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Association of Care by Hospitalists on Discharge Destination and 30-day Outcomes After Acute Ischemic Stroke

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Abstract

Objectives—The use of hospitalists is increasing. Hospitalists have been associated with reductions in length of stay and associated costs while not negatively impacting outcomes. We examine care for stroke patients because it requires complex care in the hospital and has high post discharge complications. We assessed the association of care provided by a hospitalist with length of stay, discharge destination, 30-day mortality, 30-day readmission, and 30-day emergency department visits.

Methods—This study used the 5% Medicare sample from 2002 to 2006. Models included demographic variables, prior health status, type of admission and hospital, and region. Multinomial logit models, generalized estimating equations, Cox proportional hazard models, and propensity score analyses were explored in the analysis.

Results—After adjusting models for covariates, hospitalists were associated with increased odds of discharge to inpatient rehabilitation or other facilities compared with discharge home (Odds Ratio, 1.24; 95% CI, 1.07–1.43 and Odds Ratio, 1.34; 95% CI 1.05–1.69, respectively). Mean length of stay was 0.37 days lower for patients in hospitalist care compared to nonhospitalist care. This reduction in length of stay was not appreciably changed after adjusting for discharge destination. Hospitalist care was not associated with differences in 30-day emergency department use or mortality. Readmission rates were higher for patients in hospitalist care (Hazard, 1.30; 95% CI, 1.11–1.52).

Conclusions—Hospitalists are associated with reduced length of stay and higher rates of discharge to inpatient rehabilitation. The higher readmission rates should be further explored.

Keywords

stroke; hospitalist; length of stay; discharge destination

The number of hospitalists has increased dramatically over the past 15 years,^{1,2} coinciding with pressures to increase the efficiency of care. Potential advantages of hospitalists include increased availability of the physician during the hospitalization and greater expertise in treating hospitalized patients.³ In addition, hospitalist care results in reduced length of stay and reduced hospital costs.^{3–8} Potential disadvantages of hospitalist care are the disruption in continuity of care between the patient and their primary care provider.^{9–11} Such disruption could contribute to medical errors in the transition from hospital to the post discharge setting.

Hospitalist care may be particularly effective for patients who present with complex conditions that require a high degree of coordination during the admission. Stroke is one such condition. Acute cerebrovascular disease is the third leading cause of death and a leading cause of disability,¹² and has been consistently one of the top reasons for nonmaternal hospital admissions.¹³ Readmission after discharge for stroke hospitalization is also quite high—estimates range from 20% to 27% in the first year.^{14–16} Persons of 65 years and older account for more than 70% of ischemic stroke hospitalizations.¹⁷ Mortality in the first 30 days after hospitalization for stroke is 12.7%.¹² Nearly 25% die within the first year.^{18–20}

Stroke hospitalization presents numerous challenges, and complication rates during hospital admission for stroke are high.^{21–23} Patients admitted for stroke frequently present with comorbid conditions, including arrhythmias, congestive heart failure, chronic obstructive pulmonary disease (COPD), diabetes, hypertension, peripheral vascular disease, and valvular disease.²⁴ The presence of these conditions requires complex planning and coordination of care. Discharge planning is also complex, involving stays in rehabilitation facilities or skilled nursing facilities post discharge.

We chose to focus on hospitalist care for stroke patients because of the complexity of inpatient care and the high rate of post discharge complications. Hospitalists may be particularly well suited to facilitate such complex administration given their familiarity with the hospital microcosm.²⁵ Alternatively, hospitalist care might lead to adverse outcomes post discharge because of discontinuity of care.^{26,27}

The reported reductions in length of stay associated with hospitalists have been modest.^{2,3,5,28} One potential mechanism of reducing length of stay is to transfer a patient to another facility. Although discharge destination has been included in the literature on hospitalists, it has not previously been investigated as a potential mediator for the reduction in LOS.

We examined the association between hospitalist use and outcomes. In particular, we asked if decreased LOS was due to an increase in discharge to other facilities. In addition, we assessed the impact of hospitalist care on 30-day emergency department use, readmission, and mortality.

