Inpatient Resource Use: A Comparison of Family Medicine and Internal Medicine Physicians

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Background. It is not known whether differences exist between the use of inpatient resources by family medicine and internal medicine physicians when patient demographic and complexity variables are statistically controlled.

Methods. The study population was all patients in 13 higher volume diagnosis-related groups (DRGs) discharged from the family medicine (n = 306) and internal medicine services (n = 2374) of the University of Cincinnati Hospital during 1985 and 1986. The dependent variables were length of stay and inpatient readmission within 2 weeks. Stratification by DRGs was used to control for the effects of age and case mix on these variables.

Results. With the exception of findings regarding one DRG, the results do not indicate that differences exist in average length of stay between patients of family medicine and internal medicine physicians after adjustment for other variables. Furthermore, almost all of the explained variance in length of stay was attributed to patient complexity and not to physician specialty or patient race or sex.

For all discharges, the proportion of patients readmitted within 2 weeks was about 4% higher for the internal medicine service. However, multivariate analysis did not support the importance of physician specialty (family medicine or internal medicine) as a predictor of whether readmission occurred within 2 weeks.

Conclusions. General indicators of resource use (such as length of stay or readmission occurrence) without adjustment for patient case mix, demographics, and complexity are inadequate for comparison of health care providers. Further research regarding interspecialty differences should use longitudinal data from large populations, which would permit more detailed examination of resource utilization.

Key words. Internal medicine; physicians, family; physician practice patterns; patient discharge; patient readmission; length of stay. *J Fam Pract 1992; 34:306-312.*

Examining the influence of physician decisions on health care resource utilization is of increasing interest. Variation between individual physicians' decision making and differences between physician specialties may influence health services resource utilization.

Hainer and Lawler[1] compared the delivery of critical care by internal medicine and family medicine physicians and found little difference in patient outcome, physician process, length of stay, or readmission rates. Franks and Dickinson[2] found differences in the type of diagnosis coded and the number of diagnoses assigned, but no difference in length of stay.

In contrast, several studies have identified interspecialty differences in resource use. Bertakis and Robbins[3] found that average length of stay and charges were less for family medicine patients. Other research identifies differences between family medicine and internal medicine physicians in the amount and nature of diagnostic information collected by family physicians and internists, diagnostic tests, longer average visit time with patients, and higher hospitalization rates for internists.[4,5] McMahon and Newbold[6] found that practice style explained more of the variance in length of stay than severity of illness within specific diagnosis-related groups.

In summary, research suggests that interspecialty differences as well as variation in practice style between physicians[7] may explain differences in resource utilization. If empirical evidence can be found that a particular specialty is more efficient in the delivery of medical care, the cost implications of policy actions encouraging the use of more efficient providers could be considerable.

The hypothesis examined in this study was that no

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significant differences exist in the average length of stay and the occurrence of readmission between family medicine and internal medicine physicians after adjustment for patient characteristics.

Methods

Data

Data were from family medicine and internal medicine service discharges at University Hospital in Cincinnati, Ohio, during 1985 and 1986. This is a tertiary level teaching institution, and the degree of time dedicated to teaching should be the same for both family medicine and internal medicine physicians. An additional constant characteristic is that all physicians are hospital based.

University Hospital inpatient utilization data for 1985 and 1986 were processed under contract by the Commission on Professional and Hospital Activities (CPHA) in Ann Arbor, Michigan. The study population was all 2680 patients in 13 higher volume DRGs discharged from the family medicine (n = 306) and internal medicine services (n = 2374) at the University of Cincinnati Hospital during 1985 and 1986 who did not have an outlier length of stay. To be considered a higher volume DRG in this study, at least 10 discharges from each service had to occur during the 2 years.

The basis for classification as an outlier was the 1986 fiscal year DRG-specific cutoffs for outlier length of stay established by the Health Care Financing Administration. This trimming of outliers from the higher volume DRGs reduced the number of discharges included in the study population from 2738 to 2680. The rationale for this reduction was to avoid excessive influence on the results by extremely ill patients.

