Japan consists of 47 prefectures (regions) of which Kyoto prefecture is on the main island of Honshu and has a population of approximately 2.6 million people. Hospital claims data from all hospitals in Kyoto prefecture were provided by the Kyoto National Health Insurance Organizations, in a project conducted by the Kyoto Prefectural Government. These data included information on patient demographics, comorbidities upon admission, diagnostic and therapeutic procedures, administered medications, hospital ownership, size, teaching status, and DPC system status. This study was approved by the Ethics Committee of Kyoto University Graduate School and Faculty of Medicine.

Ischaemic stroke was identified using International Classification of Diseases, 10th Revision (ICD-10) codes that signified admission due to a cerebral infarction (I63x). The study sample included admissions to hospitals in Kyoto prefecture between February 2009 and March 2010. Patients were excluded from the analysis if they had been hospitalized for a previous cerebral infarction within 30 days before the index admission, in order to remove readmissions, or if the length of hospital stay was greater than 90 days. Municipalities with fewer than 10 cases during the study period were excluded from analysis.

Spending categories

Age-sex adjusted health care spending per patient for ischaemic stroke was calculated for all 37 municipalities (including the 11 wards of Kyoto city). These municipalities were then categorized into quartiles based on age-sex adjusted spending: quartile 1 represented the

group of municipalities with the lowest spending and quartile 4 the highest spending municipalities. Health care spending in Japanese yen was converted to US dollars (USD) using 2009 purchasing power parities (JPY100 = USD0.80).

Quality of care indicators

The process indicators included (1) computed tomography (CT) or magnetic resonance imaging (MRI) scans conducted during hospitalization;[11] (2) tissue plasminogen activator (t-PA) administration during hospitalization;[12] (3) antithrombotics (aspirin, ozagrel, argatroban, heparin, low molecular weight heparin, ticlopidine, clopidogrel, cilostazol, and warfarin) administered during hospitalization;[13,14] (4) in-hospital rehabilitation services;[5] (5) early rehabilitation (within 30 days of admission); (6) rehabilitation for dysphagia; and (7) warfarin-administered to patients with AF.[15] The following two outcome indicators were used: (1) in-hospital mortality and (2) 30-day in-hospital mortality. The performance in each quality indicator was calculated for each spending quartile.

Statistical analyses

Unadjusted characteristics and indicators by spending quartiles were analysed using analysis of variance. Logistic regression models were used to analyse the association between spending and the quality of care. The binary result of each indicator was used as the dependent variable in analysis, and independent variables used are shown in Table 1.Using quartile 4 (comprising municipalities with the highest spending) as the referent category, the lower three quartiles were included in the regression models as dummy variables in order to test if municipalities with lower spending had differential performance

in the various quality indicators when compared to the high spending municipalities. All statistical analyses were conducted using SPSS, version 19. Statistical significance was set at P-value < 0.05 (two-tailed).

RESULTS

There were 3,958 admissions, 667 of which presented with atrial fibrillation (AF). At the individual municipality level, the mean health care spending per patient ranged from USD9 749 to USD14 303 from the lowest to highest municipalities, a difference of 47%. When the municipalities were categorized into quartiles by spending, the highest quartile had a mean spending per patient 26% higher than that of the lowest quartile.

Table 2 presents the mean health care spending per patient, patient characteristics and hospital characteristics for each of the quartiles. There were no variations observed in sex or mean length of stay between the four quartiles. There were, however, significant differences in age, hospital DPC status, teaching status, privately-owned hospitals and hospitals with more than 300 beds.

Variations in performance in each of the quality indicators by spending quartiles are shown in Table 3. Imaging scans were used in similar proportions in all four quartiles. In-hospital mortality and 30-day in-hospital mortality showed no significant differences between quartiles. The other quality indicators had statistically significant differences

between quartiles. In general, recommended medications and rehabilitation services showed better performance in the higher spending quartiles.

