

Comparison of Hospital Costs and Length of Stay Associated With General Internists and Hospitalist Physicians at a Community Hospital

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Objective: To compare initial and long-term hospital resource utilization of hospitalists and general internists at an urban community hospital.

Study Design: A retrospective cohort analysis.

Methods: Data were collected from 11 750 admissions associated with 28 diagnosis-related groups for 6 years (October 1, 1994, to September 30, 2000). Hospital cost, length of stay, mortality, and 30-day readmission rates of general and hospitalist internists were analyzed for comparison.

Results: Hospitalists had generally lower utilization compared with general internists. Overall, length of stay and hospital cost were 16.1% and 8.3% lower, respectively, for hospitalists. Hospital mortality and 30-day readmissions were similar for both physician groups.

Conclusions: Hospital resource utilization is moderately lower for hospitalists compared with private practicing general internists. (*Am J Manag Care. 2004;10:626-630*)

The cost of medical care and especially hospital care in the United States has been rapidly increasing after several years of stability. One proposed answer to the high cost of hospital care has been to introduce hospitalists or hospital-based faculty in teaching and nonteaching hospitals.¹⁻⁹ Evidence is growing that hospitalists may be more efficient in hospital resource utilization than traditional practicing physicians. However, introduction of the hospitalist system has not always led to reduced costs.^{3,8} Studies of hospitalist or hospital-based faculty introductions have been limited by narrow diagnostic focus,¹ short observation period,²⁻⁹ small numbers of hospitalist physicians,⁴⁻⁷ or relatively few admissions.^{1,7,9} Any or all of these factors could affect the outcome of a hospitalist system.

We decided to study the natural history of hospital resource utilization trends of physicians in a community hospital setting after hospitalists began practicing. We wanted to compare long-term utilization patterns of hospitalist internists and general internists in private practice. We included many more admissions over a

longer time, more diagnostic categories, and more hospitalists in our study than previously reported.

METHODS

Setting

The study was conducted at a 500-bed urban, non-university, community hospital from October 1, 1994, to September 30, 2000. The study population consisted of all patients admitted to the internal medicine physicians of the hospital medical staff who were in private practice.

Private practice internists included 131 general internists (generalists) and 27 hospitalist internists (hospitalists). All members of the Internal Medicine Department were board certified or board eligible in internal medicine.

The generalists consisted of a mixture of private practice models including solo practitioners and small and large group practices. Hospital coverage arrangements varied from cross-coverage among solo practitioners and small group practices to self-contained coverage in larger groups.

The hospitalists consisted of 1 practice initially and grew to 6 separate practices. Each hospitalist practice was responsible for its own hospital coverage. All hospitalist practices covered more than 1 hospital and none provided 24-hour in-hospital physician coverage. Only 1 hospitalist group provided outpatient facilities for follow-up care. No hospital policies or financial incentives were provided to the hospitalists to encourage or discourage practice at the hospital. The decision of the

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hospital administration to use hospitalists was completely voluntary.

Most of the patients admitted to private practice physicians came from the Emergency Department of the hospital. Patients were admitted to any available hospital bed without regard to socioeconomic or physician factors. The protocol for patient assignment from the Emergency Department was that patients with an established physician were admitted to the physician. Hospitalist patients were assigned by prior arrangement with other community physicians.

The Internal Medicine Department also contained a residency-training program. The medical house staff was supervised by full-time teaching physicians employed by the hospital. Uninsured and half of other unassigned patients coming to the Emergency Department were cared for by the residency-faculty teams. The other half of the unassigned patients was admitted to a rotating schedule of physicians including the hospitalists and private practice physicians. Medical residents did not participate in the care of patients assigned to generalists or hospitalists. The patients of the medical residency teams were not included in the study.

Design

The study had a retrospective cohort design. Resource utilization (cost and length of stay), 30-day readmission rates, and mortality were measured sequentially during 6 years of the study for both physician groups.

