EFFECTS OF ADMISSION TO A TEACHING HOSPITAL ON THE COST AND QUALITY OF CARE FOR MEDICARE BENEFICIARIES

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ABSTRACT

Background and Methods We studied the effects of admission to a teaching hospital on the cost and quality of care for patients covered by Medicare (age, 65 years old or older). We used data from the National Long Term Care Survey and merged them with Medicare claims data. We selected the first hospitalization for hip fracture (802 patients), stroke (793), coronary heart disease (1007), or congestive heart failure (604) occurring between January 1, 1984, and December 31, 1994, and calculated all Medicare payments for inpatient and outpatient care during the six-month period after admission. Survival was assessed through 1995. Hospitals were classified as major or minor teaching hospitals (with minor hospitals defined as those in which the number of residents per bed was less than the median number for all teaching hospitals) or as private nonprofit, government (i.e., public), or private for-profit hospitals.

Results Medicare payments for the six-month period after hospitalization were highest for patients initially admitted to teaching hospitals for the treatment of hip fracture, stroke, or coronary heart disease and for patients initially admitted to for-profit hospitals for the treatment of congestive heart failure. As compared with payments to for-profit hospitals, payments to major teaching hospitals for hip fracture were significantly higher, payments to government hospitals for coronary heart disease were lower, and payments to government and nonprofit hospitals for congestive heart failure were lower. After adjustment for patients' characteristics and social subsidies, major teaching hospitals had the lowest mortality rates (hazard ratio for death, 0.75, as compared with for-profit hospitals; 95 percent confidence interval, 0.62 to 0.91). For individual conditions, the only significant survival advantage associated with admission to major teaching hospitals was for hip fractures (hazard ratio, 0.54, as compared with for-profit hospitals; 95 percent confidence interval, 0.37 to 0.79).

Conclusions Although admission to a major teaching hospital may be associated with increased costs to the Medicare program, overall survival for patients with the common conditions we studied was better at these hospitals, especially for patients with hip fractures. (N Engl J Med 1999;340:293-9.)

THE cost of care is generally higher in teaching hospitals than in nonteaching hospitals.[1-5] The higher cost of care in teaching hospitals has been attributed to a more complex case mix; the location of teaching hospitals in urban areas, where costs for labor and overhead are higher; the amount of care provided to uninsured patients; the cost of providing graduate medical education; and the use of more sophisticated forms of technology. Studies of the relative performance of teaching and nonteaching hospitals with respect to outcomes, primarily mortality, have had conflicting results.[4,6-13] Inappropriate adjustment for the characteristics of patients and different periods of follow-up after hospitalization are possible explanations for the conflicting findings.

Medicare is a federal program that purchases inpatient services, primarily for persons 65 years old or older, from various types of hospital. Differences in cost and outcome among hospital types, if systematic and large, could be important, not only to patients, but also to Medicare itself. The hospital in which a patient is treated is chosen not by Medicare but by individual patients, their physicians, and sometimes their health plans.

The type of hospital in which a patient receives inpatient care may influence the cost of services, in part because of Medicare policies, such as providing subsidies for the treatment of low-income patients and for graduate medical education. The type of hospital may also influence patterns of referrals for patients at discharge, and these patterns, in turn, may affect the amount and mix of nonhospital services that Medicare beneficiaries receive. Using a national data base, we studied the effects of admission to a teaching hospital on the cost and quality of care for patients covered by Medicare.

METHODS

Study Design and Population

We used the National Long Term Care Survey, which was administered in 1982, 1984, 1989, and 1994, to obtain the sample for our study. The survey respondents were selected to be representative of Medicare beneficiaries who were 65 years old or older.[14] The beneficiaries were screened to select those with a limita-

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tion in at least one activity of daily living or instrumental activity of daily living that had lasted three months or more. Activities of daily living included eating, getting in or out of bed, moving around inside, dressing, bathing, and using the toilet. Instrumental activities of daily living (the more complex tasks required to live independently in the community) included preparing meals, doing laundry, shopping for groceries, managing money and paying bills, taking medicine, and making telephone calls. Persons with one or more limitations in these activities were interviewed. Respondents who were alive at each subsequent survey date were interviewed again. A total of 35,800 persons were screened, and 13,867 persons completed at least one interview. The survey included respondents living in the community and those living in institutions. Information was collected on health, functional and cognitive status, demographic characteristics, and finances. To be included in our sample, a person had to have completed either a detailed interview or a screening interview before the hospitalization. This allowed us to control for previous health status — notably, the presence or absence of limitations in activities of daily living, cognitive status, residence in the community or a nursing home, and the presence or absence of bowel or bladder incontinence.