The data were stratified into DRG subgroups for bivariate and multivariate analysis of length of stay differences between internal medicine and family medicine services. Independent variables from 1985 and 1986 data included race, sex, number of procedures, number of body systems for which there was a diagnosis (number of affected organ systems in a specific admission), number of identified complicating conditions, and physician service (internal medicine or family medicine). Race groupings were white and nonwhite. Number of procedures and number of complicating conditions were based on data entered from the medical record. Number of body systems is a variable calculated by CPHA and is based on diagnosis codes used for a particular discharge.

Dependent variables are length of stay, whether the patient was readmitted within 2 weeks, and the length of time the patient remained out of the hospital. Only length of stay and whether the patient was readmitted within 2 weeks were used as dependent variables in multivariate analyses. Length of stay was defined as the time in days between inpatient admission and discharge. Length of stay is commonly used as a measure of health care resource consumption because of the direct connection between each additional inpatient day and increased charges. Length of stay is probably the best dependent variable for initial study of health care resource use.[6] Readmission within a 2-week period is included because early discharges may have become more frequent since the implementation of DRGs, and interspecialty differences may exist.

Only physicians with family medicine training practice in the family medicine service at University Hospital, and likewise only those with internist training practice in the internal medicine service. Both the services are composed of rotating staff physician as well as several junior and senior residents and medical students. Family medicine patients are primarily admitted from the family medicine clinic on-site, while internal medicine patients are admitted from the emergency department as well as the internal medicine clinic. At University Hospital, family medicine service physicians also include as a part of their approach to patient care the direct involvement of social workers in assessing patient condition and needs. The direct use of social workers for quicker and more efficient outplacement, in combination with the greater tendency of family medicine physicians to treat patients as outpatients, may influence length of stay and readmission rates within DRG groups.

Analysis

The initial analysis of the data involved examination of the frequency distribution of the DRGs by physician service to identify higher volume DRGs. Bivariate comparison of patient demographic and complexity variables were done between family medicine and internal medicine physician services.

Nonparametric statistics were used to compare the average length of stay between physician types within a given DRG because the length of stay distributions were not normally distributed. Other continuous variables were compared by *t* tests. Associations between categorical variables were tested for statistical significance using chi-square statistics.

Control for case-mix differences between internal medicine and family medicine physicians in length of stay was sought through multivariate analyses with stratification by selected higher volume DRGs. Horn et al[8] demonstrated that considerable additional variation in re-

Table 1. Comparison of Patient Complexity Variables, by Service for All Discharges and Higher Volume DRG Discharges

Characteristic	All Discharges			Higher Volume DRG Discharges		
	Internal Medicine (n = 9246)	Family Medicine (n = 864)	*P* Value	Internal Medicine (n = 2374)	Family Medicine (n = 306)	*P* Value
Number of body systems involved*	3.54	3.38	<.01	3.68	3.55	NS
Number of procedures performed	1.78	1.64	<.01	1.28	1.07	<.05
Number of complicating conditions	2.28	1.81	<.01	2.37	2.07	<.01

**Number of affected organ systems in a specific admission.*
DRG denotes diagnosis-related groups.

source use remained unaccounted for within DRGs and that additional adjustments to incorporate variation in patient severity can substantially add to overall explained variance.

The dependent variable was length of stay, and the independent variables were physician service (internal medicine and family medicine), race (white or nonwhite), sex, number of procedures, number of complicating conditions, and number of body systems in the linear regression models. Analysis of covariance was used to determine adjusted average length of stay statistically controlling for independent variables. The DRG classification system to some extent takes into account the complexity of the patient's health condition: the primary diagnosis, whether there are complicating conditions, whether surgery occurred, and the patient's age. However, the patient demographic and complexity characteristics are expected to further explain variability in length of stay and allow assessment of physician service effects, with variation between patients more fully taken into account. A second set of linear regression analyses was conducted with whether readmission occurred within 2 weeks as the dependent variable.