Data Source and Collection

Trendstar Clinical Costing software (McKesson HBOC Inc, San Francisco, Calif) was used to collect and report information on resource utilization and clinical information for the entire 6 years of the study. To determine costs, Trendstar used an activity-based cost accounting system.^{10,11} Briefly, the hospital's ledger provided all hospital costs (direct, indirect, fixed, and variable), which were then assigned to a direct cost center. The hospital's procedure codes provided the frequencies of each procedure. The procedures and their frequencies were totaled to obtain total costs.

All 17 diagnosis-related groups (DRGs) with 250 or more admissions during the 6 years of the study were selected for serial comparison over the study intervals. The 11 DRGs closely associated with the 17 primary DRGs were included as well. For instance, DRG 80 (respiratory infections without complications) was included along with the primary DRG 79 (respiratory infections with complications). The DRGs represented a wide

range of medical disorders. Diagnosis-related groups that pertained only to a specific medical or surgical procedure (such as DRGs 112, 115, and 116 for percutaneous cardiac procedures) were not included in the analysis.

End points in the study included resource utilization and quality-of-care markers. The resource utilization end points were total hospital costs (cost) and length of stay (LOS) per discharged case. Physician fees were not included in the costs. Quality-of-care end points were mortality (death during the hospital stay) and 30-day readmission rates (calculated for each physician in the study and averaged for each physician category). Readmissions were attributed to the first physician who discharged the patient within the 30-day interval regardless of the second or subsequent physician assignment. Costs were contemporary and not discounted for inflation.

Demographic information that was collected on each case included age, race (Caucasian, black, other), sex, and health insurance coverage (Medicare, Medicaid, commercial, other).

The Institutional Review Board of Orlando Regional Healthcare approved the study methods and analytic procedure.

Statistical Analysis

Cost, LOS, mortality, and readmission rates of the 28 (17 primary and 11 secondary) DRGs were compared between the physician categories. The highest and lowest 0.5% cost and LOS admissions were removed as outliers prior to analysis.

Because of skewness and non-normality, cost and LOS underwent log base 10 transformation prior to statistical analysis. Geometric means from these analyses were reported. Cost and LOS were compared over the study periods using general linear modeling regression analysis, adjusted for differences in DRG relative weight, and demographic variables for each of the physician categories. The dependent variables were cost and LOS. The independent variables were age, sex, race, insurance, DRG relative weight, physician category, and year. Year was placed in the model as a dummy variable to adjust for patient frequency changes over time.

Mortality and readmission rates were compared using binary logistic regression analysis. In these analyses, mortality and readmission were the dependent variables and age, sex, race, insurance, DRG relative weight, and physician category were independent variables.

All of the independent variables were included because they were each statistically significantly ($P < .01$) associated with the dependent variable in univariate and multivariable regressions.

MANAGERIAL

SAS software (SAS Institute, Cary, NC) was used for all statistical analyses.

RESULTS

Table 1 depicts the basic demographic and DRG information for the 11 750 patients in the 2 physician categories. Statistically significant differences were found between the physician categories for each of the patient characteristics. Because of these differences, all end points were statistically adjusted during the analysis for the demographic and case-mix factors.

Table 2 displays the number of physicians, number of admissions, and average DRG relative weight by year and physician category. The number of hospitalists and hospitalist admissions increased rapidly during the study, whereas those of the generalists were relatively constant over time. The average DRG relative weight of hospitalist patients was lower than that of generalist patients until the last 2 years of the study.

