What affects rural beneficiaries use of urban and rural hospitals?

by William Buczko

Analysis of the Medicare provider analysis record (MEDPAR) data during fiscal years 1984 through 1989 indicates that the proportion of rural Medicare beneficiaries hospitalized in urban hospitals has remained constant during the prospective payment system (PPS). Much of the use of urban hospitals by rural beneficiaries during this period was to obtain specialized care or surgery, as suggested by the analysis, and is consistent with historical patterns of referral of rural patients. Thus, the bypassing of rural hospitals by rural beneficiaries for treatment in urban hospitals has probably not increased during PPS.

Introduction

Declining volume and increasing closures among rural hospitals have led many observers to suggest that rural residents are increasingly receiving inpatient care at urban hospitals. This article examines inpatient discharge data for Medicare beneficiaries to determine the extent to which rural Medicare beneficiaries obtain inpatient care in rural and urban hospitals. It also explores the factors that differentiate rural Medicare beneficiaries who remain in rural areas for inpatient care from those who obtain inpatient care in urban areas.

Rural hospitals under Medicare

Nearly 50 percent of short-stay hospitals are located in rural areas. These facilities are, on average, one-third the size and have a clearly less intense case-mix than urban hospitals (Hatten and Connerton, 1986). Cromwell et al. (1987) suggest that rural hospitals have historically practiced a less intensive style of medicine than urban hospitals and, as a result, rural residents who require specialized treatment are referred to urban hospitals. In addition, Finch and Christianson (1981) found low volume to be a frequent problem in rural hospitals, and to be associated with sub-optimal efficiency.

As a group, rural hospitals have not fared well in recent years and have not been helped by PPS incentives that reward intense case mix and penalize low volume. Declining inpatient volume, the major force behind the financial problems faced by rural hospitals, (Moscovice, 1989; Prospective Payment Assessment Commission, 1990) has been the result of both environmental and operational change.

Demographic and local economic trends can effect rural hospital volume. Although rural populations, after years of decline, have increased slightly in recent years, the number of Medicare beneficiaries in rural areas has declined (Gaumer, 1989). In some instances, population decline is linked to a declining local economy that can create further population and patient volume loss (U.S. General Accounting Office, 1990).

Hospitals have also changed their operating practices, partially in response to improved technology and changing practice patterns, but also in response to prospective payment. Hospitals have responded to Medicare PPS by shortening length of stay and treating less severe cases on an outpatient basis (Prospective Payment Assessment Commission, 1990). Because rural hospitals have a less severe case mix and practice a less intensive style of medicine than urban hospitals, they have shifted a greater percentage of cases to outpatient treatment than have urban hospitals. Codman Research Group, Inc. (1990) found that rural hospitals' admissions declined largely because of their treatment of less severe cases as outpatients.

Rural hospitals have lagged in the adoption of new specialized services and state-of-the-art technology (Hogan, 1988). Often, their low volume does not justify adoption of new technologies and services, especially if volume is a prerequisite for quality care. Further, financially distressed rural hospitals may not be able to obtain debt financing to purchase equipment needed to offer new services; and the specialized staff needed to provide these services may not want to practice in small rural hospitals. The lack of availability of specialized services may have diminished the desirability of rural hospitals. Anecdotal evidence suggests that rural residents prefer to obtain inpatient care in, and rural physicians would rather refer patients to, "modern" urban hospitals (U.S. General Accounting Office, 1990).

Changing Medicare payment practices have also affected rural hospitals. Medicare PPS has shifted the risk associated with volume loss and low case-mix severity to hospitals. Although the gap between rural and urban hospitals' occupancy rates and case mix has increased under PPS (Prospective Payment Assessment Commission, 1990), hospital-specific payment under sole community hospital status has improved profitability for qualifying rural hospitals (Merlis, 1989).