Results

The percentage of inpatients treated by internal medicine and family medicine services was consistent between all discharges in 1985 and 1986 patients in higher volume DRGs (about 90% and 10%, respectively). Comparison (not shown) of the race and sex composition of inpatients in higher volume DRGs in each service indicated statistically significant differences ($P < .01$). Specifically, 40% of the inpatients on the internal medicine service were white compared with 61% of inpatients in the family medicine service, and a higher proportion of internal medicine inpatients were male than family medicine inpatients (44% and 26%, respectively, $P < .01$).

Two variables associated with variation in patient complexity were also significantly different between physician groups for patients in higher volume DRGs (Table 1). The average number of body systems for which there was a diagnosis at the discharge was significantly higher among internal medicine patients than family medicine patients ($P < .01$) for all discharges in 1985 and 1986. No difference was observed in this variable between family medicine and internal medicine patients in the higher volume DRGs.

As shown in Table 1, the mean number of procedures performed in higher volume DRGs was significantly higher among both internal medicine patients and family medicine patients ($P < .05$). Among all discharges in 1985 and 1986, the mean number of procedures was also higher for internal medicine patients ($P < .01$). The mean number of complicating conditions was higher for internal medicine than family medicine patients in all discharges occurring in 1985 and 1986 and in higher volume DRGs ($P < .01$).

Length of Stay Differences

For all discharges from the internal medicine and family medicine services during 1985 and 1986, the average length of stay was found to be significantly lower for family medicine service patients than for internal medicine service patients. Among the discharges in higher volume DRGs, however, no significant difference in average length of stay was observed (Table 2).

Table 2. Comparison of Average Length of Stay, by Service for all Discharges and Higher Volume DRG Discharges

	Average Length of Stay (d)		
	Internal Medicine	Family Medicine	*P* Value
All discharges	7.39	6.70	<.01
Higher volume DRGs	6.04	5.63	NS

DRGs denotes diagnosis-related groups.

Table 3. Adjusted Average Length of Stay in Higher Volume Diagnosis-Related Groups for Internal Medicine and Family Medicine Services

Diagnosis-Related Group	Internal Medicine		Family Medicine	
	No. of Patients	Adjusted Average Length of Stay (d)	No. of Patients	Adjusted Average Length of Stay (d)
All higher volume diagnosis-related groups	2374	6.05	306	5.64
Cerebrovascular disorders (except for transient ischemic attacks)	41	10.90	23	9.04
Chronic obstructive pulmonary disease	172	5.54	24	4.91
Pneumonia and pleurisy (age >69 y with or without complications)	321	7.32	26	6.39
Bronchitis and asthma (age 18 to 69 y without complication)	266	3.99	12	4.66
Heart failure and shock	384	6.69	27	6.60
Peripheral vascular (age >69 y with or without complications)	76	8.12	11	6.65
Gastrointestinal hemorrhage (age >69 y with or without complications)	144	5.11	14	4.20
Esophagitis, gastroenteritis, and other digestive diseases (age >69 y with or without complications)	208	4.43	53	4.46
Esophagitis, gastroenteritis, and other digestive diseases (age 18 to 69 y without complications)	69	3.77	24	4.39
Diabetes (age ≥36 y)	203	6.24	26	6.83
Diabetes (age 0 to 35 y)	123	4.29	20	3.53
Nutritional and other metabolic disorders (age >69 y with or without complications)	173	6.16	11	6.21
Kidney and urinary tract infections (age >69 y with or without complications)	194	7.98	35	5.35*

*$P < .05$.