Associations between spending and quality from the regression analyses are shown in Table 4. The results reveal that patients admitted to hospitals in quartile 1 had significantly poorer performance in almost all process indicators (except CT/MRI scans). Patients in quartile 1 presenting with atrial fibrillation were also less likely to be administered warfarin during admission. These results were most pronounced in t-PA administration, dysphagia rehabilitation and warfarin administration, with patients in the referent category having more than 50% increased likelihood to be provided with these services compared to patients in quartile 1. In quartile 2, patients were significantly less likely to be provided with dysphagia rehabilitation and warfarin administration in AF patients when compared to patients in quartile 4. patients from quartile 3 were significantly less likely to be provided with dysphagia rehabilitation and warfarin when presenting with AF. In all quartiles, CT or MRI scans and both mortality indicators showed no significant associations with different levels of spending.

DISCUSSION

Regions with the lowest health care spending were found to be significantly associated with poorer performance in all but one of the process indicators, even after adjusting for variations in patient and hospital characteristics. Regression analyses demonstrated that even after adjusting for DPC status, there was significantly poorer performance in most of

the process indicators for hospitals in the lower spending regions. This suggests that the observed differences are not explained by DPC status.

In contrast, mortality showed no statistically significant association with spending. Because Japan has one of the lowest mortality rates following ischaemic stroke, it may be difficult to improve current mortality rates.[16] Other outcome measures such as improvement in functional ability or patients' health related quality of life should be analysed in future studies.

Most of the process indicators showed significantly poorer performance in the lower spending quartiles. It is possible that the increase in rehabilitation services in quartile 4 was due to more hospitals in this quartile providing these services, while hospitals in the lower quartiles rely on step-down facilities to provide the same services. However, the Japanese health care system is such that any acute service would only be provided at one institution at any one time, and rehabilitation services that occur post-discharge may mean a lengthier period before these services commence, thereby still indicating a possible target for quality improvement. Additionally, t-PA administration showed a consistent, though not statistically significant, increase with higher spending. The lack of sufficient staff with appropriate training in the lower spending regions may have contributed to these observations.

These results may indicate the existence of variations in care that are dependent on resources, in which an uneven distribution of resources has led to an inadequate provision of specialist expertise and rehabilitation services in the lower spending regions. The results

of the CT and MRI diagnostic tests may reinforce this concept, as the known abundance of CT and MRI scanners in Japan may be sufficient to provide similar performances for this indicator in all spending quartiles. [17,18] If so, the current system of allowing market forces to dictate resource distribution may need to be augmented with government intervention at the prefectural level in order to ensure more equitable access in the lower spending regions.

This study has several limitations. First, Kyoto prefecture is not a closed system and there may be some inter-prefectural movements of patients, in which patients residing in Kyoto choose to obtain their health care in other prefectures. However, the nature of ischaemic stroke is such that patients would very likely be admitted to hospitals in close proximity, which would minimize the effects of such movements. Second, we are unable to state with certainty that the relationship between spending and quality is causal. It is possible that regions with higher quality of care have better management that result in increased income. Third, due to limitations of administrative data, we were unable to adjust for several clinical variables such as consciousness level, stroke severity and activities of daily living upon admission and discharge. However, the process indicators selected were largely independent of these factors and therefore should not strongly influence the results. And fourth, the exclusion of between-hospital transfers (which are likely to have occurred soon after the initial admission) might have had an impact. We found that only about 5% of patients were discharged alive within 3 days, and further investigation of the cases revealed an even distribution across hospitals, municipalities, and spending quartiles (data not shown). Given the low incidence of such cases, as well as their apparent lack of clustering

in any of the sample units, we feel that there is little impact on our study objectives and conclusions.