These factors, as previously described, have affected the financial status of rural hospitals. Recent analyses suggest improvement in the financial status of rural hospitals, but Medicare patient margins still lag behind those of urban hospitals although total hospital margins

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Table 1

Percent of Medicare beneficiaries using inpatient care, by place of residence and place of hospitalization: Fiscal years 1984-89

Year	Total beneficiaries hospitalized in rural hospitals	Total hospitalized beneficiaries		Rural beneficiaries hospitalized	
		Rural	Urban	Rural	Urban
		Percent			
1984	21.2	30.2	69.8	70.2	29.8
1985	20.7	29.7	70.3	69.7	30.3
1986	20.3	29.3	70.7	69.4	30.6
1987	20.0	29.2	70.8	68.8	31.2
1988	19.6	27.9	72.1	70.4	29.6
1989	19.5	27.8	72.2	69.9	30.1

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data are from the Medicare Provider Analysis Survey, 1984-89.

for urban and rural hospitals have converged after years of higher total margins for urban hospitals. Wide variation in margins is evident for both urban and rural hospitals. However, greater variation in margins is evident for rural hospitals because more rural hospitals have extremely low margins. Also, although very few (1.7 percent) urban hospitals had negative margins in all five PPS years, 10.9 percent of all rural hospitals and 15.5 percent of rural hospitals with fewer than 50 beds had negative margins throughout PPS. Thus small rural hospitals (50 beds or fewer) appear to be at increased risk of closure (Prospective Payment Assessment Commission, 1990). The financial viability of rural hospitals is of concern because closures or fiscal instability may increase the percentage of rural beneficiaries treated in urban hospitals.

The remaining sections of this article examine Medicare inpatient record data to determine the extent to which rural Medicare beneficiaries are hospitalized in urban rather than rural hospitals, which diagnosis-related groups (DRGs) are most likely to be treated in urban rather than rural settings, and which demographic case mix, and clinical factors predispose rural Medicare beneficiaries to inpatient treatment in urban rather than rural areas.

Data used

MEDPAR is the major source of data for this study. MEDPAR data files contain discharge records for all short-stay hospitalizations by beneficiaries paid under Medicare Part A. For this study, rural beneficiaries are defined as all Medicare beneficiaries living outside metropolitan statistical areas (MSAs). To be consistent with Medicare program definitions, rural hospitals are defined as all hospitals located outside MSAs, although other definitions of urban and rural may be plausible (Cordes, 1989; Hewitt, 1989).

To expedite data processing, 20-percent samples of MEDPAR records for Federal fiscal years (FY) 1984-89 were used to select all hospitalizations for rural beneficiaries, and to obtain the utilization trend data in Table 1. The case-mix data and the multivariate analysis used only the 20-percent sample for FY 1987. Additional hospital-level data were linked to the MEDPAR records for rural beneficiaries from the Health Care Financing Administration provider of services (POS) file.

Statistical analysis

Because many factors may influence the use of rural or urban hospitals by rural Medicare beneficiaries, a multivariate analysis of the determinants of rural and urban hospital use is needed to examine the relative impact of each factor of predictive importance, controlling for all other factors. Because the dependent variable is a dichotomy, ordinary least squares (OLS) regression cannot be used. However, logistic regression estimated by methods of maximum likelihood is appropriate for estimation of a regression model with a dichotomous dependent variable (Hosmer and Lemeshow, 1989; Maddala, 1983).

In a logistic regression model, the dependent variable is transformed using the logarithm of the odds ratio. As such, it is a multivariate extension of logistic models that are used with contingency tables in epidemiology for the assessment of conditional relative risk (Fleiss, 1973). The slopes obtained from a logistic regression may be converted to conditional odds ratios by the following equation:

$$OR = e^{b_i},$$

where

e = the base of natural logarithms and
b_i = the logistic regression coefficient for each variable in the regression. The "relative risk" statistic obtained measures the conditional odds of hospitalization in a rural hospital.