Medicare claims data for the period from January 1, 1982, through December 31, 1995, were obtained for all types of services covered by Medicare: inpatient care, outpatient care (including durable medical equipment), physicians' services, home health care, care in a skilled nursing facility, and hospice care. The claims data were merged with the data for all persons screened for the survey in any year.[14] The study protocol was approved by the institutional review board at Duke University Medical Center.

We selected the first admission (the index admission) for a primary diagnosis of hip fracture, stroke, coronary heart disease, or congestive heart failure that occurred on or after January 1, 1984, and that resulted in a hospitalization lasting 91 days or less. We used Medicare claims data to exclude persons hospitalized for one or more of the conditions studied in 1982 or 1983, and we used the 1982 National Long Term Care Survey to exclude those reporting a study condition in 1981. This provided a three-year look-back period for selecting the first hospitalization for a study condition. *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) codes were used to select conditions (see the Appendix).

There were 802 index admissions for hip fracture, 793 for stroke, 1007 for coronary heart disease, and 604 for congestive heart failure from January 1, 1984, through December 31, 1994. If a person was hospitalized for more than one condition during the study period, each condition was considered separately. In an analysis combining the four diagnoses, we used the diagnosis that was made first if a patient was admitted for more than one condition during the study period. The combined sample included 2674 patients treated at 1378 hospitals in the United States.

We classified hospitals according to ownership and teaching status (major or minor) in the year of the index admission, using the American Hospital Association's annual hospital survey for each year of the study. A hospital was sometimes classified differently in different years because of changes in ownership or teaching status. Each hospital was assigned to one of five mutually exclusive categories. We defined teaching status according to the reported number of residents per bed set up and staffed for patient care (range, 0.001 to 1.007). Hospitals with less than the median number of residents per bed (0.097) were classified as minor teaching hospitals, and those with at least the median number of residents per bed were classified as major teaching hospitals. Hospitals with no residents were classified as nonteaching hospitals and were further classified as private, nonprofit hospitals (accounting for 1197 admissions in the combined sample), government (i.e., public) hospitals (416), or private for-profit hospitals (226). Of the 421 patients admitted to minor teaching hospitals, 364 (86.5 percent) were admitted to private, nonprofit facilities, 25 (5.9 percent) to government facilities, and 32 (7.6 percent) to for-profit facilities. Of the 414 patients admitted to major teaching hospitals, 354 (85.5 percent) were admitted to private, nonprofit facilities, 59 (14.3 percent) to government facilities, and 1 (0.2 percent) to a for-profit hospital. Data from patients admitted to hospitals of the Department of Veterans Affairs were not included in our analyses.

Payment Measures

We calculated the sum of total Medicare payments made on behalf of each patient for six months after the index admission. Payments were adjusted to 1994 dollars with the use of the all-item Consumer Price Index. In some analyses, we adjusted payments according to patients' characteristics, disproportionate-share payments (made to hospitals that provide care for a disproportionately large number of indigent persons), and indirect subsidies for the cost of graduate medical education. The data we had did not permit us to identify Medicare payments made as direct subsidies for medical education. A two-tailed t-test for the difference between means was used to compare total payments at six months and the components of payments.[15]

To adjust Medicare payments according to patients' characteristics, we used an equation in which the natural logarithm of total Medicare payments (hospital and nonhospital) within six months after the index admission was the dependent variable with several explanatory variables. The natural logarithm was used in order to account for outliers (unusually high payments).[15] We also estimated the same dependent variable using a model with dichotomous variables for the type of hospital only. The covariates in the full model were hospital type in the year of the index admission (minor or major teaching hospital, government hospital, or nonprofit hospital, with for-profit hospital as the reference category), time trend for the year of admission (from 1 to 11, with 1 denoting an index admission in 1984, 2 an index admission in 1985, and so forth), sex, education (a continuous variable based on the number of years of schooling completed), race (white or nonwhite), place of residence (community or nursing home), number of limited activities of daily living (range, 0 to 6), cognitive status, and presence or absence of bowel or bladder incontinence. Covariates measured at the date of the index admission were age, a diagnosis-based risk-adjustment score (range, −1.5 to 7.3, with a score of 1.0 representing the national average for the expected use of Medicare resources in the next year and higher scores reflecting greater expected use of resources),[16,17] disease-specific binary variables, and population density (number of persons per square mile in the primary sampling unit corresponding to the patient's place of residence). There were 173 primary sampling units (in 42 states); these were clusters of counties in metropolitan areas or single counties in nonmetropolitan areas.[14]

