Hospital utilization and expenditures in a Medicaid population

by William Buczko

Determinants of hospital utilization and expenditures are analyzed for Medicaid enrollees in the State Medicaid household sample portion of the National Medical Care Utilization and Expenditure Survey who were continuously enrolled throughout 1980. Health status measures were the best predictors of both the probability of hospitalization and total hospitalizations. Children covered by Aid to Families with Dependent Children were the Medicaid enrollees least likely to be hospitalized. Number of hospital days, surgery, and California residence directly increased hospital expenditures. Conditions responsible for hospitalization increased hospital expenditures indirectly by increasing the number of hospital days and the probability of surgery.

Introduction

There have been many studies of hospital utilization and expenditures for the general population but few studies of hospital utilization and expenditures for Medicaid enrollees. Rarely, in studies for either the general or the Medicaid population, are individual-level demographic, attitudinal, health status, diagnostic, source-of-payment, and expenditure data linked to permit multivariate analysis of hospital utilization and expenditures.

In this article, regression analysis is used to examine the determinants of the probability of a hospital visit, the number of hospitalizations, and the total inpatient hospital expenditures for Medicaid enrollees in the States of California, Michigan, New York, and Texas who were continuously enrolled throughout 1980. The data source for this study, the State Medicaid household sample portion of the National Medical Care Utilization and Expenditure Survey, is one of the few data bases containing representative samples of Medicaid enrollees in different States and self-reports of utilization and expenditures validated with Medicaid claims data.

The abundance of demographic, health status, income, source-of-payment, and employment information accompanying the data on medical care expenditures and utilization presents the opportunity for a detailed cross-sectional evaluation of the determinants of utilization and expenditures for Medicaid enrollees across four State Medicaid populations. These results can be compared with findings obtained for the general population (e.g., Mauskopf, Rodgers, and Dobson, 1985) as well as for State Medicaid populations (e.g., Kasper, 1986).

Recently, several comparative studies of State Medicaid populations have been based on data from the Tape-to-Tape project, which includes enrollment, claims, and provider data from the Medicaid Management Information Systems of five States: California, Georgia, Michigan, New York, and Tennessee. Hospital utilization and expenditures by condition (Pine, Howell, and Buczko, 1987); long-term care (McMillan et al., 1987; Ray et al., 1987; Burwell et al., 1987); and health care for children covered by Medicaid (Rymer and Adler, 1987) have been examined in these studies. In other studies, aggregate data from Form 2082 submitted to the Health Care Financing Administration have been used to determine the impact of State Medicaid program characteristics on reimbursement, number of recipients, and State program expenditures (McDevitt and Buczko, 1985; Zuckerman, 1987).

Hospital utilization and expenditure studies

Inpatient utilization of hospitals varies across sex and age groups. In the 1980 National Hospital Discharge Survey, it was found that females had more hospitalizations and shorter lengths of stay than males had (Haupt, 1982). If hospitalizations for deliveries are not considered, hospitalization rates, length of stay, and prevalence of diagnoses were nearly equal for both sexes.

Persons 65 years of age or over are more likely to be hospitalized and have longer stay lengths and higher hospital expenses than younger persons, regardless of sex. Cromwell et al. (1982) found that aged and disabled Supplemental Security Income enrollees had the highest rates of hospitalization and lengths of stay among Medicaid enrollees in Tennessee.

According to the 1980 National Hospital Discharge Survey data (Haupt, 1982), diseases of the circulatory system were a major cause of hospitalization for all adult age groups and were especially prevalent among those 65 years of age or over, accounting for 29 percent of hospitalizations for persons in this age group. Diseases of the digestive system, malignant tumors, and respiratory diseases were also more prevalent as age increased (McCarthy, 1983; Haupt, 1982; Garnick and Short, 1985) and were often associated with the most expensive hospitalizations among the elderly (Hodgson and Kopstein, 1984). Surgical rates and length of stay

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within diagnosis groups also increased with age (Pokras, 1983; McCarthy and Finkel, 1980).

Black people have lower rates of hospitalization than white people in both the Medicare and Medicaid populations (Helbing, 1980; Paringer et al., 1979; Wan, 1982). In both populations, black people have longer than average lengths of stay.

Dual enrollees in Medicare and Medicaid have higher total hospital expenditures than those enrolled in Medicare only. For elderly dual enrollees, the major third-party payer for most hospital stays is Medicare. Individuals enrolled in both Medicare and Medicaid tend to be older, sicker, more functionally limited, poorer, more likely to be hospitalized, and more likely to have high hospital costs than other Medicare enrollees (McMillan et al., 1983; McMillan and Gornick, 1984).

Several multivariate analyses of hospital utilization were aggregate, hospital-level analyses rather than patient-level studies. In these analyses, the following factors were found to affect hospital use: number of beds (Roemer, 1961; Wennberg and Gittelsohn, 1973); age (Anderson, 1973); urbanization (Harris, 1975); race and income (Feldstein and German, 1975). These results suggest that patient characteristics, hospital characteristics, and ecological characteristics each influence hospital utilization. However, in aggregate-level analyses, the impact of patient-level characteristics on hospital use is often obscured.

There have been fewer patient-level than aggregate-level analyses of hospital utilization and expenditures. Patient-level studies are of two distinct types: those assessing the impact of different diagnoses on hospital admissions, length of stay, and hospital expenditures and those applying the Andersen-Newman model (Andersen and Newman, 1973) to hospital utilization and expenditure data.

In one of the earliest of the first type of study, Ro (1969) examined the effects of income, race, payment method, employment status, living arrangement, age, and sex on length of stay, admissions, and expenditures, controlling for hospital characteristics. Number of hospital beds, teaching status, and staffing patterns affected both hospital utilization and expenditures. Third-party payment and age increased length of stay, total services used, and total hospital expenditures. White persons used fewer services and had lower hospital expenditures than did persons of other races. Diagnosed conditions were also strong predictors of length of stay, hospital utilization, and hospital expenditures.