METHODS

Source of Data

This study uses files from the 5% Medicare sample from 2002 to 2006. These files include the Medicare Provider Analysis and Review (MEDPAR) file (hospital inpatient and skilled nursing facilities), Carrier files (physician/supplier files), outpatient Standard Analytical File (hospital outpatient services), and the Denominator file. Subjects were selected for this analysis if they had a hospitalization for an incident ischemic stroke (ICD-9 433.xx or 434.xx), were 66 years of age or older, and were enrolled in both Medicare parts A and B but not in an health maintenance organization for the previous admission year. We focus on ischemic stroke to reduce the heterogeneity of the sample. Beneficiaries were included if they were hospitalized in a short stay facility and the admission was not a transfer admission ($n = 24,818$). The sample was additionally limited to those beneficiaries who had an identified primary care physician in the year before admission,¹⁰ were seen by either a hospitalist or nonhospitalist generalist on 70% or more of the days of admission ($n = 10,943$), and who had complete place of service records ($n = 9185$). We limited our sample to beneficiaries with a primary care physician to ensure that patients seen by hospitalists and

nonhospitalists both had similar access and use of health care services before admission for stroke.

Measures

Age, race, and sex were obtained from the denominator files. Socioeconomic status was assessed by whether or not the beneficiary was eligible for Medicaid. Comorbidities were assessed by examining ICD-9 codes from both inpatient and outpatient records for the previous year. Comorbid conditions were considered if they occurred in any position on the claims on 2 separate visits at least 30 days apart. The comorbidities we included were: arrhythmia, chronic heart failure, COPD, diabetes mellitus (DM), hypertension, hypothyroidism, peripheral vascular disease, and valvular heart disease. We also included origin of admission (emergency department (ER) vs. other), weekend versus week-day admission, and length of stay (LOS) from the MEDPAR file. In addition, we used diagnoses of late effects of stroke (ICD-9 code 438.xx which includes cognitive deficits, speech and language deficits, and paralysis), dysphagia (ICD-9 code 787.2), incontinence (ICD-9 codes 787.6 and 788.xx), and delirium (ICD-9 codes 293.xx and 290.4) during the hospitalization as measures of disease severity. We also included whether or not a neurologist was seen by the beneficiary during the hospital stay. Hospital characteristics were obtained from the place of service file and included number of beds, type of hospital (major medical school vs. other). Census region and metropolitan size were also included.

LOS was obtained from the MEDPAR files. We determined 30-day mortality by examining the difference between the date of discharge and the date of death listed in the denominator file. Emergency department (ER) use and 30-day readmission to an acute care facility were determined for those beneficiaries discharged to a skilled nursing facility (SNF), inpatient rehabilitation, other nonacute care facility (includes intermediate care, long term care, and hospice), or home. Patients discharged to an acute care facility were considered to be continuing the same episode of care. The first emergency department visit within 30 days was determined by Evaluation and Management billing codes in the carrier file (CPT codes 99281–99285 and 99288). This visit had to occur no >30 days after but at least 1 day post discharge. Time to readmission was extracted from the MEDPAR file.

A hospitalist was defined as a general practitioner, internist, geriatrician, or family medicine physician who had >90% of his or her evaluation and management codes generated from the care of hospital inpatients.¹ Physicians may report different specialties on different claims. We assigned a specialty based on the most frequently reported one for a given unique physician identification number. We are more inclusive than Kuo et al¹ in our list of specialties in defining hospitalist. These specialties were identified by a survey of the Society of Hospital Medicine as reported by Hoff et al.²⁹ The beneficiary was then determined to have been cared for by a hospitalist if they received all of their care from a hospitalist compared with receiving all of their care from a nonhospitalist generalist.