The risk-adjustment score was based on the Hierarchical Coexisting Conditions DxCG model, which we used to classify patients according to the diagnoses recorded on the hospital-claim forms for index admissions.[16,17] We used the risk-adjustment model only for diagnoses because we controlled directly for age and sex. This model was designed to predict future Medicare expenditures on the basis of the severity of the diagnoses recorded for the index hospitalization. One to nine ICD-9-CM diagnostic codes were recorded for each patient. For a particular primary diagnosis, such as stroke, variations in the risk-adjustment score were based on differences in secondary diagnoses.

A person was determined to have a limitation in an activity of daily living if he or she could not perform the activity without the help of another person or the use of special equipment (such as a wheelchair to move around) or if the person could not perform the activity at all. Cognitive status was determined with a 10-question mental-status questionnaire.[18] We defined a patient as cognitively aware if he or she answered seven or more of the questions correctly. If a person used a proxy to respond to the questionnaire and if the reason for a proxy response was noted as being related to cognition, then this variable was assigned a value of 0. For the analysis of hip fractures, a binary variable was used to distinguish between pertrochanteric and other fractures. For stroke, we distinguished between ischemic and hemorrhagic strokes. Separate binary variables for unstable angina or angina

TABLE 1. COMPONENTS OF TOTAL MEDICAL PAYMENTS AT SIX MONTHS ACCORDING TO CONDITION AND TYPE OF HOSPITAL.*

CONDITION AND VARIABLE	TYPE OF HOSPITAL								
	FOR PROFIT	GOVERNMENT	P VALUE	NONPROFIT	P VALUE	MINOR TEACHING	P VALUE	MAJOR TEACHING	P VALUE
Hip fracture									
No. of patients	66	110		396		117		113	
Component of payment ($)									
Index admission	8,266	7,659	0.32	8,275	0.99	9,104	0.16	10,555	<0.001
Readmission	1,484	1,613	0.83	1,921	0.47	1,536	0.94	1,921	0.55
Physicians' services†	1,944	1,550	0.19	1,776	0.55	1,736	0.50	2,026	0.80
Skilled nursing facility	1,463	1,043	0.30	1,447	0.97	1,601	0.72	1,771	0.48
Home health care	1,114	1,089	0.95	737	0.15	589	0.06	687	0.12
Total payment‡	14,586	13,266	0.31	14,569	0.99	14,917	0.80	17,501	0.05
Stroke									
No. of patients	77	129		347		124		116	
Component of payment ($)									
Index admission	6,474	4,655	0.02	6,496	0.98	7,948	0.12	7,413	0.33
Readmission	2,120	1,719	0.44	2,531	0.38	2,358	0.71	2,846	0.39
Physicians' services†	1,166	1,009	0.45	1,462	0.16	1,582	0.08	1,487	0.20
Skilled nursing facility	1,085	886	0.77	1,159	0.91	1,147	0.93	753	0.63
Home health care	714	544	0.49	673	0.86	646	0.78	1,093	0.37
Total payment‡	11,840	9,097	0.06	12,681	0.51	14,216	0.15	13,874	0.26
Coronary heart disease									
No. of patients	88	168		419		166		166	
Component of payment ($)									
Index admission	5,100	3,912	0.15	5,476	0.61	6,028	0.27	7,294	0.02
Readmission	3,344	2,455	0.28	2,832	0.47	3,030	0.71	4,400	0.27
Physicians' services†	2,080	1,133	0.04	1,332	0.08	1,476	0.18	1,805	0.54
Skilled nursing facility	128	99	0.75	239	0.37	80	0.61	66	0.49
Home health care	714	412	0.20	382	0.12	268	0.04	273	0.04
Total payment‡	11,679	8,205	0.05	10,484	0.47	11,046	0.72	14,220	0.16
Congestive heart failure									
No. of patients	66	106		268		89		75	
Component of payment ($)									
Index admission	5,068	3,397	0.005	4,239	0.16	4,739	0.62	5,853	0.28
Readmission	5,043	2,759	0.09	2,846	0.09	3,118	0.15	4,397	0.67
Physicians' services†	2,218	1,246	0.03	1,311	0.03	1,591	0.20	1,627	0.25
Skilled nursing facility	441	20	0.08	242	0.42	247	0.49	109	0.19
Home health care	1,019	635	0.20	550	0.09	456	0.04	280	0.008
Total payment‡	14,161	8,343	0.005	9,453	0.02	10,596	0.10	12,756	0.55