One of the most sophisticated efforts at estimating costs of hospital stays underscores the power of diagnosed conditions as predictors of length of stay and cost per patient day (Lave and Leinhardt, 1976). Presence of specific diagnosed conditions, length of stay, number of surgical procedures, death of patient, third-party payment from workers' compensation, sex, and race were found to be significant predictors of cost per patient day. Number of diagnoses, specific diagnosed conditions, number of surgical procedures, emergency admission, urgent admission, death of patient, age, government copayment (including Medicare and Medicaid), sex, race, occupancy rate, and day of week on which admission occurred were all significant predictors of length of stay. In this study, it was confirmed that length of stay affects expenditures and that diagnoses affect both length of stay and expenditures.

In other hospital utilization and expenditure studies, the Andersen-Newman model was employed as a conceptual framework. In this context, hospital utilization and expenditures are both functions of predisposing, enabling, and health status variables. Predisposing variables are sociodemographic and attitudinal factors that encourage the use of hospital services. Enabling variables are indicators of an individual's ability to secure hospital care. Some important enabling variables are income, insurance, having a regular source of care, and availability of services. Health status variables are measures of the existence and/or severity of the perceived or diagnosed conditions of the respondent. Health status variables often are the most important predictors of hospital utilization and expenditures.

Andersen (1975) used his model to examine the determinants of the probability and length of hospitalization. Health status variables were the best predictors of both hospital admission and total days of care. People who were separated or divorced, had comprehensive insurance coverage, or had a long travel time to a regular source of care had a higher probability of hospitalization. Age, past hospitalizations, education, marital status, and hospital beds per person in the area also affected length of stay. In subsequent studies, Wolinsky (1978) and Evashwick et al. (1984) confirmed that health status variables were the most important predictors of hospitalization.

Hospital utilization may partially result from the effects of the local supply of beds and physicians. In some studies, data on the availability of beds and physicians have been merged with patient-level data to determine their joint effect on hospital utilization and expenditures.

Davis and Reynolds (1975) found that a greater number of physicians per capita increased total hospital days but decreased the number of hospital episodes, and a greater number of hospital beds per capita increased both the number of hospital days and mean length of stay. However, health status variables, income, and work status were important predictors of number of hospital episodes, total hospital days, and mean length of stay. Black people had longer lengths of stay as a result of the greater severity of their chronic conditions.

Fuchs (1978), controlling for income and other demographic variables but not health status, discovered that a greater supply of surgeons increased the number of surgeries performed. Pauly (1980) replicated Fuchs' study with the inclusion of health status variables. Although it was found that a greater number of hospital beds per capita increased both number of hospitalizations and number of surgeries,

the availability of physicians or surgeons affected the frequency of neither hospitalizations nor surgeries. In contrast, health status variables were much more important predictors of hospital utilization than the availability of either hospital beds or physicians.

Research methods

Survey description

The data presented in this article are drawn from the National Medical Care Utilization and Expenditure Survey (NMCUES), which was cosponsored and financed by the Health Care Financing Administration and the National Center for Health Statistics. NMCUES data document the health care utilization and expenditure patterns of the civilian noninstitutionalized population of the United States during 1980.

NMCUES contains the following three components:

- A randomly selected national household survey sample panel of the civilian noninstitutionalized population.
- The State Medicaid household sample (SMHS), a randomly selected sample panel of the civilian noninstitutionalized population in four States.
- The administrative records sample (ARS) of Medicare and Medicaid records.

The data analyzed in this article were drawn from the sample of 7,643 noninstitutionalized enrollees in the SMHS survey component of NMCUES who were continuously enrolled for the full year, from January 1, 1980, to December 31, 1980. SMHS was, in effect, four separate surveys conducted in New York, California, Texas, and Michigan. A sample of noninstitutionalized enrollees, stratified by enrollment group, was drawn from the Medicaid eligibility file of each State.

Five interviews were conducted with respondents regarding events related to medical care received in 1980. The first, second, and fifth interviews were conducted in person, and the third and fourth interviews were conducted primarily by telephone. A core questionnaire that contained questions concerning utilization, expenditures, sources of payment, health insurance coverage, and employment was used in each interview. Questionnaire supplements that contained questions about demographic and social characteristics, limitations in activity, family income, employment status, and access to care were used in the first, third, and fifth rounds of interviews. SMHS response rates were 82 percent for California, 80 percent for Michigan, 77 percent for New York, and 92 percent for Texas. The weights for primary sampling units were readjusted to eliminate bias in response rates. Self-reported SMHS data on Medicaid enrollment status, utilization, and expenditures were verified with ARS data for all Medicaid enrollees (Whitmore, 1983).

State Medicaid household sample

The four SMHS States comprised 36 percent of the total Medicaid population and 40 percent of total Medicaid expenditures nationwide in 1980. The SMHS States were highly urbanized and had above average per capita incomes. Texas and Michigan had slightly younger populations than the national average; the population of New York was slightly older than the national average. Both New York and Texas had a higher than average percentage of their populations living in poverty. The 1980 unemployment rate in Michigan (12.3 percent) was much higher than the national average in a year marked by unusually high levels of unemployment nationwide. In contrast, Texas had an unemployment rate of only 5 percent in 1980.

The State Medicaid programs in California, Michigan, and New York each covered the medically needy, State-only enrollee groups; most optional groups eligible for Medicaid assistance through Aid to Families with Dependent Children (AFDC); and most of the optional services available under Medicaid in 1980 (Ruther et al., 1987). Each of these State programs had above average AFDC payment standards and large numbers of AFDC recipients as a result of less restrictive AFDC eligibility standards (Rymer, Burwell, and Madigan, 1984). Because of the number of people eligible for Medicaid in these States and the liberal coverage of optional services, Medicaid programs in California, Michigan, and New York also had high expenditure levels in 1980.

In contrast, the Texas Medicaid program in 1980 was one of the most restrictive programs in the South, where eligibility has been highly restrictive and benefit levels have been low. The Texas Medicaid program had the lowest ratio of Medicaid enrollees to persons living in poverty in the Nation (.35) because of restrictive State AFDC eligibility standards (Rymer, Burwell, and Madigan, 1984). Texas did not cover the medically needy or other State-only groups and covered only one optional AFDC-related group. Texas also limited Medicaid enrollees to 30 covered inpatient days. The AFDC payment standard in Texas was low when compared with the national average. Consequently, the Texas Medicaid program was far more limited in scope than the Medicaid programs in New York, Michigan, and California were.