Testing goodness-of-fit in logistic regression differs from standard OLS procedures. Often, chi-square-based tests, such as the likelihood ratio test and the Wald test, are used to test the significance of the overall regression and the significance of individual slope coefficients, respectively (Hosmer and Lemeshow, 1989). However, these statistics may be converted to obtain pseudo t, F, and R^2 statistics, which may be interpreted as comparable OLS statistics as demonstrated by Magee (1990), Kleinbaum, Kupper and Muller (1988), and Maddala (1983).

Another test for the logistic regression is a proportional reduction in error statistic that is based on the percent correctly classified given the marginal

Table 2

Most frequent diagnosis-related groups (DRGs) for rural beneficiaries, by place of hospitalization: Fiscal year 1987

DRG code	Description	Cases	Hospital	
			Rural	Urban
			Percent	
127	Heart failure and shock	29,441	80.46	19.54
89	Simple pneumonia and pleurisy[1,2]	24,415	83.92	16.08
140	Angina pectoris	23,435	83.02	16.98
182	Esophagitis, GI and miscellaneous digestive disorders[2]	19,867	80.20	19.80
14	Cerebrovascular disorders except transient ischemic attack	18,726	76.13	23.87
96	Bronchitis and asthma[1,2]	14,840	82.05	17.95
138	Cardiac arrythemia and conduction disorders[2]	13,484	78.29	21.71
296	Nutritional disorders[2]	12,975	80.90	19.10
209	Major joint and limb reattachment procedures	11,094	53.39	46.61
336	Transurethral prostatectomy[2]	10,966	65.30	34.70
320	Kidney and urinary tract infections[1,2]	10,459	82.77	17.23
15	Transient ischemic attack and precerebral occlusions	9,653	73.72	26.28
243	Medical back problems	9,416	70.88	29.12
174	Gastrointestinal hemorrhage[2]	9,034	80.09	19.91
122	Circulatory disorders with acute myocardial infarctions without cardiovascular complication, discharged alive	8,489	74.87	25.13

[1]Over 17 years of age.
[2]With comorbidities and complications.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data are from the Medicare Provider Analysis Survey, 1987.

distribution of the dependent variable. This statistic estimates the improvement in prediction of the dependent variable resulting from the introduction of the independent variables in the analysis. Here, the proportional reduction in error statistic, likelihood ratio test, conditional odds ratios, and pseudo t, F, and R^2 statistics are reported for the logistic regression analysis.

Variables used

The dependent variable, hospital location, is determined by whether or not the hospital is located in an MSA. The following independent variables are used in the logistic regression analysis: patient age, sex, disabled beneficiary indicator, chronic renal disease beneficiary indicator, PPS exempt unit indicator, transfer to another hospital indicator, length of stay, intensive care days, coronary care days, number of diagnoses (ICD-9-CM), surgery indicator, number of procedures (ICD-9-CM), and DRG weight.

Indicator variables for the following conditions are also included in the analysis: craniotomy and spinal procedures (DRGs 1-4), major head and neck procedures (DRG 49), miscellaneous ear, nose, and throat procedures (DRG 55), cardiovascular procedures (DRGs 103-112, 117, 124, 125), kidney and urinary tract procedures (DRG 315), hysterectomy (DRG 353), splenectomy and other operating room procedures for blood forming organs (DRGs 392, 393, 394), neoplasms (DRGs 406, 407, 408), radiotherapy (DRG 409), chemotherapy (DRG 410), injury procedures (DRG 442), and rehabilitation (DRG 462).

Rural and urban hospital use

The data in Table 1 indicate that hospitalized rural beneficiaries are twice as likely to receive inpatient care in a rural hospital as in an urban hospital. The percentage of rural beneficiaries using rural hospitals has ranged from 68.8 to 70.4 during PPS. These data do not support the hypothesis that rural beneficiaries have increasingly bypassed rural hospitals for urban hospitals during PPS, because there is no indication of an increase in use of urban hospitals by rural beneficiaries. Rather, this percent has remained constant from 1984 to 1989.