Analysis

Initial bivariate relationships between the study variables and care by a hospitalist were explored with χ^2 statistics, t tests, and unadjusted Kaplan-Meier tests. Multinomial logit models were used to assess the association of hospitalist care with discharge destination, accounting for clustering at the hospital level. Generalized estimating equations with log link and normal distribution were used to assess the association of discharge setting on LOS stay through the comparison of least squared means. Cox proportional hazard models, accounting for clustering of admissions within hospitals, were used to assess the impact of covariates on the risk of 30-day mortality, 30-day emergency department visit, and 30-day readmission for any cause. Patients were censored at the end of 30 days or death. In

addition, propensity score analyses were carried out. The propensity of a beneficiary receiving care by a hospitalist was generated from a logistic regression model. Stepwise regression was used to determine the covariates with a P value of 0.05 to enter. We then grouped the beneficiaries in 5 quintiles of the propensity score. We used the Cochran-Mantel-Haenszel test to determine whether the covariates were balanced or not after adjusting for quintiles of propensity. Covariates were included in the propensity analysis if they were significant in these tests. All tests of statistical significance were 2-sided, with $P < 0.05$ being considered significant. Analyses were carried out with SAS version 9.2 (SAS Inc., Cary, NC) and STATA version 10mp (STATA Corp, College Station, TX).

RESULTS

Table 1 shows the demographics, comorbidities, and inpatient characteristics of Medicare beneficiaries admitted for stroke. Patients seen by hospitalists were demographically similar to those seen by nonhospitalist generalist physicians. Patients cared for by hospitalists were less likely to have the comorbidities of COPD and valvular heart disease and were more likely to be in teaching hospitals and large hospitals, to have weekend and emergency department admissions, and ICU use. Baseline frequencies also showed that hospitalist care was associated with a 0.33 day shorter LOS.

Table 2 presents the baseline frequencies of discharge destination and unadjusted percentages for 30-day emergency department use, readmission, and mortality. Hospitalists were associated with significantly higher rates of discharge to inpatient rehabilitation facilities and increased 30-day readmissions.

Presented in Table 3 are the results of a multinomial logistic regression examining discharge destination in the hospitalist and nonhospitalist groups. The unadjusted models show an association between hospitalists and discharge to inpatient rehabilitation. The subsequent model controlled for clustering at the hospital level and the individual level characteristics of age, race/ethnicity, sex, Medicaid eligibility number of hospital admissions in the earlier 12 months, hospital size and teaching status, emergency department and weekend admission, ICU use indicators of disease severity, neurologist care, comorbidities, census region, and metropolitan size. After adjusting for these covariates odds of discharge to inpatient rehabilitation and to other nonacute care facilities were both significantly higher for patients cared for by hospitalists (Odds Ratio, 1.25; 95% CI, 1.07–1.43 and Odds Ratio, 1.34; 95% CI, 1.05–1.69, respectively), compared with discharge home. There was no significant difference between the groups in odds of discharge to a skilled nursing facility.

We next asked if the reduction in LOS associated with hospitalist care was mediated by the increase in discharges to other institutional settings compared with discharge home. Differences in mean LOS between patients cared for by hospitalists and nonhospitalists is presented in Table 4. The unadjusted length of stay showed a reduction of 0.32 days for patients cared for by hospitalists. After adjusting for demographics, comorbidities, hospital characteristics, region, metropolitan size, emergency room admission, weekend admission, ICU use, severity measures, and neurologist care, the length of stay for patients who received hospitalist care was 0.37 days shorter than for nonhospitalists. The addition of discharge location (home vs. all other locations) to the model minimally reduced the difference in length of stay for hospitalists compared with nonhospitalists to 0.34 days.

We next examined the association of hospitalist care and hazard of 30-day emergency department use, readmission, and mortality. Hazard ratios from Cox proportional hazard models are presented in Table 5. Neither the unadjusted models nor adjusted models showed a statistically different hazard of emergency department use or 30-day mortality for patients

cared for by hospitalists, thought there was a nonsignificant trend for higher emergency department use (Hazard Ratio (HR), 1.08; 95% CI, 0.95–1.23 and HR, 1.11; 95% CI, 0.98–1.27 respectively). The hazard of readmission was significantly higher for patients cared for by hospitalists both before and after adjustment for covariates (HR, 1.24; 95% CI, 1.07–1.44 and HR, 1.30; 95% CI, 1.11–1.52, respectively).