Cost and LOS trends for all DRGs during the 6 years of the study are depicted in the **Figure** for both physician categories. The cost and LOS were adjusted for age,

Table 1. Characteristics of Patients by Physician Category

Characteristic	Physician Category		
	Generalist	Hospitalist	Total
Number of admissions	8617	3133	11 750
Age, mean \pm SD, y*	66.5 \pm 16.3	62.5 \pm 16.0	65.4 \pm 16.2
Sex, % male [†]	43.0	46.5	43.9
Ethnicity, % [†]			
Caucasian	66.0	70.0	66.9
Black	20.4	18.4	19.8
Other	13.7	12.0	13.2
Payer, % [†]			
Medicare	63.8	52.2	60.7
Medicaid	2.7	2.5	2.7
Commercial	32.2	42.4	34.9
Self	1.3	3.0	1.7
DRG relative weight \pm SD*	0.921 \pm 0.318	0.891 \pm 0.319	0.913 \pm 0.318
DRG, % [†]			
14 CVA	7.4	7.6	7.5
79–80 Respiratory infections	3.4	2.6	3.2
88 COPD	6.0	5.0	5.7
89–90 Pneumonia	7.0	8.3	7.3
121–123 Acute MI	4.5	5.2	4.6
127 Heart failure	10.1	10.0	10.0
132–133 Arteriosclerosis	3.5	3.6	3.5
138–139 Cardiac arrhythmia	4.8	4.1	4.6
141–142 Syncope	4.6	4.8	4.6
143 Chest pain	16.2	21.0	17.5
174–175 GI bleeding	6.1	5.5	6.0
182–183 Esophagitis/gastroenteritis	8.8	8.6	8.8
204 Pancreas disorders	2.0	2.9	2.3
294 Diabetes	2.4	2.0	2.3
296–297 Nutritional & metabolic disease	4.5	3.4	4.2
320–321 Kidney & urinary infections	4.4	3.9	4.0
416 Septicemia	4.3	2.5	3.8

* $P < .05$ for differences between physician categories using Student *t* test.

[†] $P < .05$ for differences between physician categories using chi square.

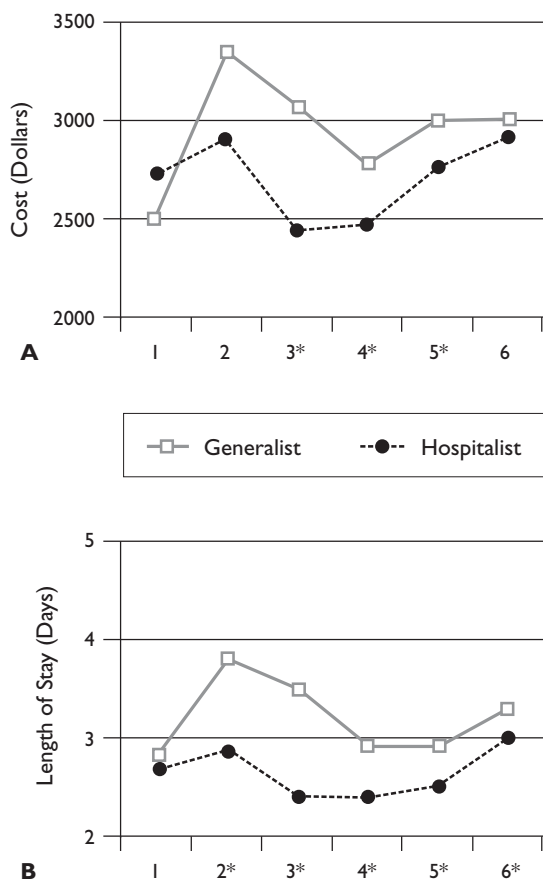
COPD indicates chronic obstructive pulmonary disease; CVA, cerebrovascular accident; GI, gastrointestinal; MI, myocardial infarction; SD, standard deviation.

Table 2. Number of Physicians and Admissions and Average DRG Relative Weight by Physician Category and Year

Physician Category	Year						Total, N*
	1	2	3	4	5	6	
Generalist							
Physicians, n	56	59	63	71	68	69	131
Admissions, n	1329	1289	1623	1594	1486	1296	8617
DRG relative weight	0.891	0.957	0.937	0.915	0.927	0.893	0.921
Hospitalist							
Physicians, n	1	1	5	8	15	26	27
Admissions, n	37	48	339	654	698	1357	3133
DRG relative weight	0.755	0.856	0.876	0.868	0.927	0.893	0.891

*Total denotes total number of admissions and total number of different physicians for all years. DRG indicates diagnosis-related group.