This study offers a first glimpse of regional variations in health care spending in Japan. The novelty of these findings lies in the observation of variations in spending and quality despite the presence of a universal insurance system and hospital reimbursement system. Understanding the relationship between health care spending and the quality of health care on a larger scale would provide further insight into the balance between health care economics, resource distribution and quality. Care must be taken when policy-makers reduce resources to ensure that the quality of care provided is not detrimentally affected. Because the free market can lead to a maldistribution of resources, there may be a need for policy interventions to ensure proper distribution, continuity, and efficient concentration of care. As Japan faces massive challenges in ensuring an equitable, effective and affordable health care system, understanding the nature of regional variations will be central to effective regional health planning and policy.

Acknowledgements

This work was supported in part by a Health Sciences Research Grant from the Ministry of Health, Labour and Welfare of Japan [grant number H22-seisaku-ippan-028]; and a Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science [grant number Kiban-A-22249015]. The funding sources had no role in study design; in the

collection, analysis, and interpretation of data; in the writing of the report; or in the decision to submit the article for publication.

References

1. McCurry J. Japan moves to guard against future health-spending rises. Lancet 2006;367:1385–6.
2. Kim AS, Johnston SC. Global variation in the relative burden of stroke and ischemic heart disease. Circulation 2011;124:314–23.
3. Ministry of Health, Labour and Welfare, Japan [website]. Analysis by cause of death. Abridged Life Tables For Japan 2010. http://www.mhlw.go.jp/english/database/db-hw/lifetb10/4.html Accessed [11th October 2012].
4. Fisher ES, Wennberg DE, Stukel TA, et al. The implications of regional variations in Medicare spending. Part 1: The content, quality and accessibility of care. Ann Intern Med 2003;138:273–87.
5. Fisher ES, Wennberg DE, Stukel TA, et al. The implications of regional variations in Medicare spending. Part 1: Health outcomes and satisfaction with care. Ann Intern Med 2003;138:288–98.
6. Stukel TA, Fisher ES, Alter DA, et al. Association of hospital spending intensity with mortality and readmission rates in Ontario hospitals. JAMA 2012;307:1037-45.

7. Rudd A, Irwin P, Rutledge Z, et al. Regional variations in stroke care in England, Wales and Northern Ireland: results from the National Sentinel Audit of Stroke. Clin Rehabil 2001;15:562–72

8. Fisher ES, Wennberg JE. Health care quality, geographic variations and the challenge of supply-sensitive care. Perspect Biol Med 2003;46:69–79.

9. Otsubo T, Imanaka Y, Lee J, et al. Evaluation of resource allocation and supply-demand balance in clinical practice with high-cost technologies. J Eval Clin Prac 2011;17:1114–21.

10. Tanihara S, Kobayashi Y, Une H, et al. Urbanization and physician maldistribution: a longitudinal study in Japan. BMC Health Serv Res 2001;11:260

11. Adams H, del Zoppo G, Alberts M, et al. Guidelines for the Early Management of Adults With Ischemic Stroke: A Guideline From the American Heart Association/ American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, and the Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups: The American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists. Stroke 2007;38:1655–711.

12. The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. N Engl J Med 1995;333:1581–7.

13. Albers GW, Amarenco P, Easton JD, et al. Antithrombotic and thrombolytic therapy for ischemic stroke: the Seventh ACCP Conference on Antithrombotic and Thrombolytic Therapy. Chest 2004;126:483S–512S.

14. Sandercock PA, van den Belt AG, Lindley RI, et al. Antithrombotic therapy in acute ischaemic stroke: an overview of the completed randomised trials. J Neurol Neurosurg Psychiatry 1993;56:17–25.

15. Sudlow M, Rodgers H, Kenny RA, et al. Population based study of use of anticoagulants among patients with atrial fibrillation in the community. BMJ 1997;314:1529–30.

16. Organisation for Economic Co-operation and Development. "In-hospital mortality following stroke", in OECD, Health at a Glance 2011: OECD Indicators, OECD Publishing. http://www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-2011/in-hospital-mortality-following-stroke_health_glance-2011-43-en Accessed [11th October 2012].