The percentage of total Medicare beneficiaries hospitalized in rural hospitals has declined only slightly from 21.2 in 1984 to 19.5 in 1989. However, this decrease appears to be because of the declining percentage of Medicare beneficiaries living in rural areas (Gaumer, 1989). These data imply that declining patient volume in rural hospitals may be more plausibly attributable to absolute declines in the number of Medicare beneficiaries, and trends toward increased outpatient treatment. The latter may reflect more stringent utilization review practices. Without admission rate data, one cannot determine if rural beneficiaries are putting off inpatient care because of lack of access. Gaumer (1989) suggests this as an explanation for declining rural Medicare admissions, and this possibly could explain the decline observed here.

Case-mix data

Table 2 lists the 15 most frequent DRGs for rural Medicare beneficiaries by place of hospitalization for FY 1987. The DRGs included in this list are, with few exceptions, identical to those examined by the author for FYs 1984-86, 1988, and 1989. This list is similar to DRG data, by frequency of occurrence, for all Medicare beneficiaries (Latta and Helbing, 1988).

Examination of this list indicates that most rural beneficiaries receive treatment for these conditions in

Table 3

Diagnosis-related groups (DRGs) where 60 percent or more rural beneficiaries are hospitalized in urban hospitals, by place of hospitalization: Fiscal year 1987

DRG code	Description	Cases	Hospital	
			Rural	Urban
			Percent	
410	Chemotherapy	6,285	35.30	64.74
125	Circulatory disorders except acute myocardial infarctions with catheterization, no complex diagnosis	6,052	14.72	85.38
112	Percutaneous cardiovascular procedures	4,544	22.62	77.48
124	Circulatory disorders except acute myocardial infarctions with catheterization and complex diagnosis	3,503	20.22	79.88
110	Major cardiovascular procedures[1]	3,444	38.10	61.90
106	Coronary bypass with catheterization	3,314	7.90	92.07
5	Extracranial vascular procedures	2,813	38.14	61.86
442	Other operating room procedures for injuries[1]	2,223	38.06	61.94
214	Back and neck procedures[1]	1,933	26.49	73.51
107	Coronary bypass without catheterization	1,870	9.36	90.64
462	Rehabilitation	1,730	25.49	74.51
75	Major chest procedures	1,570	38.73	61.27
1	Craniotomy, over 17 years of age except for trauma	1,287	19.66	80.34
315	Other kidney and urinary operating room procedures	1,161	31.52	68.48
36	Retinal procedures	1,114	10.41	89.59
42	Intraocular procedures except retina, iris, lens	1,049	24.22	75.78

[1]With comorbidities and complications.

NOTE: Only DRGs accounting for at least 0.2 percent of rural beneficiaries' hospitalizations are included in this Table.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data are from the Medicare Provider Analysis Survey, 1987.

rural hospitals. Indeed, more than 80 percent of hospitalized rural beneficiaries are treated in rural hospitals for 8 of the 15 DRGS listed. Only DRG 209 (major joint and limb reattachment procedures) and DRG 336 (transurethral prostatectomy with comorbidities and complications) have more than 30 percent of rural beneficiaries treated in urban areas.

These results compare favorably with the analysis of rural hospitalization trends by the Codman Research Group, Inc. (1990). The DRGs listed in Table 2 were assigned in the Codman study to DRG groups that were primarily treated in local hospitals rather than referred for tertiary care. The Codman study attributed much of the decline in rural hospitals of rural beneficiaries' admissions to increased outpatient treatment of these conditions.

It appears that a minimum 15 to 20 percent of rural Medicare beneficiaries are treated in urban hospitals within each DRG. Although this represents a sizeable percentage of rural beneficiaries, it may reflect the proximity of urban hospitals to some rural beneficiaries. Similar data analyses not reported in this article for FYs 1984-86 and 1988 show comparable trends in urban and rural hospitalization. Most hospitalizations of rural Medicare beneficiaries involve conditions that, as Codman (1990) would suggest, are amenable to local hospital treatment and, consequently, are treated in rural hospitals.