We also reassessed the association of hospitalist care on readmission rate with propensity analyses. We divided the study population into quintiles of propensity of receiving care from a hospitalist. In these subanalyses we found no difference in the hazard across quintiles, as the confidence intervals overlapped. The hazard for readmission for the lowest quintile was 1.63 (95% CI, 1.21–2.19) and for the highest quintile was 1.38 (95% CI 0.98–1.94).

DISCUSSION

Between 1996 and 2006 there was a large increase in the use of hospitalists.^{1,2} However, few studies are available using nationally representative data to examine outcomes for patients treated by hospitalists. In these analyses we examined the association of hospitalist care with discharge destination, length of stay, the impact of destination on length of stay, and 30-day post discharge outcomes. We chose stroke because it requires complex care in hospital and has high post discharge complications.

We found that hospitalist care was associated with significantly higher odds of discharge to an inpatient rehabilitation facility. Rehabilitation facilities provide more intensive therapy than that available at a skilled nursing facility or home. Thus, discharging to rehabilitation facilities may represent better overall care. It may be that the differences in discharge setting between patients receiving hospitalist versus nonhospitalist care are due to differences in the health status of the patients or the availability of rehabilitation beds.³⁰ Hospitalists are more likely to work in large hospitals in urban areas.¹ Such a location may have more availability of inpatient rehabilitation facilities. However, adjustment for patient factors and hospital and metropolitan size did not affect the association of hospitalist care on discharge to rehabilitation facilities.

The reduced length of stay associated with hospitalist care was expected. The magnitude of the reduction, 0.38 days, is consistent with other studies.^{2,3,5,28} This reduction may be due to improved clinical pathways in facilities that employ hospitalists. We tested also to see if this reduction was mediated by an increase in discharge to other institutions versus discharge home. The reduction in length of stay after adjustment was almost unchanged. On the basis of these data it does not seem that the shortened length of stay associated with hospitalist care is due to the increase in patients being transferred to other facilities. The decrease in length of stay is similar to that reported by Lindenauer et al⁵ (0.40 d reduction) comparing hospitalists to nonhospitalist generalist. They estimated that this translated to \$268 less cost per admission, an approximate 3% decrease. When applied across 795,000 admissions for new and recurring stroke each year,¹² this represents a substantial sum.

We found a nonsignificant trend in increased emergency department use and a significant increase in readmission rates. We found no association with mortality. Readmission rates following discharge after stroke are high.^{14,18} We found that the 30-day readmission rate for patients treated by hospitalists was significantly higher in both unadjusted and adjusted models. Earlier studies have produced conflicting results, with most reporting no change in readmission rate.^{3,8,31} Somekh et al³² found readmission rates were higher after care by hospitalists compared with cardiologists for patients admitted for chest pain. In addition, Bellet and Whitaker³³ found readmission rates to be higher for patients in hospitalist care compared with nonhospitalists in a pediatric setting.

We focused on a particularly challenging patient population. These patients tend to have multiple comorbidities. The top reasons for readmission in our sample (based on diagnosis related group) were stroke, pneumonia, respiratory infections, heart failure, urinary tract infections, septicemia, and gastrointestinal bleeding. It is not possible to assess using Medicare data whether any particular readmission is preventable. One possible explanation for the higher readmission rates reported here could be a disruption in inpatient to outpatient continuity of care. Despite the benefits they offer, hospitalist care disrupts the continuity of care between the patient and their primary care provider.^{9,10} Deficits in communication across transition from inpatient to outpatient are common and may adversely impact patient care.^{34–36} This loss of continuity in turn generates a challenge for coordinating post hospital care.³⁷ Maintaining continuity across transitions decreases emergency department use, lowers hospital admission rates, and improves control of comorbid conditions and patient satisfaction.^{38,39}

It is also possible that the earlier studies that showed no differences in readmission rates with hospitalist care were studying “early adopters” of hospitalist care, and that the physicians may have been more motivated to ensure adequate communication across the discharge process. We also limited our study to patients who receive all of their generalist inpatient care from either a hospitalist or nonhospitalist. Earlier studies were not so exclusive. These factors combined may partially explain the difference in readmission rates reported here.