Statistical methods

In the statistical analyses in this article, the following dependent variables are examined: probability of hospitalization during 1980, number of hospitalizations during 1980, and total inpatient hospital expenditures during 1980. These variables are initially presented in descriptive tables by health status, age, Medicare coverage, death during 1980, presence of surgical procedures, Medicaid enrollment group, and State. Then the joint effects of several independent variables are assessed for each dependent

variable using multiple regression. The independent variables used in these regressions are correlated with each other. Therefore, the regression results do not represent the unique effects of each predictor but instead represent the effects of each predictor after controlling for all other predictors in the regression.

The probability of hospitalization is examined for total enrollees. In contrast, regressions for total hospitalizations and hospital expenditures include only those enrollees with one hospitalization or more.

The regression equations presented are the result of a two-step process. No bivariate correlation in the matrixes for these regressions was high enough to suggest the presence of multicollinearity. Initially, all independent variables included in a model were run against the dependent variable in a simple linear regression. Only those variables attaining statistical significance at the .05 level were retained. These variables were then regressed against the dependent variable, using a backward selection stepwise procedure and retaining those predictors attaining significance at the .05 level to obtain final estimates of these coefficients.

Ordinary statistical procedures should not be used when analyzing data from surveys in which a cluster sampling design is used. Because NMCUES was a cluster sample, regression equations used in this study were estimated using SURREGR, a software package designed by Research Triangle Institute to appropriately estimate the standard errors of linear models from complex survey designs (Holt, 1982).

Normally, estimates of linear models for dichotomous dependent variables are made by employing either a logit or probit algorithm because of the heteroscedasticity implicit in dichotomous dependent variables. Because state-of-the-art software for probit or logit models do not incorporate design effects for complex samples when calculating standard errors, the regression analysis for a dichotomous dependent variable, such as the probability of hospitalization, was estimated in linear probability form using SURREGR. This method of estimation was appropriate because the Taylor linearization method used by SURREGR does not require normally distributed data or a constant variance across all error terms (homoscedasticity).

Only unstandaridized regression coefficients are used in this article, because SURREGR does not provide standardized regression estimates. Because standardized coefficients were not available, the relative importance of coefficients in the regression models presented here cannot be assessed through path analytic methods, which would allow one to make an explicit assessment of the relative importance of independent variables (Duncan, 1975).

It is incorrect to compare unstandardized coefficients of predictors within the same equation to determine their relative importance because the magnitude of each coefficient is affected by differences in the magnitude and variability of each independent variable (Lewis-Beck, 1980). Consequently, the relative importance of independent variables in the equations presented can be best, albeit imperfectly, evaluated through comparison of significance levels of the F test for their regression coefficients. The denominator of the F test for the overall model is the number of strata rather than the number of cases minus number of regressors.

The data for conditions responsible for hospitalization are primarily self-reported data, augmented by diagnosis data available from the ARS for hospital stays. Because data on conditions responsible for hospitalization are available only for users of hospital services, these data are used only in analyses restricted to recipients of inpatient hospital care.

The expenditure data in these analyses represent total payments actually made to providers for inpatient hospital visits. Total expenditures include not only self-reported Medicaid expenditures verified by Medicaid claims but also self-reports of expenditures covered by Medicare, private insurance, out-of-pocket payment, and other payers. Similarly, utilization totals represent all reported hospitalizations regardless of source of payment, including visits not covered by Medicaid. The data are weighted using the person identifier weights developed by Research Triangle Institute.

Data analysis

In 1980, 16.7 percent of the Medicaid enrollees in the SMHS population who were continuously enrolled during the year were hospitalized. Full-year enrollees averaged 1.9 hospital days per enrollee, with an average total expenditure for hospital care of $704 per enrollee. In comparison, 17 percent of the general population was hospitalized during 1980, averaging 1.2 hospital days per person (Haupt, 1982). Circulatory disease was the condition most frequently responsible for hospitalization in the SMHS population, followed by digestive disease, respiratory disease, and injuries.

In the sample, 62 percent were female, 13 percent were married, 12 percent were in the labor force during 1980, 18 percent had at least completed high school, and 87 percent resided in standard metropolitan statistical areas, as shown in Table 1. Nearly 39 percent of the population were not white. Respondents dually enrolled in Medicare and Medicaid comprised 22 percent of the sample.

Most SMHS respondents perceived their health to be good; only 22 percent reported a limiting condition. However, they were less healthy than the general population, as noted in previous research by Kasper and Howell (1985), and averaged 12 bed days per enrollee. Among the enrollees in this sample, 43 (0.6 percent) died during 1980.

In Table 2, the percent of SMHS full-year, continuously enrolled Medicaid enrollees hospitalized during 1980, the mean number of hospitalizations per enrollee, and the mean hospital expenditure per enrollee are shown by health status, age, Medicare coverage, whether they died during 1980, whether

Table 1

Percent or mean and standard deviation for variables in the analysis of hospital utilization and expenditures: California, Michigan, New York, and Texas, 1980

Variable	Percent or mean[1]	Standard deviation
Total hospital expenditures	($703.97)	2,761.23
Probability of hospitalization	16.7	.373
Hospitalizations per enrollee	24.2	.658
Hospital days per enrollee	(1.87)	7.493
Probability of surgery	7.7	.256
Health status (1 = excellent; 2 = good; 3 = fair; 4 = poor)	(2.18)	.998
Presence of limiting condition	22.4	.430
Died during 1980	0.6	.075
Bed disability days	(12.03)	30.81
Condition responsible for admission:		
Infectious and parasitic diseases	0.4	.061
Neoplasms	0.9	.092
Endocrine, nutritional, and metabolic diseases	1.0	.100
Mental disorders	0.6	.079
Nervous system and sense organ disorders	1.3	.114
Cardiovascular diseases	2.7	.163
Respiratory system diseases	1.9	.136
Digestive system diseases	2.0	.141
Genitourinary diseases	1.5	.123
Deliveries	1.1	.105
Skin and musculoskeletal disorders	1.5	.121
Congenital and newborn disorders	1.7	.129
Injuries	1.8	.132
Annual family income	($9,335.77)	8,867.53
Medicare coverage	22.1	.415
Age	(30.22)	25.82
Sex (1 = female; 0 = male)	61.7	.486
Married	13.3	.339
High school education or more	17.7	.381
Race other than white	38.9	.488
Family size	(3.88)	2.31
In labor force during 1980	12.1	.326
SMSA resident	87.3	.333
Enrollee group:		
SSI aged	14.6	.353
SSI blind and disabled	16.8	.374
AFDC adult	22.1	.415
AFDC child	39.1	.488
State only	7.1	.258
State:		
California	41.7	.493
Michigan	16.5	.371
New York	31.1	.463
Texas	10.7	.309

[1]Means are shown in parentheses.