In contrast to the data presented here, hospitalizations for a small group of conditions are predominantly treated in urban hospitals. Table 3 lists the DRGs where 60 percent or more rural Medicare beneficiaries are hospitalized in urban hospitals. Of the 16 DRGs listed, 6 are cardiovascular conditions requiring either surgery or catheterization. Eight of these DRGs—1, 5, 106, 107, 112, 214, 410—were classified by the Codman study as technology-intensive conditions that often require referral to teaching hospitals. Five other DRGs—75, 124, 125, 315, and 442—were classified by Codman as having an above average (33 percent or greater) likelihood of referral.

For DRGs 36, 106, 107, and 125, more than 85 percent of rural residents were hospitalized in urban hospitals. This set of DRGs accounts for a relatively small percentage of rural beneficiaries' hospitalizations. Also, these data suggest that these DRGs are highly unlikely to be treated in any rural setting (including rural referral centers).

Access to inpatient care for rural Medicare beneficiaries may differ for routine and specialized care. Comparison of these data with earlier research by Cromwell et al. (1987) suggests that the trends described here reflect longstanding differences in case mix and practice patterns between urban and rural hospitals. Factors affecting access to specialized care for rural beneficiaries may be quite different from those influencing access to routine care.

Indeed, many rural beneficiaries were hospitalized in urban hospitals for surgeries. Although only 44.8 percent of rural beneficiaries in rural hospitals had surgery, 71.9 percent of rural beneficiaries in urban hospitals had surgery. Kane et al. (1978) noted a similar pattern in an earlier study, especially for more specialized surgical procedures, where almost one-third of the rural patients had surgery in urban hospitals.

Rural hospitals appear unlikely to develop greater specialized capacity. Even if changes in Medicare payment for capital direct more payment dollars for new equipment, hiring specialized staff is not likely especially in small rural hospitals, given existing trends in the location of specialists (Lawlor and Reid, 1981). Further, such expansion may be undesirable especially

if expected volume does not justify expansion on clinical grounds, because recent studies concerning the impact of physician and hospital volume on outcome quality for surgical procedures clearly indicate that hospital volume plays a major role in reducing adverse outcomes (Luft et al., 1986; Hughes et al., 1987). Some conditions (e.g., coronary artery bypass graft [CABG]) are very sensitive to volume and are highly unlikely to be performable in all but a very few rural settings without risking an unacceptable likelihood of adverse outcomes. Here, "regionalization" of care may be a necessity (Maerki et al., 1986; Codman, 1990).

Determinants of rural or urban hospitalization

The previous tables suggest that specialized care for a small set of conditions is strongly associated with hospitalization of rural beneficiaries in urban areas. Several case-mix factors affecting whether or not rural Medicare beneficiaries are treated in rural or urban hospitals have been previously discussed. Descriptive statistics for these factors from FY 1987 MEDPAR data for these factors, which will be used as explanatory variables in the logistic regression analysis to follow, are listed along with their descriptive statistics in Table 4. The average age of the hospitalized beneficiaries in the analysis was 73.6 years, and slightly more than 53 percent were female. Their average length of stay was 7.6 days, and 53.5 percent of the hospitalizations in the analysis involved surgery. These data are representative of the population of hospitalized Medicare beneficiaries in other years.

Table 5 displays the means for selected variables from Table 4 by place of hospitalization. These MEDPAR data for FY 1987 show that rural beneficiaries hospitalized in rural areas are older and are more likely to be female than beneficiaries hospitalized in urban areas. Beneficiaries hospitalized in rural areas have shorter lengths of stay, are hospitalized for less severe conditions (as indicated by the DRG weight), have fewer intensive care unit (ICU) days and cardiac care unit (CCU) days, have fewer surgeries and procedures performed, and have fewer hospitalizations for cardiovascular or other specialized procedures than urban residents. These data suggest that hospitalization in urban hospitals are for more intense care than in rural hospitals. This is consistent with the finding that rural hospitals perform a less intensive style of inpatient care than urban hospitals (Cromwell et al., 1987). Rural beneficiaries, thus, appear to utilize urban hospitals to avail themselves of more intense care for severe conditions.