Bivariate comparison (not shown) of unadjusted average length of stay indicates that within the 13 higher volume DRGs none showed a statistically significant difference between the average length of stay of family medicine patients and internal medicine patients. The low number of cases for family medicine patients in some DRGs to some extent accounted for no statistically significant differences being identified. When covariates were statistically controlled using analysis of variance (Table 3), only in the DRG for kidney and urinary tract infection, age greater than 69 years, with or without complicating conditions, was the difference in adjusted average length of stay statistically significant between internal medicine and family medicine patients: family medicine patients had a significantly lower average length of stay ($P < .05$). All F statistic values (not shown) were significant ($P < .01$), indicating that across all higher volume DRGs and within each DRG the patients' characteristics explained a substantial amount of the variance in length of stay between internal medicine and family medicine patients.

Correlation coefficient statistics and scatterplots were generated for combinations of integer independent variables to assess the possibility of multicollinearity. No strong linear relationships between the independent variables—number of body systems, number of procedures,

Table 4. Variance in Length of Stay Explained in Higher Volume Diagnosis-Related Groups of Family Medicine and Internal Medicine Services

Diagnosis-Related Group	Variance Explained, %			
	Patient Race and Sex	Patient Complexity*	Physician Service	Total
All higher volume diagnosis-related groups	0.1	25.3	0.0	25.4
Cerebrovascular disorders (except for transient ischemic attacks)	0.0	32.3	0.0	32.3
Chronic obstructive pulmonary disease	0.0	17.3	0.0	17.3
Pneumonia and pleurisy (age >69 y with or without complications)	0.0	26.8	0.0	26.8
Bronchitis and asthma (age 18 to 69 y without complications)	0.0	6.7	0.0	6.7
Heart failure and shock	0.0	23.6	0.0	23.6
Peripheral vascular (age >69 y with or without complications)	4.2	19.9	0.0	24.1
Gastrointestinal hemorrhage (age >69 y with or without complications)	2.8	30.1	0.0	32.9
Esophagitis, gastroenteritis, and miscellaneous digestive diseases (age >69 y with or without complications)	0.0	33.3	0.0	33.3
Esophagitis, gastroenteritis, and miscellaneous digestive diseases (age 18 to 69 y without complications)	0.0	27.9	0.0	27.9
Diabetes (age ≥36 y)	0.0	25.6	0.0	25.6
Diabetes (age 0 to 35 y)	1.8	17.3	0.0	19.1
Nutritional and miscellaneous metabolic disorders (age >69 y with or without complications)	0.0	17.5	0.0	17.5
Kidney and urinary tract infections (age >69 y with or without complications)	0.0	15.1	0.0	15.1

**Includes number of body systems, number of procedures performed, and number of complicating conditions.*

and number of complicating conditions—were observed. Examination of standardized residuals and standardized scatterplots of residuals with independent variables indicated a good fit to the regression model without the need for data transformation.

As indicated in Table 4, the regression models used generally explained about one fifth to one third of the variance in length of stay. With regard to the original hypothesis of this research, no evidence was found that interspecialty differences contributed to explaining variation in length of stay. With the exception of the higher volume DRGs involving peripheral vascular, gastrointestinal hemorrhage, and diabetes with age younger than 36 years, the demographic variables of race and sex showed no effect. The complexity variables did explain substantial additional variance in length of stay within each higher volume DRG and across all 13 DRGs.

Comparison of Readmission within 2 Weeks

Comparison of readmission within 2 weeks of a previous discharge gave mixed results (Table 5). For all discharges in the 2-year interval, readmission within 2 weeks was higher among internal medicine than family medicine patients, 8.1% as compared with 4.2% ($P < .01$). Comparison of the percentage readmitted within 2 weeks among higher volume discharges indicated no statistically significant difference.

