Death by Market Power:
Reform, Competition and Patient Outcomes in the National Health Service

By MARTIN GAYNOR, RODRIGO MORENO-SERRA, CAROL PROPPER

Online Appendix

Table A1: Data sources

Variable	Source
30 day AMI mortality rate (on or after discharge, ages 35-74)	Office for National Statistics (ONS) and Hospital Episode Statistics (HES)
28 day all-cause mortality rate (in-hospital, all ages)	Hospital Episode Statistics (HES)
28 day all-cause mortality rate excluding AMI admissions (in-hospital, all ages)	Hospital Episode Statistics (HES)
Herfindahl-Hirschman index (all elective services)	Authors' own calculations using admissions data from Hospital Episode Statistics (HES)
Mean length-of-stay	Hospital Episode Statistics (HES)
Total, elective and AMI admissions	Hospital Episode Statistics (HES)
Age-gender distribution of admissions within 5 year age-gender bands	Hospital Episode Statistics (HES)
Operating expenditure	Department of Health: Trust financial returns; Published Income and Expenditure Accounts for Foundation Trusts
Market forces factor	Department of Health: Reference costs
Retained surplus or deficit	Department of Health: Trust financial returns; Published Income and Expenditure Accounts for Foundation Trusts
Full time male wages at the local authority level	Office for National Statistics: Annual Survey of Hours and Earnings (ASHE)
Age-gender standardized mortality rate at the local authority level	NHS: National Centre for Health Outcomes Development (NCHOD)
Charlson index	Authors' own calculations based on data from Hospital Episode Statistics (HES)
Urgent and life-threatening (category A) ambulance calls responded within eight minutes	Care Quality Commission (CQC)
Number of ISTCs within 30 kilometers	Authors' own calculations using Hospital Episode Statistics (HES) and Department of Health data
AMI patients having thrombolytic treatment	Myocardial Infarction Audit Project - Minap (Minap 2005, 2008, 2010)
AMI patients having primary angioplasty (PCI)	Myocardial Infarction Audit Project - Minap (Minap 2005, 2008, 2010)
AMI patients discharged on secondary prevention medication (aspirin, beta blockers, statins)	Myocardial Infarction Audit Project - Minap (Minap 2005, 2008, 2010)

Table A2: Sample selection

Year	(1) Active acute hospitals	(2) Hospitals with at least 5,000 total admissions	(3) Hospitals with non-missing HHI and mortality data	(4) Hospitals with at least 150 AMI admissions per year
2003	180	170	162	130
2007	175	167	162	121

Notes: The table reports the number of hospitals in our sample in each year (2003 and 2007) under different restrictions on the set of all English NHS hospitals. Each column puts a further restriction on the sample compared to the column before it, so column (4) is a strict sub-sample of (3) and so on. Column (1) presents the total number of active acute hospitals in each year. Column (2) refers to the number of hospitals with at least 5,000 admissions in each year. Column (3) reports the number of hospitals for which the Herfindahl-Hirschman (HHI) concentration indices could be calculated, and for which mortality data (all causes) were available. Thus column (3) corresponds to the full sample used in our main difference-in-differences model estimations. Column (4) presents the sub-sample used in the AMI mortality rate regression models.