Logistic regression analysis

An exploratory multivariate analysis of indicators of specialized conditions and indicators of more severe case intensity (LOS, ICU and CCU days, number of diagnoses and procedures, whether surgery was performed, and DRG weight) that predispose rural beneficiaries to urban rather than rural hospitals is described in the following paragraphs. A logistic regression analysis of 1987 MEDPAR data for rural beneficiaries found several demographic factors and case-mix factors that affected variation the likelihood of rural hospitalization (Table 6). Several demographic factors are important predictors of use of rural or urban hospitals by rural beneficiaries. Older beneficiaries and females were significantly more likely to use rural hospitals. This is consistent with the results of an earlier study of hospitalization patterns of rural residents (Hogan, 1986) and may reflect the lower incidence of major cardiovascular conditions among women, and the reluctance of doctors to perform surgery on very old patients.

Some program-related factors also influenced whether rural beneficiaries were hospitalized in rural or urban hospitals. Disabled Medicare beneficiaries were more likely than others to be hospitalized in a rural hospital. In contrast, Chronic Renal Disease Program beneficiaries and beneficiaries hospitalized in a PPS-exempt hospital unit (rehabilitation, psychiatric, or alcohol and drug treatment unit) were far more likely than other beneficiaries to be hospitalized in an urban hospital. This reflects the paucity of facilities for treating chronic renal disease patients, rehabilitation, psychiatric, and alcohol and drug abuse in rural areas.

With two exceptions, the summary clinical variables included in the analysis indicated a very slight predisposition toward urban hospitalizations. Decreasing length of stay, number of ICU days, number of CCU days, DRG weight, and number of procedures performed each indicated a very slight, but statistically significant, tendency toward urban hospitalization. A greater number of diagnoses appears, in contrast, to predispose rural beneficiaries to rural hospitalization, because many beneficiaries age 75 years or over are likely to have several chronic conditions and tend not to travel great distances for inpatient care (Hogan, 1986).

It is not surprising to find that surgery strongly predisposes rural beneficiaries toward urban hospitalization. This appears to indicate segmentation in the rural inpatient marketplace where non-surgical patients remain in rural hospitals, whereas the need for surgery promotes hospitalization in urban areas. Because several specialized conditions are also controlled for in this logistic regression, the predisposing effect of the surgery variable is general and not because of a small subset of DRGs. Need for specialized or high-technology care strongly predisposed rural beneficiaries toward use of urban hospitals. Rural beneficiaries who were hospitalized for major cardiovascular conditions were decidedly more likely to receive care in urban hospitals, as the low odds ratio for the cardiovascular procedures indicator would show.

The lowest odds ratios observed were for hysterectomy (0.134) and radiotherapy (0.154). Rural beneficiaries were also strongly predisposed to treatment in urban hospitals for chemotherapy and craniotomy and spinal procedures. Only hospitalizations for injuries requiring operating room procedures, splenectomy, and procedures on other blood-forming organs had odds ratios above 0.4. Most