Table 5. Number and Percentage of Patients Readmitted within 2 Weeks for Family Medicine and Internal Medicine Services, All Discharges, and Higher Volume Diagnosis-Related Groups (DRGs)

	All Discharges		Higher Volume DRG Discharges	
	Internal Medicine No. (%)	Family Medicine No. (%)	Internal Medicine No. (%)	Family Medicine No. (%)
All discharges				
No readmission within 2 weeks	8378(91.9)	813(95.8)*	2235(95.9)	293(97.3)
Readmitted within 2 weeks	743(8.1)	36(4.2)	96(4.1)	8(2.7)

*$P < .01$.

NOTE: Discharges after 12/17/86 were excluded because 2-week follow-up for a readmission was not possible. One case was excluded owing to data entry error in a date.

Multivariate Prediction of Whether Readmitted within 2 Weeks

Multivariate analyses (not shown) using readmission occurring within 2 weeks as a dichotomous dependent variable indicated that within each of the higher volume DRGs and across all DRGs the predictor variables explained a very small portion of total variance (ranging from 1% to 12%). Physician service (internal medicine or family medicine) was not a predictor of readmission within 2 weeks; however, the sample size was quite small for many of the DRGs, which may have contributed to physician service not being identified as a significant predictor variable.

Discussion

Previous studies of the differences in physicians' use of resources have varied in their findings. In this study only one of the 13 higher volume DRGs showed a statistically significant difference in adjusted length of stay between internal medicine and family medicine physicians. No significant difference existed between internal medicine and family medicine physicians among study DRGs in rates of readmission within 2 weeks.

This research indicated that most of the explained variation in length of stay between family medicine and internal medicine discharges was accounted for by differences in case mix and the complexity characteristics of the patients. Analyses stratifying by DRG and statistically controlling for patient demographic and complexity characteristics showed that physician service had an influence on length of stay in only one higher volume DRG. The results of this study generally agree with the Franks and Dickinson[2] comparison of family medicine and internal medicine physicians that found no interspecialty differences in length of stay. A related issue is that interspecialty differences between family medicine and internal medicine physicians may be less than the contrast with other physician specialists. This could explain the McMahon and Newbold[6] finding that practice style variation influences resource use. For example, Linn et al[9] observed a marked contrast in medical testing recommended between psychiatrists in comparison with internal medicine and family medicine physicians in response to presented patient vignettes.

This study supports the view that commonly observed variations in aggregate average length of stay between internal medicine and family medicine physicians are at least partially explained by case mix or patient complexity rather than by interspecialty differences in provision of medical care. Complexity variables accounted for 7% to 33% of explained variance in length of stay within the higher volume DRGs. This is consistent with the Horn[8] finding that considerable lack of homogeneity in resource use exists within DRGs. Intraphysician variation probably explains much of the remaining variance in length of stay, because within the same specialty and patient severity level substantial intraphysician differences in resource use occur.[7]

Other studies indicate variation with regard to other variables or dimensions related to patient care. Examples of such variation include: hours and location of practice activity,[10] use of medical testing,[5] and differences in the approach used in patient assessment,[11] which are potential influences on resource use not examined in this study.

This study suggests that further research should use longitudinal data from large populations that allow detailed examination of resource utilization. Comparison of general indicators of resource use (such as length of stay and readmissions occurrence) without consideration of adjustment for patient complexity or other predictors of resource use does not allow for fair comparison of physician interspecialty differences. Future studies should examine whether readmissions occur for a similar medical problem or a problem unrelated to the reasons for the prior admission. Comparison of internal medicine and family medicine physician resource use based on alternative utilization measures (eg, charges or resource units), controlling for patient complexity or severity, could also contribute to assessment of interspecialty differences.

When making assessments of interspecialty differences, managed care plans are encouraged to examine indicators of resource use such as test ordering or diagnostic procedures as to the extent of their contribution to: (1) the quality of the differential diagnosis, and (2) the development of an appropriate treatment plan for a particular medical condition. Evaluation of health care providers' efficiency in resource use should seek to fully

account for all issues related to delivery of medical care to avoid inaccurate comparison of different types of providers.

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