17. Hisashige A. MR imaging in Japan and the United States: analysis of utilization and economics. Am J Roentgenol 1994;162:507–10.

18. Oh EH, Imanaka Y, Evans E. Determinants of the diffusion of computed tomography and magnetic resonance imaging. Int J Technol Assess Health Care 2005;21:73–80.

Patient Factors
Sex
Age upon admission
Surgery performed (excluding blood transfusions)
Acute myocardial infarction
Congestive heart failure
Peripheral vascular disease
Dementia
Chronic pulmonary disease
Connective tissue disease
Ulcer
Liver disease
Diabetes with chronic complications
Hemiplegia or paraplegia
Malignancy (excluding skin cancers)
Metastatic solid tumor
Hospital Factors
DPC status
Teaching status
Private ownership
>300 beds

Table 1. Independent variables used in regression analyses.

	Health Care Spending Categories				
	Quartile 1	Quartile 2	Quartile 3	Quartile 4	
Spending (Mean, USD)*	10 657	11 623	12 440	13 407	
Municipalities	8	9	8	8	
Admissions (N)	629	952	1 291	1 086	
Patient Characteristics					P-value
Age (Mean, Years)	78.4	78.1	76.8	77.5	0.001
Female (%)	46.1	47.6	44.9	46.1	0.669
Length of Stay (Mean, Days)	25.8	27	25.9	25.7	0.471
Hospital Characteristics					
DPC system hospital (%)	54.5	46.4	58.9	75.8	<0.001
Teaching hospital (%)	65.3	72	61	64.8	<0.001
Private ownership (%)	38.6	56	56.2	57	<0.001
>300 beds (%)	34.3	67.2	60.6	64.8	<0.001

Table 2. Patient and hospital characteristics of the sample in each of the health care spending quartile categories. Spending refers to age-sex adjusted health care spending per admission for ischemic stroke care. DPC: Diagnosis Procedure Combination payment system. P-values were calculated using ANOVA between spending categories.

	Health Care Spending Categories				
Indicators	Quartile 1	Quartile 2	Quartile 3	Quartile 4	P-value
CT or MRI scans	95.9	96.2	96.8	96.7	0.688
t-PA Administration	0.5	2.6	3.2	3.7	0.001
Antithrombotics	84.9	88.1	89.9	89.2	0.010
In-Hospital Rehabilitation	60.6	67.8	68.8	70.1	<0.001
Early Rehabilitation	58.7	66.4	66.7	68.4	<0.001
Dysphagia Rehabilitation	4.1	8.5	8	16.8	<0.001
Warfarin in AF patients	52.8	56.5	59.6	71.6	<0.001
In-Hospital Mortality	6.2	5.8	5.9	6.1	0.984
30-day Mortality	4.1	3.9	3.8	4.4	0.879

Table 3. Performance (%) of the various quality indicators, by spending quartile. Municipalities in Quartile 1 had the lowest spending, and municipalities in Quartile 4 had the highest spending. Early rehabilitation refers to rehabilitation provided within 30 days of admission. CT: Computer Tomography; MRI: Magnetic Resonance Imaging; t-PA: Tissue plasminogen activator; AF: Atrial Fibrillation. P-values were calculated using ANOVA between spending categories.