Table 4

Variables used in the analysis

Variable name	Mean	Standard deviation
Patient age	73.56	10.94
Sex[1]	1.533	0.498
Disabled beneficiary[2]	0.104	0.305
Chronic renal disease beneficiary[1]	0.004	0.066
PPS exempt unit[1]	0.013	0.114
Transferred to another hospital[1]	0.033	0.178
Length of stay	7.633	8.57
Intensive care days	0.625	2.59
Coronary care days	0.250	1.44
Number of diagnoses[2]	3.73	1.37
Surgery	0.533	0.499
Number of procedures[2]	1.059	1.18
DRG weight	1.248	0.807
Craniotomy and spinal procedures (DRGs 1-4)[1]	0.003	0.056
Major head and neck procedures (DRG 49)[1]	0.0005	0.023
Miscellaneous ear, nose and throat procedures (DRG 55)[1]	0.0009	0.030
Cardiovascular procedures (DRGs 103-112, 117, 124, 125)[1]	0.044	0.205
Kidney and urinary tract procedures (DRG 315)[1]	0.002	0.045
Hysterectomy (DRG 353)[1]	0.0002	0.013
Splenectomy and other operation room procedures for blood forming organs (DRGs 392, 393, 394)[2]	0.0004	0.020
Neoplasms (DRGs 406, 407, 408)[1]	0.002	0.040
Radiotherapy (DRG 409)[1]	0.0008	0.029
Chemotherapy (DRG 410)[1]	0.011	0.104
Injury procedures (DRG 442)[1]	0.004	0.062
Rehabilitation (DRG 462)[1]	0.003	0.055

[1]Coding for dichotomous variables: sex—male = 1, female = 2; disabled beneficiary, chronic renal disease beneficiary, PPS exempt unit, transferred from another hospital—yes = 1, no = 0; specific procedures—procedure performed = 1, procedure not performed = 0.
[2]*International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM).

NOTE: DRG is diagnosis-related group.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data are from the Medicare Provider Analysis Survey, 1987.

Table 5

Comparing rural beneficiaries using rural and urban hospitals: Fiscal year 1987

Variable name	Rural hospital mean	Urban hospital mean
Patient age	74.43	71.64
Sex	1.548	1.500
Length of stay	7.111	8.784
Intensive care days	0.506	0.888
Coronary care days	0.180	0.402
Number of diagnoses	3.76	3.65
Surgery	0.448	0.719
Number of procedures	0.852	1.516
DRG weight	1.155	1.454
Craniotomy and spinal procedures (DRGs 1-4)	0.001	0.008
Major head and neck procedures (DRG 49)	0.002	0.0011
Miscellaneous ear, nose, and throat procedures (DRG 55)	0.0004	0.0019
Cardiovascaular procedures (DRGs 103-112, 117, 124, 125)	0.012	0.1133
Kidney and urinary tract procedures (DRG 315)	0.001	0.0044
Hysterectomy (DRG 353)	0.00003	0.0004
Splenectomy and other operating room procedures for blood forming organs (DRGs 392, 393, 394)	0.0002	0.0007
Neoplasms (DRGs 406, 407, 408)	0.0008	0.0034
Radiotherapy (DRG 409)	0.0003	0.0019
Chemotherapy (DRG 410)	0.0056	0.0225
Injury procedures (DRG 442)	0.0021	0.0076
Rehabilitation (DRG 462)	0.0011	0.0071

NOTE: DRG is diagnosis-related group.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data are from the Medicare Provider Analysis Survey, 1987.

Table 6

Effects of demographic and case-mix variables on the use of rural inpatient care, by rural Medicare beneficiaries: Fiscal year 1987

Predictors	Logistic regression coefficient (*b*)	Standard error	*T*	Relative risk
Age	0.0224	0.0004	56.48	1.023
Sex	0.0644	0.0062	10.42	1.067
Disabled	0.3129	0.0135	23.10	1.367
Chronic renal disease	-0.8511	0.0482	-17.64	0.427
Exempt unit	-1.1140	0.2701	-41.25	0.328
Transferred to another hospital	0.6654	0.2036	32.69	1.945
Length of stay	-0.0085	0.0004	-19.53	0.991
Intensive care unit days	-0.0121	0.0013	-9.13	0.988
Coronary care unit days	-0.0702	0.0025	-27.77	0.932
Number of diagnoses	0.0629	0.0023	27.48	1.064
Surgery	-0.5691	0.0111	-51.29	0.566
Number of procedures	-0.1628	0.0047	-34.81	0.850
DRG weight	-0.0725	0.0046	-15.91	0.930
Craniotomy and spinal procedures	-1.5464	0.0594	-26.04	0.213
Major head and neck procedures	-0.9239	0.1244	-7.43	0.397
Ear, nose, and throat procedures	-1.1689	0.0935	-12.51	0.310
Cardiovascular procedures	-1.6797	0.0174	-96.35	0.186
Kidney procedures	-0.9697	0.0649	-14.94	0.379
Hysterectomy	-2.0091	0.2831	-7.10	0.134
Splenectomy and BFO procedures	-0.5656	0.1363	-4.15	0.568
Neoplasms	-1.1343	0.0696	-16.29	0.322
Radiotherapy	-1.8396	0.1038	-17.71	0.159
Chemotherapy	-1.4868	0.0273	-54.38	0.226
Injury procedures	-0.7788	0.0451	-17.26	0.459
Rehabilitation	-1.1743	0.0619	-18.98	0.309
Intercept	-0.3855	—	—	—

