Patients in Mental Health Trusts are more likely to require more complex post-discharge social and community care, which may take longer to organise. An increase in available long-term and community care resources, appropriate for patients with mental health conditions, may therefore have a bigger impact on delayed discharge for Mental Health Trusts than for other types of Trust.

Specialist hospitals tend to have far fewer delays, after controlling for beds. Differences can be large (about 46 per cent fewer delays after controlling for case mix, readmission rates and long-term care) but are not statistically significant. The shorter delays may be due to the concentration of expertise and experience in the relevant field of medicine, the ability to adopt approaches best suited to the care of a particular patient group, and perhaps better availability of funding and resources.

Teaching Trusts have similar delays to Acute Trusts after controlling for size. Teaching status is generally considered a marker of higher quality. Teaching Trusts also offer a wider range of specialised services, attracting more severe patients. The higher quality may therefore raise demand and a more complex case mix can put an upward pressure on delays. In addition, the

[33] Requirements for obtaining FT status are set out in Monitor (2007 and 2013).

responsibilities of training medical students might increase the time it would otherwise have taken to discharge a patient. The higher perceived quality of teaching hospitals may also imply they have better management and more dedicated staff, which in turn may reduce delays.

Increases in the supply of long-term care are associated with fewer delays, as in previous studies.[34] As a patient can only be discharged to institutional long-term care when a bed is available, an increased supply of such beds would be expected to reduce delayed discharges from hospital. However, such institutional care might not always be the most appropriate setting for care immediately after discharge. Especially for less severe patients, alternatives such as support in a patient's own home, if available, may be preferred by the patient. Local care homes' prices do not have a statistically significant impact on delays. This may reflect the overriding importance of providing appropriate care in a timely manner rather than searching for the lowest price.

Trusts with a higher percentage of patients aged 75+ have more delays. Older patients are more intensive users of hospital and LTC services,[35] are likely to have more comorbidities and disabilities,[36] and therefore require a more complex care package. This finding suggests that an ageing population might lead to more delays in the future.

VI. Conclusions

Reducing delays in discharge from hospital is a long-standing policy concern. This study has investigated differences in delays by type of hospital. Hospital types are easily observable to the regulator and policy interventions can easily be targeted at a particular hospital type.

We find that Foundation Trusts have fewer delays. Foundation Trusts might therefore be used as exemplars of good practice in managing delays. Policymakers could investigate how such reductions have been achieved and provide insights to ensure that good practice is spread throughout the NHS. There is particular value in using Foundation Trusts as exemplars as all types of Trust (Acute, Specialist, Teaching, and Mental Health) have become Foundation Trusts.

Mental Health Trusts have more delayed discharges due to non-NHS factors including social care. This may indicate unmet social care needs for mental health patients requiring more sophisticated care packages, which take longer to organise, and suggest that better coordination of hospital, community and social care would be particularly beneficial in reducing delayed discharges for mental health patients.

[34] Fernandez and Forder, 2008; Gaughan, Gravelle and Siciliani, 2015.
[35] Bardsley et al., 2012; Forder, 2009.
[36] Kasteridis et al., 2015; de Meijer et al., 2011.

Supporting information

Additional supporting information may be found in the online version of this paper on the publisher's website:

- Appendix

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