Table A3: Descriptive statistics

Variable		Mean	Standard deviation	Minimum	Maximum	Observations
Death rates						
30 day AMI mortality rate	overall	6.9	2.6	1.8	22.8	N = 251
(on or after discharge, ages 35-74, percent)	between		2.4	3.3	22.8	n = 133
	within		1.6	0.8	13.1	
28 day all-cause mortality rate	overall	1.6	0.6	0.0	3.3	N = 324
(in-hospital, all ages, percent)	between		0.5	0.1	2.7	n = 162
	within		0.2	1.0	2.2	
28 day all-cause mortality rate	overall	1.6	0.6	0.0	3.2	N = 324
(in-hospital, excluding AMI all ages, percent)	between		0.5	0.1	2.6	n = 162
	within		0.2	1.0	2.2	
Market concentration						
Herfindahl-Hirschman index	overall	5,543	1,410	2,674	9,050	N = 324
(actual patient flows)	between		1,395	2,742	8,896	n = 162
	within		221	4,663	6,423	
Herfindahl-Hirschman index	overall	4,308	1,931	1,878	9,550	N = 324
(predicted patient flows)	between		1,929	1,966	9,548	n = 162
	within		139	3,218	5,398	
Length of stay and admissions						
Mean length-of-stay (days)	overall	1.2	0.8	0.3	7.1	N = 324
	between		0.8	0.5	6.8	n = 162
	within		0.3	0.1	2.2	
Total admissions	overall	67,896	35,929	8,792	206,633	N = 324
	between		35,331	9,079	201,744	n = 162
	within		6,817	25,471	110,321	
Total AMI admissions (all ages)	overall	412	198	153	1,275	N = 262
	between		182	154	1,142	n = 135
	within		79	180	643	
Elective admissions (number)	overall	35,135	20,109	3,882	116,471	N = 324
	between		19,715	4,024	111,307	n = 162
	within		4,111	18,350	51,921	
Elective admissions (percent of total)	overall	52.4	12.2	24.4	98.4	N = 324
	between		12.0	26.7	98.2	n = 162
	within		2.3	42.6	62.2	
Finances and prices						
Operating expenditure (£1,000)	overall	197,082	125,368	18,881	766,137	N = 319
	between		120,012	37,764	691,830	n = 162
	within		35,841	85,736	308,428	
Total expenditure per admission (£1,000)	overall	3.0	1.3	0.2	9.9	N = 319
	between		1.2	1.1	9.4	n = 162
	within		0.4	1.4	4.7	
Market forces factor	overall	1.00	0.07	0.89	1.28	N = 324
	between		0.07	0.91	1.23	n = 162
	within		0.01	0.96	1.05	
Retained surplus (£1,000)	overall	0.2	6.5	-40.3	56.0	N = 303
	between		4.7	-22.2	28.0	n = 162
	within		4.3	-27.7	28.2	
Average male full time wage in area (£)	overall	24,955	3,774	18,985	34,551	N = 320
	between		3,391	19,691	32,362	n = 160
	within		1,668	22,111	27,799	
Area health, case mix and economic conditions						
Standardized mortality rate	overall	100.0	10.0	77.6	129.5	N = 324
(per 100,000, normalized)	between		8.4	83.5	123.0	n = 162
	within		5.4	91.5	108.5	
Charlson index (average for all admissions)	overall	0.48	0.23	0.03	1.85	N = 324
	between		0.22	0.04	1.83	n = 162
	within		0.05	0.28	0.69	

(cont.)

Table A3: Descriptive statistics *(continued)*

Variable		Mean	Standard deviation	Minimum	Maximum	Observations
Area health, case mix and economic conditions						
Urgent ambulance calls responded within eight minutes (percent)	overall	76.4	3.3	55.7	86.6	N = 306
	between		2.6	63.9	83.8	n = 162
	within		2.0	68.1	84.6	
Controls for other policy changes						
Number of ISTCs within 30 kilometers	overall	0.9	1.9	0.0	11.0	N = 324
	between		1.2	0.0	5.5	n = 162
	within		1.5	0.0	6.4	
AMI patients having thrombolytic treatment within 30 minutes of arrival at hospital (percent)	overall	83.5	9.3	47.0	100.0	N = 218
	between		8.1	60.0	98.0	n = 126
	within		5.3	59.5	107.5	
AMI patients having thrombolytic treatment within 60 minutes of calling for help (percent)	overall	58.9	19.3	8.0	95.0	N = 223
	between		14.9	8.0	90.0	n = 127
	within		13.4	25.4	92.4	
AMI patients having primary angioplasty (PCI) (percent)	overall	5.1	18.4	0.0	100.0	N = 232
	between		14.1	0.0	100.0	n = 128
	within		12.7	-44.9	55.1	
AMI patients discharged on aspirin (percent)	overall	97.8	2.6	84.0	100.0	N = 240
	between		2.1	91.0	100.0	n = 129
	within		1.6	90.3	105.3	
AMI patients discharged on beta blockers (percent)	overall	92.8	6.5	68.0	100.0	N = 240
	between		5.4	77.0	100.0	n = 129
	within		3.6	77.8	107.8	
AMI patients discharged on statins (percent)	overall	95.9	3.5	81.0	100.0	N = 240
	between		2.8	85.5	100.0	n = 129
	within		2.1	89.4	102.4	