*Payments are mean values expressed in 1994 dollars. P values are for the comparison with for-profit hospitals and were calculated with the two-tailed Student's t-test.

†Physicians' services include reimbursement of physicians' fees by Medicare Part B.

‡The total payment includes reimbursement for outpatient services (including nonhospital services such as durable medical equipment) and hospice care.

pectoris and for ischemic heart disease with acute myocardial infarction, which was the omitted reference group, were used for coronary heart disease. Finally, we used a binary variable to distinguish uncomplicated congestive heart failure from congestive heart failure that occurred with hypertensive or renal disease.

The adjustment of total Medicare payments according to patients' characteristics was based on changes in coefficients of the hospital-type variables in analyses with and without other covariates. We compared the change in payments (in dollars) indicated by hospital-type coefficients in the model with only hospital-type explanatory variables with the same coefficients in the model adjusted for patients' characteristics. If the amount of payment adjustment by hospital type differed when we controlled for patients' characteristics, then such characteristics explained a portion of the difference in payments according to hospital type. If the difference in adjustments was positive, suggesting that the type of hospital in question had a less costly patient mix than nonteaching for-profit hospitals, we added this amount to total payments; if the difference was negative, we subtracted it from total payments. The patient-mix adjustment factor was constant for a given hospital type. We then removed indirect subsidies for medical education and disproportionate-share payments documented in the claims data, in order to obtain adjusted total payments at six months.

Statistical Analysis

We measured survival from the date of the index admission (on or after January 1, 1984) through December 31, 1995. Because the last index admission occurred on December 31, 1994, we had a minimal follow-up of one year. The National Long Term Care Survey documented the date of death with use of information from Medicare enrollment records, the National Death Index, and state records of vital status.[14] Cox proportional-hazards regression was used to analyze survival separately for each condition and for all four conditions combined.[19] We used the same covariates as in the regression analysis of Medicare payments.

RESULTS

In terms of mean total Medicare payments during the six-month period after the index admission, major teaching hospitals were the most expensive for

TABLE 2. ADJUSTED TOTAL MEDICARE PAYMENTS AT SIX MONTHS.*

CONDITION AND HOSPITAL TYPE	UNADJUSTED PAYMENT ($)	P VALUE	ADJUSTMENT FACTOR FOR PATIENT CHARACTERISTICS ($)†	ADJUSTMENT FACTOR FOR SUBSIDIES ($)‡	P VALUE	ADJUSTED PAYMENT ($)	P VALUE
Hip fracture							
For profit	14,586		0	43		14,543	
Government	13,266	0.31	1,163	78	0.22	14,351	0.89
Nonprofit	14,569	0.99	7	91	0.05	14,485	0.96
Minor teaching	14,917	0.80	816	256	<0.001	15,477	0.49
Major teaching	17,501	0.05	−1,887	663	<0.001	14,951	0.76
Stroke							
For profit	11,840		0	54		11,786	
Government	9,097	0.06	118	93	0.31	9,122	0.07
Nonprofit	12,681	0.51	−609	63	0.69	12,009	0.87
Minor teaching	14,216	0.15	−503	144	0.003	13,569	0.27
Major teaching	13,874	0.26	−1,192	824	<0.001	11,858	0.96
Coronary heart disease							
For profit	11,679		0	63		11,616	
Government	8,205	0.05	666	99	0.37	8,772	0.11
Nonprofit	10,484	0.47	116	117	0.08	10,483	0.49
Minor teaching	11,046	0.72	−377	200	<0.001	10,469	0.51
Major teaching	14,220	0.16	−1,669	672	<0.001	11,879	0.88
Congestive heart failure							
For profit	14,161		0	94		14,067	
Government	8,343	0.005	760	81	0.80	9,022	0.02
Nonprofit	9,453	0.02	692	62	0.38	10,083	0.05
Minor teaching	10,596	0.10	437	184	0.17	10,849	0.14
Major teaching	12,756	0.55	41	543	0.003	12,254	0.44