An additional explanation for both decreased length of stay and increased readmissions might be found in Medicare’s prospective payment system. Medicare pays a fixed price for an episode of care for a given diagnosis related group. Physicians are under increasing pressure to keep costs in line with these boundaries. Physicians who work for hospitals may be faced with greater pressure to contain these costs than nonhospitalist generalists. As such, hospitalists may be more inclined to discharge earlier than a nonhospitalist generalist.

One unusual finding was that incontinence during hospitalization was associated with lower 30-day mortality (Table 5). We suspect that a diagnosis of incontinence is an indirect marker for less severe disease because very sick patients would have a indwelling urinary catheter and thus be “continent.”

Several limitations bear acknowledgement. First, this research used administrative data that does not capture the level of detail available on chart review. There may be residual confounding introduced through selection bias. One way to limit such bias is to reduce the heterogeneity of underlying characteristics within the study population. We sought to reduce such heterogeneity by selecting only beneficiaries who had a primary care physician before admission, were seen only by a hospitalist or only a nonhospitalist during inpatient stay, and had that contact on at least 70% of the days of admission. In addition, we controlled for covariates to further reduce bias in our estimates. We also carried out a propensity analysis, which showed no difference between groups. One way to indirectly assess the presence of selection bias is to examine more distal outcomes such as long-term mortality. If patients seen by a hospitalist were less healthy in general than those seen by a nonhospitalist, one might expect to see differences in mortality between 30 days and 1 year. We carried out an analysis of 30-day to 1-year mortality and found no significant difference between patients seen by hospitalists and those seen by nonhospitalists (HR, 1.04; 95% CI, 0.92–1.20). However, as in all observational studies, we cannot rule out the possibility of residual confounding from selection bias. An additional limitation is in our use of Medicaid eligibility as a measure of socioeconomic status. We acknowledge that this is an imprecise measure as eligibility requirements vary from state to state. An advantage found in this

measure is that it represents socioeconomic status at the individual level as opposed to using a metric at an aggregated level such as census tract median household income.

In conclusion, care by hospitalist for patients admitted with acute ischemic stroke is associated with increased discharge to inpatient rehabilitation facilities, decreased length of stay, and increased readmission rates. The finding of increased readmission rates reported here should be further explored in other patient populations that require complex discharge planning.

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TABLE 1

Characteristics of Beneficiaries Admitted for Acute Ischemic Stroke by Physician Type[†] in the 5% Medicare Sample, 2002–2006

	Nonhospitalist Care	Hospitalist Care
	n = 8630	n = 2254
Demographics		
Female	61.70%	62.87%
White	88.48%	88.33%
Black	7.84%	8.30%
Other	3.67%	3.37%
Age (mean)	79.62 ± 7.26 y	79.36 ± 7.43 y
66–69	7.25%	8.56%
70–74	14.92%	16.06%
75–79	21.99%	20.90%
80–84	25.25%	24.36%
85–89	18.57%	18.32%
90–94	9.07%	9.14%
95+	2.93%	2.66%
Medicaid eligible	16.00%	17.35%
Earlier admissions	0.77 ± 1.38 admissions	0.72 ± 1.42 admissions
Select comorbidities		
Arrhythmia	18.54%	18.28%
CHF	1.70%	1.86%
COPD	12.89%	10.03% **
DM-complicated	2.29%	1.86%
DM-uncomplicated	9.17%	7.72%
Hypertension	65.48%	64.91%
Peripheral vascular disease	9.30%	8.30%
Pulmonary/circulatory disorders	0.42%	0.31%
Valvular disease	5.32%	4.26%
Complications [‡]		
Late effects of stroke	26.60%	24.71%
Swallowing difficulty	8.12%	9.28%
Incontinence	2.66%	2.83%
Delirium	0.85%	0.62%
Inpatient characteristics		
Neurologist [§]	62.31%	65.69% **
Medical school	14.41%	18.86% **
Beds (total)	332.80 ± 253.29 beds	442.23 ± 314.96 beds **
Weekend admission	23.49%	26.04% *
Emergency department admission	77.60%	84.43% **

	Nonhospitalist Care	Hospitalist Care
	n = 8630	n = 2254
ICU	8.67%	9.76% *
Expired	5.90%	4.88%
Length of stay	5.00 ± 3.75 d	4.67 ± 3.71 d **

* $P < 0.05$.