NOTES: The mean is presented for all continuous variables. For all dichotomous variables except sex, 1 = yes; 0 = no. Percent of total is presented for all dichotomous variables. SMSA is standard metropolitan statistical area. SSI is Supplemental Security Income. AFDC is Aid to Families with Dependent Children.

SOURCE: Health Care Financing Administration and National Center for Health Statistics: Data from the State Medicaid household sample, National Medical Care Utilization and Expenditure Survey, 1980.

Table 2

Mean hospital expenditures, probability of hospitalization, and number of hospitalizations for full-year Medicaid enrollees, by selected variables: California, Michigan, New York, and Texas, 1980

Variable	Number of cases	Mean hospital expenditures	Percent probability of hospitalization	Hospitalizations per enrollee
Health status				
Excellent	2,236	$223.12	9.8	.11
Good	2,808	430.36	13.3	.17
Fair	1,594	978.09	19.8	.30
Poor	1,005	2,101.50	37.1	.64
Age				
Under 17 years	3,293	174.57	7.8	.09
17-34 years	1,720	583.50	19.6	.27
35-49 years	614	993.67	22.0	.32
50-64 years	748	1,249.77	24.4	.39
65 years or over	1,268	1,780.57	29.0	.46
Medicare coverage				
Yes	1,689	1,829.37	29.0	.48
No	5,954	384.77	13.3	.17
Died during 1980				
Yes	43	9,621.87	78.0	1.52
No	7,600	653.35	16.4	.23
Surgery during 1980				
Yes	540	5,399.01	100.0	1.52
No	7,103	346.93	10.4	.14
Enrollment group				
SSI aged	1,117	1,809.83	29.0	.47
SSI blind and disabled	1,285	1,301.52	25.0	.42
AFDC adult	1,697	529.12	18.9	.24
AFDC child	2,993	136.17	7.4	.09
State-only	552	689.97	16.2	.24
State				
California	3,188	864.77	17.6	.25
Michigan	1,261	550.94	16.2	.23
New York	2,380	542.02	13.8	.19
Texas	814	784.82	22.9	.36

NOTES: SSI is Supplemental Security Income. AFDC is Aid to Families with Dependent Children.

SOURCE: Health Care Financing Administration and National Center for Health Statistics: Data from the State Medicaid household sample, National Medical Care Utilization and Expenditure Survey, 1980.

surgery was performed, enrollment group, and State. The probability of hospitalization, total hospitalizations per enrollee, and hospital expenditures per enrollee all increased as health status declined. Similarly, respondents who died during 1980 were far more likely than enrollees surviving the year to be hospitalized, and they had higher total expenditures per enrollee.

Hospitalization and hospital expenditures both increased with age. Respondents under 17 years of age had decidedly lower levels of hospitalization and hospital expenditures than adults had. Enrollees 65 years of age or over were the most likely to be hospitalized and had the highest level of expenditures for hospital care of any age group.

Respondents with Medicare coverage had a higher probability of hospitalization and higher hospital expenditures than other full-year enrollees had. In previous research on the dually enrolled population, it was found that dual enrollees are a high-utilization, high-expenditure group, primarily because they are in poorer health than other Medicare beneficiaries (McMillan et al., 1983; McMillan and Gornick, 1984).

Aged enrollees in the Supplemental Security Income (SSI) program were the enrollment group most likely to be hospitalized and, as a group, had the highest hospital expenditures during 1980. In contrast, AFDC children were far less likely to be hospitalized and had the lowest hospital expenditures per enrollee of any enrollment group.

Medicaid enrollees in Texas had a higher probability of hospitalization than enrollees in other States had. This resulted from the greater than average proportion of SSI aged enrollees in the Texas Medicaid population because of restrictive State AFDC eligibility policies and from limits on covered outpatient services.

Hospital expenditures per enrollee were highest in California because of higher than average per diem costs for hospitals and higher physician costs. Although it may appear that high hospital costs per enrollee in California are the result of liberal coverage of a wide variety of optional services, the State with the next highest hospital cost per enrollee is Texas. Liberal coverage of optional services did not lead to high levels of hospital expenditures per enrollee in either Michigan or New York.

The variation in hospital utilization and costs across States by demographic variables presented in this article may be affected by the underlying distribution of age, sex, or other demographic variables in the four SMHS States. Variation in program characteristics affects recipient eligibility and service accessibility, which act as indirect and direct controls, respectively, on utilization and expenditures. These differences were summarized in the description of the four SMHS States.

Interstate variation in demographics and Medicaid program characteristics result in interstate variation in the composition of the covered population. For example, a younger Medicaid population will have different utilization and expenditure patterns than an older Medicaid population will have. Interstate variation in the cost of medical care, supply of physicians and hospital beds, health care coverage, and other economic factors also will affect hospital utilization and expenditures.

Figure 1

Regression equations used in the analysis of hospital utilization and expenditures

Hospital utilization

$$\text{PHOSP} = B_1H_1 + B_2H_2 + B_3H_3 + B_4H_4 + B_5E_1 + B_6E_2 + B_7X_1 + B_8X_2 + B_9X_3 + B_{10}X_4 + B_{11}X_5 + B_{12}X_6 + B_{13}X_7 + B_{14}X_8 + B_{15}X_9 + B_{16}X_{10} + B_{17}X_{11} + B_{18}X_{12} + B_{19}X_{14} + B_{20}X_{16} + B_{21}X_{17} + a_{\text{PHOSP}} + e_1 \quad (1)$$

$$\text{NHOSP} = B_1H_1 + B_2H_2 + B_3H_3 + B_4H_4 + B_5C_1 + B_6C_2 + B_7C_3 + B_8C_4 + B_9C_5 + B_{10}C_6 + B_{11}C_7 + B_{12}C_8 + B_{13}C_9 + B_{14}C_{10} + B_{15}C_{11} + B_{16}C_{12} + B_{17}C_{13} + B_{18}E_1 + B_{19}E_2 + B_{20}X_1 + B_{21}X_2 + B_{22}X_3 + B_{23}X_4 + B_{24}X_5 + B_{25}X_6 + B_{26}X_7 + B_{27}X_8 + B_{28}X_9 + B_{29}X_{10} + B_{30}X_{11} + B_{31}X_{12} + B_{32}X_{14} + B_{33}X_{16} + B_{34}X_{17} + a_{\text{NHOSP}} + e_2 \quad (2)$$