*Data are mean values expressed in 1994 dollars. P values are for the comparison with for-profit hospitals and were calculated with the two-tailed Student's t-test. We did not perform t-tests for the patient-mix adjustment factor because it was a constant for a given hospital type, making P values unmeaningful.

†To adjust for patient mix, we estimated an equation with the natural logarithm of total payments as the dependent variable, with full and reduced models, as described in the Methods section. The adjustment was based on changes in hospital-type coefficients relative to for-profit hospitals, with and without other covariates. We calculated a patient-mix adjustment factor by comparing the payments in the full and reduced models. If the difference suggested a less costly patient mix, we added this value to total payments; if it suggested a more costly patient mix, we subtracted the value. The patient-mix adjustment factor was constant for a given condition and hospital type.

‡Adjustments for subsidies (including indirect subsidies for medical education and disproportionate-share payments) were made by excluding (subtracting) such payments as documented in the claims data.

the treatment of hip fracture ($17,501, as compared with $14,586 for for-profit hospitals; P=0.05) (Table 1). For the treatment of coronary heart disease and congestive heart failure, government hospitals had the lowest payments ($8,205, as compared with $11,679 for for-profit hospitals [P=0.05] and $8,343 as compared with $14,161 [P=0.005], respectively). Payments for patients with congestive heart failure who were initially admitted to nonprofit hospitals were lower than payments for patients with the same conditions who were admitted to for-profit hospitals ($9,453 vs. $14,161, P=0.02).

As compared with for-profit hospitals, major teaching hospitals received higher mean payments for index admissions of patients with hip fractures ($10,555 vs. $8,266, P<0.001) and those with coronary heart disease ($7,294 vs. $5,100, P=0.02). Government hospitals received lower payments for index admissions of patients with stroke ($4,655, as compared with $6,474 for for-profit hospitals; P=0.02) and those with congestive heart failure ($3,397 vs. $5,068, P=0.005).

Patients initially treated in teaching hospitals for coronary heart disease or congestive heart failure had lower costs for home health care than those treated in for-profit hospitals (major teaching hospitals, $273 vs. $714 [P=0.04] and $280 vs. $1,019 [P=0.008], respectively; minor teaching hospitals, $268 vs. $714 [P=0.04] and $456 vs. $1,019 [P=0.04], respectively). Payments for physicians' services were lower for patients with coronary heart disease and those with congestive heart failure who were initially treated in government hospitals than for those treated in for-profit hospitals ($1,133 vs. $2,080 [P=0.04] and

TABLE 3. UNADJUSTED PROBABILITY OF SURVIVAL ACCORDING TO HOSPITAL TYPE.

CONDITION	FOR PROFIT	GOVERNMENT	NONPROFIT	MINOR TEACHING	MAJOR TEACHING
Hip fracture					
No. of patients	66	110	396	117	113
Survival at 4 wk	0.95	0.93	0.94	0.93	0.97
Survival at 52 wk	0.85	0.77	0.81	0.73	0.86
Stroke					
No. of patients	77	129	347	124	116
Survival at 4 wk	0.91	0.79	0.85	0.86	0.88
Survival at 52 wk	0.66	0.60	0.69	0.69	0.73
Coronary heart disease					
No. of patients	88	168	419	166	166
Survival at 4 wk	0.93	0.85	0.91	0.94	0.92
Survival at 52 wk	0.78	0.75	0.80	0.83	0.82
Congestive heart failure					
No. of patients	66	106	268	89	75
Survival at 4 wk	0.88	0.92	0.87	0.85	0.93
Survival at 52 wk	0.62	0.68	0.64	0.60	0.73

$1,246 vs. $2,218 [P=0.03], respectively). Payments for physicians' services for patients with congestive heart failure who were admitted to nonprofit hospitals were also lower than those for patients admitted to for-profit hospitals ($1,311 vs. $2,218, P=0.03).