** $P < 0.01$.

† 100% care by Hospitalist vs. 100% care by nonhospitalist generalist.

‡ Complications during initial hospitalization used as a proxy for disease severity.

§ Neurologist indicates at least 1 inpatient E&M billing code for a neurologist present during hospitalization.

COPD indicates chronic obstructive pulmonary disease.

TABLE 2

Discharge Destination and Outcomes After Discharge for Ischemic Stroke Patients Receiving Hospitalist or Nonhospitalist Care in the 5% Medicare Sample, 2002–2006

Discharge Destination	Nonhospitalist Care	Hospitalist Care
Home	49.60	47.29
Skilled nursing facility	26.51	24.52
Inpatient rehabilitation	18.25	21.79**
Other facility	5.62	6.35
Kaplan-Meier analysis [†]		
30 d emergency department	15.17	16.19
30 d readmission, any cause	9.79	12.00*
30 d mortality	13.07	13.33

* $P < 0.05$.

** $P < 0.001$.

[†] Kaplan-Meier survival estimates (%) at 30 d.

TABLE 3

Multinomial Logistic Regression Estimating Odds of Discharge to Skilled Nursing Facility, Rehabilitation Hospital, or Other Nonacute Care Facility (Compared With Discharge Home) for Stroke Patients Receiving Hospitalist Care Compared With Nonhospitalist Care

	SNF	Inpatient Rehabilitation	Other Nonacute
	OR (95%CI)	OR (95%CI)	OR (95%CI)
Unadjusted model [*]			
Hospitalist	0.97 (0.85–1.10)	1.25 (1.10–1.43)	1.19 (0.95–1.49)
Adjusted model [†]			
Hospitalist	0.99 (0.86–1.14)	1.24 (1.07–1.43)	1.34 (1.05–1.69)
Age	1.10 (1.09–1.10)	1.03 (1.02–1.04)	1.10 (1.09–1.12)
Black	0.97 (0.78–1.21)	1.22 (0.97–1.52)	0.94 (0.63–1.39)
Other	0.80 (0.58–1.09)	0.85 (0.59–1.22)	0.69 (0.39–1.24)
Female	1.41 (1.26–1.58)	1.19 (1.05–1.34)	1.29 (1.07–1.56)
Medicaid eligible	1.65 (1.41–1.93)	1.13 (0.95–1.34)	1.40 (1.09–1.80)
Earlier admissions (#)	1.18 (1.13–1.24)	1.02 (0.96–1.07)	1.22 (1.14–1.30)
Beds (/100)	0.99 (0.96–1.02)	1.04 (1.02–1.07)	0.95 (0.90–0.99)
Medical school	0.89 (0.74–1.07)	1.00 (0.82–1.22)	0.98 (0.73–1.33)
Emergency department admission	1.41 (1.22–1.63)	1.20 (1.03–1.39)	1.24 (0.98–1.57)
Weekend admission	1.03 (0.91–1.16)	1.14 (1.00–1.30)	1.09 (0.88–1.35)
Neurologist	1.16 (1.03–1.30)	1.90 (1.65–2.19)	0.97 (0.80–1.17)
Late effects of stroke [‡]	3.05 (2.69–3.47)	4.78 (4.20–5.45)	3.30 (2.66–4.09)
Swallowing difficulty	3.62 (2.95–4.45)	2.45 (1.93–3.11)	2.98 (2.17–4.08)
Incontinence	1.85 (1.36–2.53)	1.54 (1.09–2.19)	0.72 (0.35–1.47)
Delirium	1.30 (0.74–2.31)	2.05 (1.14–3.71)	1.16 (0.40–3.39)
ICU use	1.51 (1.23–1.86)	1.72 (1.39–2.12)	2.95 (2.20–3.96)

* Standard errors adjusted for clustering at the hospital level.

[†] Model also adjusted for comorbidities (arrhythmia, CHF, COPD, diabetes, HTN, hypothyroidism, peripheral vascular disease, and valvular disease), census region and metropolitan size.