Hospital expenditures

$$\text{TEXP} = B_1\text{DAYS} + B_2\text{NHOSP} + B_3\text{PSURG} + B_4X_{14} + B_5X_{16} + B_6X_{17} + a_{\text{TEXP}} + e_3 \quad (3)$$

$$\text{DAYS} = B_1H_1 + B_2H_2 + B_3H_3 + B_4H_4 + B_5C_1 + B_6C_2 + B_7C_3 + B_8C_4 + B_9C_5 + B_{10}C_6 + B_{11}C_7 + B_{12}C_8 + B_{13}C_9 + B_{14}C_{10} + B_{15}C_{11} + B_{16}C_{12} + B_{17}C_{13} + B_{18}E_1 + B_{19}E_2 + B_{20}X_1 + B_{21}X_2 + B_{22}X_3 + B_{23}X_4 + B_{24}X_5 + B_{25}X_6 + B_{26}X_7 + B_{27}X_8 + B_{28}X_9 + B_{29}X_{10} + B_{30}X_{11} + B_{31}X_{12} + B_{32}X_{14} + B_{33}X_{16} + B_{34}X_{17} + B_{35}\text{PSURG} + a_{\text{DAYS}} + e_4 \quad (4)$$

$$\text{PSURG} = B_1H_1 + B_2H_2 + B_3H_3 + B_4H_4 + B_5C_1 + B_6C_2 + B_7C_3 + B_8C_4 + B_9C_5 + B_{10}C_6 + B_{11}C_7 + B_{12}C_8 + B_{13}C_9 + B_{14}C_{10} + B_{15}C_{11} + B_{16}C_{12} + B_{17}C_{13} + B_{18}E_1 + B_{19}E_2 + B_{20}X_1 + B_{21}X_2 + B_{22}X_3 + B_{23}X_4 + B_{24}X_5 + B_{25}X_6 + B_{26}X_7 + B_{27}X_8 + B_{28}X_9 + B_{29}X_{10} + B_{30}X_{11} + B_{31}X_{12} + B_{32}X_{14} + B_{33}X_{16} + B_{34}X_{17} + a_{\text{PSURG}} + e_5 \quad (5)$$

NOTES: B = regression coefficient. a = intercept. e = error term. PHOSP = probability of hospitalization. NHOSP = number of hospitalizations. TEXP = total hospital expenditures. DAYS = number of hospital days. PSURG = probability of surgery. H_1 = health status, H_2 = limiting conditions, H_3 = died during 1980, H_4 = bed days. C_1 = infectious and parasitic diseases; C_2 = neoplasms; C_3 = endocrine, nutritional, and metabolic diseases; C_4 = mental disorders; C_5 = nervous system and sense organ disorders; C_6 = cardiovascular diseases; C_7 = respiratory system diseases; C_8 = digestive system diseases; C_9 = genitourinary diseases; C_{10} = deliveries; C_{11} = skin and musculoskeletal disorders; C_{12} = congenital and newborn disorders; C_{13} = injuries. E_1 = annual family income, E_2 = Medicare coverage. X_1 = age, X_2 = sex, X_3 = married, X_4 = high school education or more, X_5 = race other than white, X_6 = family size, X_7 = in labor force during 1980, X_8 = resident of standard metropolitan statistical area, X_9 = Supplemental Security Income aged enrollee, X_{10} = Supplemental Security Income blind and disabled enrollee, X_{11} = Aid to Families with Dependent Children adult enrollee, X_{12} = Aid to Families with Dependent Children child enrollee, X_{13} = State-only enrollee, X_{14} = California State program, X_{15} = Michigan State program, X_{16} = New York State program, X_{17} = Texas State program.

These factors must be considered when examining data presented by State for Medicaid program utilization and expenditures. Thus, multivariate analysis must be used to control for factors that may account for differences across States observed in bivariate data.

Multivariate analysis of hospital utilization

Regression equations for the probability of hospitalization for all full-year, continuously enrolled Medicaid enrollees and the number of hospitalizations for those hospitalized are displayed in Figure 1, equations (1) and (2), respectively. In the regression for the probability of hospitalization, the dependent variable is dichotomous, indicating whether the respondent had at least one hospitalization during 1980. The regression for the number of hospitalizations includes only those full-year enrollees with one hospitalization or more during 1980. The dependent variables for these two regressions are measures of contact and volume of inpatient service utilization, respectively, in the Andersen-Newman model.

The independent variables in the hospital utilization regressions are similar to those used by Andersen (1975). Age, sex, race, education, employment, family size, marital status, and urban residence are the predisposing variables used in each regression analysis (Figure 1). The literature review indicates that the following groups should have above average utilization of hospital services:

- Older people.
- Females.
- Married people.
- Urban residents.
- High school graduates.
- White people.
- Members of small families.
- People employed during 1980.

Annual family income and Medicare coverage are the enabling variables used in these regressions (Figure 1). The Medicare coverage variable indicates whether respondents are dually enrolled in both Medicare and Medicaid. Higher income and dual enrollment should increase both the probability of hospitalization and the number of hospitalizations per enrollee.

Perceived health status, activity limitations, bed days, and death during 1980 are the health status variables used in these regressions (Figure 1). The death indicator allows one to assess the effect on hospital utilization of being in the last year of life. The following groups should use more hospital services than others:

- People who evaluate their health status as either fair or poor.
- People with activity limitations.
- People with a large number of bed days per year.
- People in their last year of life.

The regression for number of hospitalizations also includes a set of 13 dichotomous variables indicating the presence of diagnosed conditions responsible for hospitalization. People with neoplasms or cardiovascular disease should be more likely than others to have multiple hospitalizations (Zook, Savickis, and Moore, 1980).