Adjusting total Medicare payments according to patients' characteristics and subsidies (indirect subsidies for medical education and disproportionate-share payments) reduced differences in Medicare payments at six months (Table 2). The only significant difference from for-profit hospitals was for total adjusted payments to both government and nonprofit hospitals for the treatment of congestive heart failure ($9,022 vs. $14,067 [P=0.02] and $10,083 vs. $14,067 [P=0.05], respectively).

The proportion of patients who were alive at the end of the study period (December 31, 1995) ranged from 37.6 percent for those with coronary heart disease to 16.6 percent for those with congestive heart failure. One year after the index admission, patients initially treated at major teaching hospitals for hip fracture, stroke, or congestive heart failure had the highest unadjusted probability of survival, and the probability was similar for patients with coronary heart disease treated at major teaching hospitals (0.82) and those treated at minor teaching hospitals (0.83) (Table 3).

When the analysis was adjusted for other determinants of survival, Medicare patients admitted to major teaching hospitals had lower mortality rates than those admitted to other types of hospitals (Table 4). In the pooled analysis, the mortality rate for patients treated at teaching hospitals was 25 percent lower than that for patients treated at for-profit hospitals (hazard ratio for death, 0.75; 95 percent confidence interval, 0.62 to 0.91; P=0.004). Hazard ratios for other types of hospitals did not differ significantly from 1.0.

Among the patients initially treated in major teaching hospitals, those with hip fractures had the lowest hazard ratio (0.54; 95 percent confidence interval, 0.37 to 0.79; P=0.002 for the comparison with for-profit hospitals); for those with coronary heart disease, there was a nonsignificant trend toward better survival. Among patients with stroke or congestive heart failure, the mortality rate was similar for those initially hospitalized in major teaching hospitals and those initially hospitalized in for-profit hospitals.

Individual characteristics associated with decreased survival in the pooled sample were older age, male sex, residence in the community before the index admission, a higher number of limited activities of daily living before admission, normal cognitive status before admission, and a higher risk-adjustment score (P<0.001 for all the comparisons).

DISCUSSION

We found that total Medicare payments over a period of six months after the index admission were highest for patients admitted to teaching hospitals for the treatment of hip fracture, stroke, or coronary heart disease. When patients' characteristics and social subsidies were accounted for, differences in payments according to the type of hospital were reduced. For patients with coronary heart disease or congestive heart failure, the type of hospital where the patient initially received treatment influenced the subsequent use of nonhospital services. Medicare payments for home health care services were higher for patients with coronary heart disease or congestive heart failure who were initially treated at for-profit hospitals than for those treated at teaching hospitals, and payments for physicians' services were lower for patients with those conditions who were initially admitted to government hospitals than for those admitted to for-profit hospitals.

An analysis adjusted for a large number of patient characteristics, including coexisting conditions, showed that patients admitted to major teaching hospitals had better survival than those admitted to other types of hospital. This finding was strongest for patients with hip fractures. Although previous studies of the relation between hospital type and mortality have had conflicting results, a comprehensive study found that mortality rates were higher and the quality of care was lower at public hospitals than at teaching hospitals.[7] As compared with data bases used in previous studies, our data base afforded a longer follow-up period and allowed us to control for health status before the index admission and coexisting conditions at the time of admission in determining mortality. With respect to changes after the index admission in limitations in activities of daily living or instrumental activities of daily living and cognitive status, we found few differences according to hospital type (data not shown).