Indicators	Quartile 1			Quartile 2			Quartile 3		
	Odds Ratio	P-value	95% Confidence Intervals	Odds Ratio	P-value	95% Confidence Intervals	Odds Ratio	P-value	95% Confidence Intervals
CT or MRI scans	0.81	0.463	0.452-1.435	0.83	0.464	0.509-1.360	1.06	0.822	0.659-1.692
t-PA Administration	0.15	0.003	0.045-0.520	0.75	0.291	0.431-1.287	0.98	0.946	0.623-1.556
Antithrombotics	0.66	0.012	0.475-0.913	0.86	0.325	0.643-1.158	1.05	0.729	0.796-1.385
In-Hospital Rehabilitation	0.68	0.001	0.546-0.857	0.89	0.235	0.726-1.082	0.94	0.525	0.787-1.130
Early Rehabilitation	0.71	0.003	0.567-0.886	0.92	0.394	0.754-1.118	0.94	0.525	0.790-1.128
Dysphagia Rehabilitation	0.24	<0.001	0.152-0.378	0.37	<0.001	0.268-0.506	0.42	<0.001	0.320-0.550
Warfarin in AF patients	0.48	0.013	0.264-0.856	0.58	0.031	0.354-0.950	0.58	0.019	(0.369-0.916)
In-Hospital Mortality	0.88	0.575	0.554-1.388	0.90	0.596	0.601-1.340	1.00	0.997	0.696-1.435
30-day Mortality	0.87	0.567	0.502-1.501	0.87	0.939	0.542-1.399	0.98	0.997	0.644-1.502

Table 4. The relationship between the lower quartiles of health care spending and quality of care indicators. Odds ratios, statistical significance and 95% confidence intervals were calculated using logistic regression analyses. Dependent variables in the regression models were the respective quality of care indicators, and independent variables included patient age, sex, comorbidities, surgeries performed, hospital size, teaching status and ownership. Patients in Quartile 4 of hospital spending (highest hospital spending) were used as the reference category. Early rehabilitation refers to rehabilitation provided within 30 days of admission. CT: Computer Tomography; MRI: Magnetic Resonance Imaging; t-PA: Tissue plasminogen activator; AF: Atrial Fibrillation.

Appendix: [Note to production editor: Appendix is web-only]

Dependent Variable	CT or MRI scans			
Independent Variables	B	S.E.	Exp(B)	P-value
Sex	-0.211	0.189	0.809	0.264
Age upon admission	-0.003	0.010	0.997	0.764
Surgery performed (excluding blood transfusions)	-0.090	0.338	0.914	0.791
Acute myocardial infarction	0.216	0.616	1.241	0.726
Congestive heart failure	0.064	0.275	1.066	0.817
Peripheral vascular disease	-1.175	0.555	0.309	0.034
Dementia	0.719	0.727	2.052	0.323
Chronic pulmonary disease	>10.000	>10.000	>10.000	0.999
Connective tissue disease	-0.023	0.736	0.977	0.975
Ulcer	0.332	0.255	1.394	0.192
Liver disease	-0.187	0.224	0.830	0.405
Diabetes with chronic complications	0.463	0.526	1.589	0.379
Hemiplegia or paraplegia	0.405	0.443	1.499	0.361
Malignancy (excluding skin cancers)	0.316	0.487	1.372	0.515
Metastatic solid tumor	-0.067	1.090	0.935	0.951
DPC status	-0.866	0.248	0.420	<0.001
Teaching status	0.656	0.164	1.927	<0.001
Private ownership	0.135	0.101	1.145	0.182
>300 beds	0.019	0.257	1.019	0.942
Quartile 1	-0.216	0.294	0.806	0.463
Quartile 2	-0.183	0.251	0.833	0.464
Quartile 3	0.054	0.241	1.056	0.822
Constant	3.235	1.354	25.409	0.017
Hosmer Lemeshow P-value	0.103			
AUROC	0.666			