N = 577,712
Dependent variable mean = 0.688
Likelihood ratio X^2 = 76,395.68 with 25 degrees of freedom
Percent correctly classified = 72.8 percent
Proportional reduction in error = 0.128
F = 2,741.40 at (25, 577,111) degrees of freedom
R^2 = 0.1061

NOTE: DRG is diagnosis-related group.

SOURCE: Health Care Financing Administration, Bureau of Data Management and Strategy: Data are from the Medicare Provider Analysis Survey, 1987.

of the other procedures in the analysis had odds ratios between 0.3 and 0.4.

In a previous study by HCFA staff, transfers were found to differ from non-transfer cases in terms of severity of illness and cost (Jencks and Bobula, 1988). Because of this, a dummy variable that indicates whether a hospitalized beneficiary was transferred was included. The slope and odds ratio for this variable indicate that transferred cases overwhelmingly tended to originate in rural hospitals, suggesting little patient flow from urban to rural areas. Because destination data for transfers are not on the MEDPAR record, one cannot determine whether these transfers were to urban or to other rural hospitals.

The overall statistical significance of the logistic regression is strong, as indicated by the likelihood ratio X^2 and the pseudo *F* ratio. The predictive power as measured by the pseudo R^2 and the proportional reduction-in-error statistic show a small improvement in predictability based on this analysis.

Summary

Because a substantial percentage of rural Medicare beneficiaries obtain hospital care in urban hospitals, this analysis shows that the change over time in the percentage of rural beneficiaries hospitalized in urban areas has been negligible. Large scale movement of Medicare beneficiaries in rural areas to urban hospitals for inpatient care is not evident. The present level of inpatient hospitalization care in urban areas of rural Medicare beneficiaries appears to have persisted over several years. Declining volume in rural hospitals, thus, is probably because of the higher rate of shifting low intensity cases to outpatient settings, or to population loss, but not to increased bypassing of rural hospitals in favor of urban hospitals during PPS.

Much of the utilization of urban hospitals by rural beneficiaries appears to be related to obtaining inpatient services that are not provided in rural hospitals. Rural beneficiaries are hospitalized in urban hospitals for surgery or for other severe or specialized conditions that probably could only be treated in the largest rural hospitals. These conditions have not been historically treated in rural settings because appropriate care is not readily available in many rural areas (Codman Research Group, Inc., 1990). This appears to be especially important for beneficiaries who require cardiovascular surgery. The data present suggest that use of urban hospitals by rural Medicare beneficiaries

reflects the organization of some types of inpatient care in urban hospitals rather than a preference for urban hospitals in instances when care is available in both urban and rural hospitals.

These results also suggest a need for further research to provide more detailed analysis concerning patterns of inpatient care for rural Medicare beneficiaries. Further research on case-mix specialization in rural referral centers, and analyses of Medicare inpatient markets by condition for rural beneficiaries is needed to show how rural hospitals differ by size and type (e.g., rural referral center, sole community hospital) and to show where rural beneficiaries obtain inpatient care.

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