Dummy variables are included for each State (with Michigan excluded as a reference group) and for each enrollment group (with State-only enrollees excluded as a reference group). These variables indicate whether any factors specific to State or enrollment group influence either the probability of hospitalization or the number of hospitalizations per enrollee.

Regression analysis of hospital utilization

Probability of hospitalization

Health status variables were the most important predictors of the probability of hospitalization, as shown in Table 3. The most significant health status variable was number of bed days. Individuals forced by ill health to spend several days in bed were more likely than others to be hospitalized. Enrollees who died during 1980 were 39.5 percent more likely to have been hospitalized prior to death than enrollees who were alive for the full year. Enrollees with a perceived health status of fair or poor had a higher probability of hospitalization than enrollees who evaluated their health as either excellent or good.

The AFDC child enrollment group dummy variable attained the second highest level of significance,

Table 3

Effects of selected predictors on the probability of hospitalization for all full-year Medicaid enrollees: California, Michigan, New York, and Texas, 1980

Predictor	Regression coefficient (*b*)	*t*	Significance
Health status	0.027	4.02	0.0001
Bed days	0.003	10.17	<0.0001
Died during 1980	0.395	7.07	<0.0001
Female	0.031	3.28	0.0010
Employed	−0.051	3.25	0.0012
New York	−0.042	3.75	0.0002
AFDC child	−0.093	9.06	<0.0001
Intercept	0.1047	—	—

R^2 = .140
F = 102.81
at (7,200) degrees of freedom
Significance = <0.0001
N = 7,643
Dependent variable mean = 0.167

NOTES: AFDC is Aid to Families with Dependent Children. R^2 is the percent of variance explained. F is the ratio of explained to unexplained variance. N is the number of cases. t = Student's t for b.

SOURCE: Health Care Financing Administration and National Center for Health Statistics: Data from the State Medicaid household sample, National Medical Care Utilization and Expenditure Survey, 1980.

indicating that AFDC children were significantly less likely than members of other enrollment groups to be hospitalized. The New York State dummy variable indicated that the probability of hospitalization was lower in New York than in the other SMHS States, even after health status, enabling, and predisposing variables and eligibility group were controlled for. Because the New York State Medicaid program has few limits on inpatient hospitalization, the lower rate of hospitalization in New York did not result from service controls.

Females were significantly more likely to be hospitalized than were males, primarily because of deliveries. People who were employed during 1980 were less likely to be hospitalized than other people were.

Although age was a significant bivariate determinant of the probability of hospitalization, it did not attain significance in this regression because the effects of age were parceled out across several other independent variables, most notably perceived health status. When regression analyses were conducted for both dependent variables using only health status and age as independent variables, health status was strongly significant in each case, but age was either a weak predictor or not significant.

These results are consistent with those of other studies in which the Andersen-Newman model was used, because health status variables were the best predictors of hospitalization (Andersen, 1975; Wolinsky, 1978; Evashwick et al., 1984). However, no enabling variables attained significance, probably because Medicaid enrollees had first-dollar coverage for almost all of their inpatient expenses. Thus, access would have been generally enabled through enrollment in Medicaid.

The variance explained by this regression (R^2 = 0.140) was similar to the amount of variance explained in previous studies. Estimation of similar regressions by Andersen (1975) and Evashwick et al. (1984) produced R^2 values of .148 and .062, respectively.

Number of hospitalizations

Conditions responsible for hospitalization were the most important predictors of number of hospitalizations. It is not surprising that cardiovascular disease was the condition most significantly associated with number of hospitalizations (Table 4). In previous research, Zook, Savickis, and Moore (1980) found a strong association between repeat hospitalizations and cardiovascular disease. However, it is notable that each of the 13 condition variables was significant, and apparently condition variables were far more important as predictors than health status, enabling, predisposing, or State and enrollment group variables were. Skin and musculoskeletal disorders; respiratory system diseases; congenital and newborn disorders; injuries; endocrine, nutritional, and metabolic diseases; digestive system diseases; and genitourinary diseases followed in importance as predictors of number of hospitalizations.

Table 4

Effects of selected predictors on the number of hospitalizations for all full-year Medicaid enrollees with at least one hospitalization: California, Michigan, New York, and Texas, 1980

Predictor	Regression coefficient (*b*)	*t*	Significance
Condition responsible for admission:			
Infectious and parasitic diseases	0.559	4.71	<0.0001
Neoplasms	1.150	7.04	<0.0001
Endocrine, nutritional, and metabolic diseases	0.847	8.86	<0.0001
Mental disorders	1.261	5.70	<0.0001
Nervous system and sense organ disorders	0.840	7.86	<0.0001
Cardiovascular diseases	1.111	13.92	<0.0001
Respiratory system diseases	0.977	10.09	<0.0001
Digestive system diseases	0.734	8.85	<0.0001
Genitourinary diseases	0.955	8.51	<0.0001
Deliveries	0.658	4.89	<0.0001
Skin and musculoskeletal disorders	0.792	11.54	<0.0001
Congenital and newborn disorders	0.819	9.79	<0.0001
Injuries	0.597	8.98	<0.0001
Died during 1980	2.060	5.81	<0.0001
Bed days	0.003	4.28	<0.0001
Income	0.00001	2.48	0.0130
Age	−0.006	5.61	<0.0001
Employed	−0.176	2.85	0.0044
Intercept	0.584	—	—

R^2 = .328
F = 30.62
at (18,200) degrees of freedom
Significance = <0.0001
N = 1,518
Dependent variable mean = 1.548

NOTES: R^2 is the percent of variance explained. F is the ratio of explained to unexplained variance. N is the number of cases. t = Student's t for b.

SOURCE: Health Care Financing Administration and National Center for Health Statistics: Data from the State Medicaid household sample, National Medical Care Utilization and Expenditure Survey, 1980.

Enrollees who died during 1980 were much more likely than other enrollees to have more than one hospitalization, even after the variation in severity of their hospitalizations is controlled for. Medicaid enrollees in their last year of life not only were more likely than others to be hospitalized but also were much more likely to have more than one hospitalization.