Dependent Variable	t-PA administration			
Independent Variables	B	S.E.	Exp(B)	P-value
Sex	-0.478	0.213	0.620	0.025
Age upon admission	-0.001	0.011	0.999	0.957
Surgery performed (excluding blood transfusions)	-0.247	0.382	0.781	0.518
Acute myocardial infarction	-0.261	0.753	0.770	0.729
Congestive heart failure	0.760	0.262	2.137	0.004
Peripheral vascular disease	0.953	0.775	2.593	0.219
Dementia	0.243	0.616	1.275	0.693
Chronic pulmonary disease	1.916	1.328	6.795	0.149
Connective tissue disease	-0.106	1.075	0.899	0.921
Ulcer	-0.235	0.272	0.790	0.388
Liver disease	-0.221	0.283	0.801	0.434
Diabetes with chronic complications	-0.268	0.526	0.765	0.610
Hemiplegia or paraplegia	0.992	0.403	2.695	0.014
Malignancy (excluding skin cancers)	-0.323	0.598	0.724	0.589
Metastatic solid tumor	<-10.000	>10.000	0.000	0.998
DPC status	-0.156	0.305	0.855	0.608
Teaching status	0.759	0.328	2.137	0.020
Private ownership	0.353	0.095	1.423	0.000
>300 beds	0.230	0.399	1.259	0.564
Quartile 1	-1.876	0.623	0.153	0.003
Quartile 2	-0.295	0.279	0.745	0.291
Quartile 3	-0.016	0.234	0.984	0.946
Constant	<-10.000	>10.000	0.000	0.998
Hosmer Lemeshow P-value	0.658			
AUROC	0.751			

Dependent Variable	Antithrombotics administration			
Independent Variables	B	S.E.	Exp(B)	P-value
Sex	0.001	0.110	1.001	0.992
Age upon admission	-0.045	0.006	0.956	<0.001
Surgery performed (excluding blood transfusions)	0.028	0.200	1.029	0.888
Acute myocardial infarction	0.159	0.329	1.172	0.629
Congestive heart failure	0.282	0.158	1.326	0.075
Peripheral vascular disease	-0.666	0.402	0.514	0.097
Dementia	-0.266	0.274	0.767	0.332
Chronic pulmonary disease	>10.000	>10.000	>10.000	0.999
Connective tissue disease	-0.281	0.404	0.755	0.487
Ulcer	0.350	0.143	1.420	0.014
Liver disease	0.095	0.139	1.100	0.494
Diabetes with chronic complications	0.176	0.305	1.192	0.564
Hemiplegia or paraplegia	0.859	0.283	2.361	0.002
Malignancy (excluding skin cancers)	-0.602	0.207	0.548	0.004
Metastatic solid tumor	-0.440	0.504	0.644	0.383
DPC status	-0.430	0.141	0.650	0.002
Teaching status	0.360	0.096	1.434	<0.001
Private ownership	0.281	0.059	1.325	<0.001
>300 beds	0.052	0.143	1.053	0.719
Quartile 1	-0.417	0.167	0.659	0.012
Quartile 2	-0.148	0.150	0.863	0.325
Quartile 3	0.049	0.141	1.050	0.729
Constant	4.754	0.784	116.057	<0.001
Hosmer Lemeshow P-value	0.687			
AUROC	0.698			

Dependent Variable	In-Hospital Rehabilitation			
Independent Variables	B	S.E.	Exp(B)	P-value
Sex	-0.142	0.073	0.868	0.051
Age upon admission	0.014	0.004	1.014	<0.001
Surgery performed (excluding blood transfusions)	0.388	0.140	1.475	0.006
Acute myocardial infarction	-0.238	0.228	0.788	0.297
Congestive heart failure	-0.163	0.104	0.849	0.116
Peripheral vascular disease	0.610	0.389	1.841	0.116
Dementia	0.011	0.217	1.011	0.960
Chronic pulmonary disease	>10.000	>10.000	>10.000	0.999
Connective tissue disease	0.425	0.316	1.529	0.180
Ulcer	-0.002	0.088	0.998	0.982
Liver disease	0.215	0.091	1.240	0.018
Diabetes with chronic complications	0.296	0.182	1.344	0.104
Hemiplegia or paraplegia	1.179	0.185	3.251	<0.001
Malignancy (excluding skin cancers)	-0.072	0.166	0.931	0.666
Metastatic solid tumor	-0.489	0.436	0.613	0.262
DPC status	-0.085	0.096	0.919	0.379
Teaching status	0.377	0.071	1.457	<0.001
Private ownership	-0.073	0.036	0.930	0.043
>300 beds	0.027	0.102	1.028	0.789
Quartile 1	-0.379	0.115	0.684	0.001
Quartile 2	-0.121	0.102	0.886	0.235
Quartile 3	-0.059	0.092	0.943	0.525
Constant	-0.516	0.566	0.597	0.362
Hosmer Lemeshow P-value	0.479			
AUROC	0.615			