TABLE 4. EFFECT OF HOSPITAL TYPE ON MORTALITY.*

HOSPITAL TYPE	POOLED ANALYSIS		HIP FRACTURE		STROKE		CORONARY HEART DISEASE		CONGESTIVE HEART FAILURE	
	HAZARD RATIO (95% CI)	P VALUE	HAZARD RATIO (95% CI)	P VALUE	HAZARD RATIO (95% CI)	P VALUE	HAZARD RATIO (95% CI)	P VALUE	HAZARD RATIO (95% CI)	P VALUE
No. of patients	2674		802		793		1007		604	
No. of deaths	1924		574		614		628		504	
Government	0.99 (0.82–1.20)	0.94	0.90 (0.63–1.27)	0.56	1.11 (0.81–1.51)	0.54	1.07 (0.77–1.49)	0.69	0.98 (0.69–1.39)	0.90
Nonprofit	0.93 (0.78–1.09)	0.36	0.76 (0.56–1.04)	0.08	1.08 (0.82–1.42)	0.58	0.87 (0.65–1.17)	0.33	1.16 (0.84–1.57)	0.37
Minor teaching	0.91 (0.75–1.10)	0.34	0.81 (0.56–1.14)	0.23	1.09 (0.79–1.49)	0.61	0.81 (0.58–1.13)	0.21	1.22 (0.84–1.77)	0.29
Major teaching	0.75 (0.62–0.91)	0.004	0.54 (0.37–0.79)	0.002	0.89 (0.64–1.24)	0.49	0.76 (0.55–1.07)	0.11	0.95 (0.64–1.41)	0.81

*Mortality was determined from the date of the index admission through December 31, 1995. The reference category was for-profit, nonteaching hospitals. Covariates that were significant in the pooled analysis and that decreased survival were older age, male sex, residence in the community, normal cognitive status, higher risk-adjustment score, ischemic stroke, hemorrhagic stroke, acute myocardial infarction, congestive heart failure, and congestive heart failure with hypertension or renal disease. A higher value for time trend increased survival. Disease-type variables are relative to pertrochanteric hip fracture. Covariates that were not significant in the pooled analysis were education, race (white vs. nonwhite), income, marital status, presence or absence of bowel or bladder incontinence, population density for area of residence, presence or absence of ischemic heart disease, and presence or absence of angina pectoris or unstable angina. CI denotes confidence interval.

Many individual characteristics had significant and plausible effects on survival. In the pooled sample, older persons and those with a higher number of limitations in activities of daily living had lower survival rates. The lower survival for patients who were living in the community and for those who had a normal cognitive status before the index admission may be explained by the fact that elderly persons in nursing homes and those with cognitive problems are less likely than others to be hospitalized after a life-threatening event.

After adjustment for patients' characteristics and social subsidies, total payments at six months for patients admitted to for-profit hospitals for the treatment of congestive heart failure remained higher than payments for patients with this condition who were admitted to government or nonprofit hospitals. Patients with congestive heart failure who were treated in for-profit hospitals had higher Medicare payments for subsequent nonhospital care, but these higher payments were not associated with improved outcomes.

In one study, patients treated by cardiologists incurred greater costs because they received more intensive care, but they also had higher survival and lower readmission rates.[20] Several studies of predischarge and outpatient management of congestive heart failure have shown that improved care planning results in lower readmission rates.[20-24] For-profit hospitals may be particularly adept at maximizing Medicare payments and at shifting the cost of care for patients with congestive heart failure from the inpatient settings to other settings by increasing the use of physician visits, skilled nursing facilities, and home health care. However, such shifts have not resulted in either improved survival for patients or savings for Medicare.

There is debate about whether the subsidies teaching hospitals receive for graduate medical education and disproportionate-share payments are justified. According to our analysis, ending such subsidies and payments would reduce total Medicare payments at six months by less than 5 percent for patients with hip fractures, stroke, coronary heart disease, or congestive heart failure who are treated initially at major teaching hospitals. The overall improvement in long-term survival after treatment for these conditions at major teaching hospitals is a social benefit worth considering.

Supported in part by a grant (2RO1-AG-09468-04A1) from the National Institute on Aging.

We are indebted to Shin-Yi Chou for excellent research assistance.

APPENDIX

ICD-9-CM CODES USED TO SELECT CASES.

CONDITION	ICD-9-CM CODES
Hip fracture	
Pertrochanteric	820.20–820.22, 820.30, 820.31
Other	820.00, 820.02, 820.03, 820.9–820.13, 820.19, 820.8, 820.9
Stroke	
Ischemic	434.0, 434.1, 434.9, 436 (all subcategories)
Hemorrhagic	430–432 (all subcategories)
Coronary heart disease	
Acute myocardial infarction	410.0–410.9
Angina pectoris or unstable angina	411.1, 411.8–411.81, 411.89, 413.0, 413.1, 413.9
Ischemic heart disease	414.00–414.05, 414.8, 414.9
Congestive heart failure	
Congestive heart failure alone	428.0, 428.1, 428.9
Congestive heart failure with hypertensive or renal disease	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93

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