[‡] Late effects include cognitive deficits, speech and language deficits, and paralysis.

TABLE 4

The Effect of Discharge Location on Length of Stay in Stroke Patients Treated by Hospitalists Compared With Nonhospitalists

	Mean Length of stay		Difference in Days (95% CI)
	Nonhospitalist	Hospitalist	
Unadjusted model	5.00	4.68	0.32 (0.15–0.50)
Model adjusted for characteristics *	4.89	4.53	0.37 (0.19–0.53)
Model adjusted for discharge destination [†]	4.83	4.48	0.34 (0.17–0.51)

* Adjusted for clustering at the hospital level; full models also adjusted for comorbidities (arrhythmia, CHF, COPD, diabetes, HTN, hypothyroidism, peripheral vascular disease, and valvular disease), weekend admission, Emergency department admission, hospital size, medical school, census region, metropolitan size, treatment by neurologist, and complications.

[†] Includes all other characteristics and compares other destinations to discharge home.

TABLE 5

Cox Proportional Hazard Models* Estimating Hazard of 30-day Emergency Department Use, Readmission, and Mortality for Stroke Patients Treated by a Hospitalist Compared With a Nonhospitalist

	Emergency Department			Readmission			Mortality†		
	Unadjusted	Adjusted‡	HR (95%CI)	Unadjusted	Adjusted‡	HR (95%CI)	Unadjusted	Adjusted*	HR (95%CI)
	HR (95%CI)			HR (95%CI)			HR (95%CI)		
Hospitalist	1.08 (0.95–1.23)		1.11 (0.98–1.27)	1.24 (1.07–1.44)		1.30 (1.11–1.52)	0.99 (0.87–1.14)		1.04 (0.91–1.19)
Age		1.00 (0.99–1.01)			1.01 (1.00–1.02)			1.03 (1.03–1.04)	
Black		1.08 (0.90–1.30)			1.03 (0.81–1.30)			0.96 (0.75–1.23)	
Other		0.81 (0.60–1.10)			0.84 (0.57–1.24)			1.11 (0.80–1.52)	
Female		1.00 (0.90–1.11)			0.93 (0.81–1.06)			0.93 (0.84–1.04)	
Medicaid eligible		1.18 (1.02–1.35)			1.03 (0.86–1.24)			0.75 (0.64–0.88)	
Earlier admissions (#)		1.11 (0.98–1.27)			1.11 (1.07–1.16)			1.05 (1.02–1.09)	
Beds (/100)		1.00 (0.99–1.01)			1.00 (0.98–1.02)			0.99 (0.97–1.01)	
Medical school		1.08 (0.90–1.30)			1.07 (0.89–1.27)			1.03 (0.89–1.20)	
Emergency department admission		1.55 (1.34–1.79)			0.93 (0.79–1.11)			1.30 (1.11–1.53)	
Weekend admission		1.02 (0.91–1.15)			1.10 (0.95–1.27)			1.05 (0.94–1.18)	
Neurologist		0.96 (0.86–1.08)			1.12 (0.97–1.29)			0.95 (0.85–1.07)	
Late effects of stroke		0.91 (0.80–1.04)			1.01 (0.87–1.18)			1.26 (1.13–1.41)	
Swallowing difficulty		1.14 (0.95–1.36)			0.95 (0.76–1.19)			1.44 (1.24–1.66)	
Incontinence		0.85 (0.62–1.17)			0.86 (0.58–1.27)			0.57 (0.36–0.90)	
Delirium		0.97 (0.53–1.75)			0.59 (0.24–1.43)			1.09 (0.60–1.99)	
ICU use		0.96 (0.86–1.08)			1.01 (0.79–1.29)			1.65 (1.45–1.86)	

* Standard errors adjusted for clustering at the hospital level.

† Sample for mortality models includes in-hospital deaths (n = 10,175).

‡ Full models also adjusted for comorbidities (arrhythmia, CHF, COPD, diabetes, HTN, hypothyroidism, peripheral vascular disease, and valvular disease), census region, and metropolitan size.