Individuals who had many bed days, had above average income, or were unemployed had greater than average hospital stays during 1980, controlling for all other predictors. Age, however, was negatively correlated with number of hospitalizations when reason for hospitalization was controlled for. This suppression effect occurs because age is correlated with the incidence of some conditions, such as

cardiovascular disease. Health status was not statistically significant, possibly as a result of controlling for conditions responsible for hospitalization as well as including in this analysis only enrollees who had been hospitalized.

No State or enrollment group variable was statistically significant in this regression. Apparently, the State-specific factors that lowered the probability of hospitalization for New York enrollees did not affect the number of hospitalizations for those hospitalized at least once during 1980.

Overall, as shown in Table 4, number of hospitalizations is primarily a function of the conditions responsible for hospitalization and their severity rather than a function of demographic or enabling variables, enrollment group, or State characteristics. The regression explained 32.8 percent of the variance in number of hospitalizations for those with at least one hospital stay, which was higher than expected and probably reflected the impact of conditions responsible for hospitalization on the dependent variable.

Multivariate analysis of hospital expenditures

The regression analysis for hospital expenditures for full-year, continuously enrolled Medicaid enrollees differs from the regressions for utilization. The multiple equation model for hospital expenditures consists of a regression analysis for total hospital expenditures, followed by regression analyses for each independent variable in the hospital expenditures regression (number of hospital days, number of hospitalizations, and probability of surgery), as shown in Figure 1, equation (3). The latter regressions are used to identify independent variables that indirectly affect hospital expenditures because of their impact on utilization (Figure 1, equations (2), (4), and (5)).

Total hospital expenditures for all full-year enrollees with one hospitalization or more during 1980 are primarily a function of the number of days spent in a hospital. If each day in a hospital stay were equally expensive, annual hospital expenditures for any individual could be represented by the sum of total hospital days multiplied by the hospital per diem cost for each hospitalization. However, the cost of each day in a hospital stay is not constant. The cost for a day of care is more expensive if more intense care (e.g., tests or surgery) is provided. Surgery may add to the cost of hospitalization indirectly if additional recovery days are required, especially for the elderly (Pokras, 1983). However, the cost of additional recovery days is minimal when compared with the high cost of the surgical procedure itself. Because surgery has a major effect on inpatient expenditures, a dummy variable indicating that a respondent had surgery is entered into the regression.

Because most diagnostic and testing procedures are done early in a hospital stay, initial days of a hospital stay are more expensive than later days. Two individuals may have had an equal number of hospital days during the year, but if the first individual had only one hospitalization and the second individual had two hospitalizations, the second individual may have more high-cost days on which tests were performed. As a result, the expenditures for the second individual would be higher than those for the first. For this reason, the number of hospitalizations is also included in the regression.

The cost of a hospital stay varies from State to State because of real differences in the cost of hospital care or of all goods and services. State Medicaid policy differences may also affect total hospital expenditures. State governments may choose to impose limits on inpatient hospital services. Other State Medicaid program restrictions, particularly those on ambulatory services, may increase utilization of inpatient hospital care. Practice patterns may also differ across States (Wennberg, 1984). Because each of these factors may affect hospital expenditures, dummy variables for each State (with Michigan excluded as a reference variable) are used to detect any aggregate, State-specific differences in inpatient expenditures.

Indirect effects on hospital expenditures

Some variables may affect hospital expenditures indirectly through their impact on hospital utilization (as measured here by number of hospitalizations, number of hospital days, and the probability of surgery). Among these variables are conditions responsible for hospitalization; demographic characteristics; enabling, health status, State, and Medicaid enrollment group variables. Path analysis is the ideal method for examining the potential indirect effects of these variables on hospital expenditures through intervening measures of inpatient utilization, but it could not be used here, as noted in the description of the statistical methodology.

One can estimate a separate regression equation for each variable included as an independent variable in the hospital expenditures model (except for State characteristics, which will be considered exogenous). These regressions comprise a system of equations that, together, form a multiple equation model of hospital expenditures. In this manner, the indirect effects of the determinants of hospital days, number of hospitalizations, and the probability of surgery on total hospital expenditures may be assessed.

The regression analyses for number of hospital days and number of hospitalizations include the following independent variables—conditions responsible for hospitalization; predisposing, enabling, and health status measures; and whether surgery was performed—as well as dummy variables for States and for enrollment groups. Most of these variables were used in the inpatient utilization regression and are described earlier. The regression analysis for probability of surgery includes the predictors used in the regressions for number of hospitalizations and

hospital days, except for the variable indicating whether or not surgery was performed.

Regression analysis of hospital expenditures

The regression results for the multiple equation model for hospital expenditures are presented in this section. The regression for hospital expenditures is presented first, followed by the regressions for number of hospital days and the probability of surgery. Because number of hospitalizations was not significant in the hospital expenditures regression, the regression for this variable is excluded from the multiple equation model.

Expenditures

Most of the variables in Figure 1, equation (3) were statistically significant: Only number of hospitalizations was not significant. As shown in Table 5, the most significant predictor of hospital expenditures was the number of hospital days. Each hospital day resulted in an additional $345 in total hospital expenditures. This confirmed the expectation that number of hospital days would be the most important determinant of hospital expenditures. As indicated by the California State dummy variable, hospital expenditures were $2,520 higher in California, even after utilization and surgery were controlled for. This is partially a result of higher relative prices for medical care services in California.

Surgery was also a significant predictor of hospital expenditures. Surgery increased hospital costs by $1,259, as shown in Table 5. This confirmed the expectation that hospitalizations in which surgery was performed were more expensive than nonsurgical hospitalizations. Number of hospitalizations, however, did not attain significance. Therefore, hospital days for multiple hospitalizations were not costlier than those for single hospitalizations, after the effects of surgeries were controlled for. The regression analysis presented here had an R^2 of .373.

Table 5

Effects of number of hospital days, surgery, and State on total hospital expenditures for all full-year Medicaid enrollees with at least one hospitalization: California, Michigan, New York, and Texas, 1980

Predictor	Regression coefficient (*b*)	*t*	Significance
Hospital days	345.092	9.36	<0.0001
Surgery	1,258.860	4.54	<0.0001
California	2,520.570	6.29	<0.0001
Intercept	−863.59	—	—

R^2 = .373
F = 29.37
at (3,200) degrees of freedom
Significance = <0.0001
N = 1,518
Dependent variable mean = 4,620.74

NOTES: R^2 is the percent of variance explained. F is the ratio of explained to unexplained variance. N is the number of cases. t = Student's t for b.