Figure. Adjusted Cost in Dollars (A) and Length of Stay in Days (B) for Each Year of the Study for Each Physician Category



P < .05 for difference from generalist.

sex, race, insurance, and DRG relative weight. Hospitalists had lower adjusted cost and LOS than generalists throughout most of the study years. Only 1 hospitalist accounted for the cases in year 1 and 2, but the number of hospitalists increased over time.

The resource and utilization gap narrowed as the number of physicians and admissions increased. Table 3 shows resource utilization for the physician categories. Both unadjusted and adjusted geometric means are displayed. We found statistically significant differences in adjusted cost and LOS between physician categories after adjusting for the effect of differences in demographic and case-mix variables. Hospitalists had 16.1% lower LOS and 8.3% lower cost than generalists.

Table 4 displays mortality and readmission data for the physician categories. Logistic regression analysis of mortality and readmission adjusted for age, race, sex, insurance, and DRG relative weight revealed no statistically significant differences between the groups for mortality or 30-day readmissions.

DISCUSSION

We have demonstrated that a voluntary system composed of multiple private hospitalist practices can provide modest reductions in hospital costs and LOS compared with general internists in a variety of traditional practice styles. The LOS and cost differentials we found (16.1% and 8.3%, respectively) were comparable to those of other recently published studies.^{1-3,5,7,8} We have also demonstrated that erosion of the reductions in utilization can occur as the number of hospitalists and hospital cases. Caution is, therefore, indicated in

Table 3. Unadjusted and Adjusted Geometric Mean LOS and Cost per Hospital Admission by Physician Category

Physician Category	LOS, Days		Cost, Dollars	
	Unadjusted	Adjusted	Unadjusted	Adjusted
Generalist	3.3	3.1	3007	2909
Hospitalist	2.6	2.6	2743	2667

Adjusted means and significance tests are based on general linear model regression analysis using log base 10 transformation. Dependent variables are LOS and cost. Independent variables are age, DRG relative weight, sex, race, payer, physician category, and year. *P* < .0001 for pairwise comparisons of adjusted LOS and cost. DRG indicates diagnosis-related group; LOS, length of stay.

Table 4. Discharge Status and Logistic Regression Analysis of Hospital Mortality and Readmission Rates by Physician Category

Physician Category	Discharge and Mortality Status				30-Day Readmission Rate	
	Home, %	SNF/Other Facility, %	Mortality, %	OR (95% CI)*	Crude, %	OR (95% CI)*
Generalist	83.9	12.8	3.3	1	6.5	1
Hospitalist	85.6	11.7	2.7	0.96 (0.76–1.28)	4.9	0.87 (0.72–1.04)

Odds ratios were derived from logistic regression analysis with mortality and readmission as dependent variable and age, DRG relative weight, race, sex, payer, and physician category as independent variables.

CI indicates confidence interval; OR, odds ratio; SNF, skilled nursing facility.

coming to early conclusions about the success of hospitalists in any one setting.

As in all epidemiologic investigations, statistical adjustment for inequality of groups is always a potential problem. By using a very large database with 100% case sampling of the most frequent DRGs of all hospitalists and private practice general internists, selection biases should be minimized.

Hospital mortality and readmission rates have limitations as quality-of-care markers. Mortality may be

transferred to other settings such as nursing homes, and readmissions may occur in other regional hospitals that would not be captured. Despite these limitations, hospital mortality and readmission rates were similar for the 2 physician groups and were less than the rates found in other contemporary studies.^{2,3} Both physician groups had similar rates of discharge to home and skilled nursing facilities.

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