Notes: Summary statistics refer to fiscal years 2003 and 2007. N = Total number of hospital-year observations for the whole sample; n = Total number of hospitals in the sample. The samples for the AMI mortality rates include only hospitals with at least 150 AMI admissions. Herfindahl-Hirschman indices computed using all elective services. Market forces factor used by the Department of Health to adjust hospital reimbursement tariffs. Male full time wage is the average of the median full-time gross wages for male workers (all occupations) in the local area districts within a radius of 30 kilometers from the hospital. Age-gender area standardized mortality rate (normalized) is an inverse distance weighted average rate specific to the hospital. Average Charlson index for admissions at the hospital. Share of urgent and life-threatening (category A) ambulance calls receiving an emergency response at the scene of the incident within eight minutes. We also use, as measures of case mix, 36 variables corresponding to shares of cause-specific admissions within 5 year age-gender bands.

Table A4: Additional robustness tests: difference-in-difference estimates

Robustness test	(1) 30 day AMI mortality rate (on or after discharge, ages 35-74)	(2) 28 day all-cause mortality rate (in-hospital)	(3) Mean length-of-stay (days)
1. Baseline	0.291**	0.099***	0.230***
	(0.115)	(0.031)	(0.057)
Observations	251	324	324
Specification of the DiD estimator			
2. Year dummies*top quartile HHI 2003			
2004*top quartile HHI	0.071	0.023	-0.010
	(0.070)	(0.018)	(0.032)
2005*top quartile HHI	0.096	0.044**	0.012
	(0.074)	(0.021)	(0.033)
2006*top quartile HHI	0.133	0.042**	0.024
	(0.073)	(0.020)	(0.034)
2007*top quartile HHI	0.217***	0.055***	0.074*
	(0.072)	(0.021)	(0.041)
Observations	619	810	810
3. Time-varying HHI (2003 and 2007)	0.301**	0.102***	0.237***
	(0.117)	(0.030)	(0.057)
Observations	251	324	324
4. Actual HHI (2003)	0.258	0.154***	0.489***
	(0.192)	(0.046)	(0.091)
Observations	251	324	324
Controls for case mix			
5. No controls	0.195**	0.094***	0.125**
	(0.088)	(0.027)	(0.050)
Observations	251	324	324
6. Controlling for the number of cause-specific admissions	0.279**	0.092***	0.223***
	(0.112)	(0.029)	(0.055)
Observations	251	324	324
Local area economic conditions			
7. Controlling for share of urgent ambulance calls answered within 8 minutes	0.374***	-	-
	(0.131)		
Observations	234		

Weighting			
8. All hospitals weighted by number of admissions	0.190*	0.100***	0.262***
	(0.102)	(0.026)	(0.064)
Observations	294	324	324
Linear model			
9. Outcomes and HHI in levels (implied elasticity)	0.241**	0.084***	0.206***
Observations	251	324	324

Notes: Models estimated by OLS with standard errors (in parentheses) robust to arbitrary heteroskedasticity. Time period is 2003 and 2007, except for row 2 (all years between 2003-2007). HHI measured in year 2003 (except in row 3) for all elective services, calculated using predicted patient flows (actual patient flows in row 4). Controls are year 2007 dummy (except in row 2 where dummies for all years between 2004-2007 are included) and 36 case mix variables corresponding to shares of cause-specific admissions within 5 year age-gender bands (except in row 5). Row 6 adds as a control the number of AMI admissions (column (1)) or total number of admissions (columns (2) and (3)). Row 7 adds the share of category A ambulance calls (defined as urgent and life-threatening) receiving an emergency response at the scene of the incident within eight minutes. Row 8 regressions are weighted by AMI admissions (column (1)) or total admissions (columns (2) and (3)), and use all hospitals regardless of the number of AMI admissions in column (1). In all rows except 9 the dependent and independent variables (except age-gender controls) are in logs. All models also include a constant and a full set of hospital dummies. * Significant at 10%; ** significant at 5%; *** significant at 1%.