Dependent Variable	Early Rehabilitation			
Independent Variables	B	S.E.	Exp(B)	P-value
Sex	-0.131	0.072	0.878	0.070
Age upon admission	0.014	0.004	1.014	<0.001
Surgery performed (excluding blood transfusions)	0.432	0.139	1.540	0.002
Acute myocardial infarction	-0.301	0.224	0.740	0.180
Congestive heart failure	-0.149	0.103	0.862	0.148
Peripheral vascular disease	0.366	0.354	1.442	0.302
Dementia	-0.012	0.213	0.988	0.955
Chronic pulmonary disease	>10.000	>10.000	>10.000	0.999
Connective tissue disease	0.734	0.331	2.083	0.027
Ulcer	0.054	0.087	1.056	0.536
Liver disease	0.143	0.089	1.153	0.110
Diabetes with chronic complications	0.281	0.178	1.324	0.116
Hemiplegia or paraplegia	1.044	0.170	2.840	<0.001
Malignancy (excluding skin cancers)	-0.123	0.164	0.884	0.453
Metastatic solid tumor	-0.493	0.438	0.611	0.260
DPC status	-0.057	0.095	0.944	0.548
Teaching status	0.391	0.070	1.479	<0.001
Private ownership	-0.054	0.036	0.947	0.127
>300 beds	0.130	0.100	1.139	0.194
Quartile 1	-0.344	0.114	0.709	0.003
Quartile 2	-0.086	0.101	0.918	0.394
Quartile 3	-0.058	0.091	0.944	0.525
Constant	-0.357	0.583	0.700	0.541
Hosmer Lemeshow P-value	0.303			
AUROC	0.623			

Dependent Variable	Dysphagia Rehabilitation			
Independent Variables	B	S.E.	Exp(B)	P-value
Sex	0.091	0.117	1.096	0.435
Age upon admission	0.033	0.007	1.034	<0.001
Surgery performed (excluding blood transfusions)	0.916	0.165	2.499	<0.001
Acute myocardial infarction	0.134	0.349	1.143	0.701
Congestive heart failure	-0.013	0.168	0.988	0.941
Peripheral vascular disease	0.075	0.621	1.078	0.904
Dementia	0.561	0.297	1.753	0.059
Chronic pulmonary disease	1.767	0.974	5.854	0.070
Connective tissue disease	-0.140	0.566	0.869	0.804
Ulcer	-0.253	0.153	0.776	0.097
Liver disease	0.037	0.147	1.037	0.803
Diabetes with chronic complications	0.088	0.282	1.092	0.756
Hemiplegia or paraplegia	-0.740	0.345	0.477	0.032
Malignancy (excluding skin cancers)	0.189	0.257	1.209	0.460
Metastatic solid tumor	<-10.000	>10.000	0.000	0.998
DPC status	-0.388	0.159	0.679	0.015
Teaching status	0.222	0.139	1.248	0.111
Private ownership	-0.023	0.051	0.977	0.652
>300 beds	1.163	0.200	3.200	<0.001
Quartile 1	-1.429	0.233	0.239	<0.001
Quartile 2	-0.999	0.162	0.368	<0.001
Quartile 3	-0.869	0.138	0.420	<0.001
Constant	-4.208	0.784	0.015	<0.001
Hosmer Lemeshow P-value	0.232			
AUROC	0.743			