SOURCE: Health Care Financing Administration and National Center for Health Statistics: Data from the State Medicaid household sample, National Medical Care Utilization and Expenditure Survey, 1980.

Table 6

Effects of selected predictors on the number of hospital days for all full-year Medicaid enrollees with at least one hospitalization: California, Michigan, New York, and Texas, 1980

Predictor	Regression coefficient (*b*)	*t*	Significance
Condition responsible for admission:			
Neoplasms	7.481	2.40	0.0163
Endocrine, nutritional, and metabolic diseases	6.152	3.27	0.0011
Mental disorders	14.238	4.52	<0.0001
Nervous system and sense organ disorders	4.377	2.95	0.0032
Cardiovascular diseases	8.553	6.12	<0.0001
Respiratory system diseases	5.152	3.98	0.0001
Digestive system diseases	6.569	5.14	<0.0001
Genitourinary diseases	6.872	4.50	<0.0001
Skin and musculoskeletal disorders	7.746	3.92	0.0001
Congenital and newborn disorders	5.602	3.31	0.0009
Injuries	5.130	3.88	0.0001
Died during 1980	41.976	4.20	<0.0001
Bed days	0.117	6.02	<0.0001
Income	0.0001	2.37	0.0176
California	−5.552	5.69	<0.0001
Texas	−3.672	3.80	0.0001
Intercept	2.101	—	—

R^2 = .284
F = 23.62
at (16,200) degrees of freedom
Significance = <0.0001
N = 1,518
Dependent variable mean = 12.259

NOTES: R^2 is the percent of variance explained. F is the ratio of explained to unexplained variance. N is the number of cases. t = Student's t for b.

SOURCE: Health Care Financing Administration and National Center for Health Statistics: Data from the State Medicaid household sample, National Medical Care Utilization and Expenditure Survey, 1980.

Number of hospital days

The most significant predictor of number of hospital days was presence of cardiovascular diseases, as shown in Table 6. Patients admitted with cardiovascular disease had 8.6 more hospital days than others who were hospitalized. As an extension of these findings, it is no surprise that Hodgson and Kopstein (1984) linked cardiovascular disease to expensive hospital stays. Digestive system diseases; mental disorders; genitourinary diseases; respiratory system diseases; skin and musculoskeletal disorders; injuries; congenital and newborn disorders; endocrine,

nutritional, and metabolic diseases; nervous system and sense organ disorders; and neoplasms were other conditions significantly increasing total hospital days. Mental disorders increased total hospital days by 14 days.

Bed days had the second highest level of significance: Enrollees who had a high number of bed days were likely to have a larger than average number of hospital days. Individuals who died during 1980 had 42 more hospital days than other enrollees.

The negative slope of the California State dummy variable indicates that, despite the generosity of the California State Medicaid program and its absence of limits on inpatient hospital days, total annual hospital days for hospitalized California Medicaid recipients were below average. The Texas State dummy variable was negatively related to hospital days, indicating that the 30-day limit on the number of covered hospital days per stay in the Texas Medicaid program may have significantly limited the total number of hospital days for Medicaid enrollees.

The surgical procedure dummy variable did not attain significance at the .05 level in this regression. Thus, the major impact of surgery on expenditures was directly attributable to the cost of the surgical procedures performed. Any indirect effect of surgery on hospital expenditures through increased hospital days was not supported in this regression.

Probability of surgery

Several conditions responsible for hospitalization were among the best predictors of probability of surgery for full-year Medicaid enrollees with one hospitalization or more (Table 7). The condition that most affected the probability of surgery was neoplasms. Hospitalizations for neoplasms were 53 percent more likely than others to require surgery. Genitourinary disease, nervous system and sense organ disorders, digestive system disorders, skin and musculoskeletal disorders, injuries, congenital and newborn disorders, and deliveries also increased the probability of surgery. However, both infectious and parasitic diseases and mental disorders had negative slopes, indicating a decreased probability of surgery for these conditions.

The SSI blind and disabled enrollment group dummy variable had a negative impact on the probability of surgery; that is, these Medicaid recipients were less likely than others to have surgery if hospitalized. Many enrollees in this group suffer from chronic conditions that may require hospitalization but not surgery.

The absence from this regression equation of the dummy variables for cardiovascular disease; respiratory disease; and endocrine, nutritional, and metabolic diseases is noteworthy because these conditions are both severe and costly. Their absence may stem from high variation in the occurrence of surgery within these condition groups. This regression explained 20 percent of the variance in probability of surgery.

Table 7

Effects of selected predictors on the probability of surgery for all full-year Medicaid enrollees with at least one hospitalization: California, Michigan, New York, and Texas, 1980

Predictor	Regression coefficient (*b*)	*t*	Significance
Condition responsible for admission:			
Infectious and parasitic diseases	−0.165	3.66	0.0003
Neoplasms	0.528	11.11	<0.0001
Mental disorders	−0.142	3.03	0.0024
Nervous system and sense organ disorders	0.389	6.10	<0.0001
Digestive system diseases	0.295	5.63	<0.0001
Genitourinary diseases	0.453	8.38	<0.0001
Deliveries	0.204	2.59	0.0095
Skin and musculoskeletal disorders	0.276	4.61	<0.0001
Congenital and newborn disorders	0.153	2.75	0.0060
Injuries	0.231	3.91	0.0001
SSI blind and disabled	−0.086	2.63	0.0085
Intercept	0.240	—	—

R^2 = .200
F = 35.60
at (11,200) degrees of freedom
Significance = <0.0001
N = 1,518
Dependent variable mean = 0.422

NOTES: SSI is Supplemental Security Income. R^2 is the percent of variance explained. F is the ratio of explained to unexplained variance. N is the number of cases. t = Student's t for b.

SOURCE: Health Care Financing Administration and National Center for Health Statistics: Data from the State Medicaid household sample, National Medical Care Utilization and Expenditure Survey, 1980.

Summary

Findings from the regression analyses for hospital utilization support findings from previous Andersen-Newman model studies because health status variables were among the strongest predictors of both the probability of hospitalization and number of hospitalizations. Diagnosed conditions were important predictors of number of hospitalizations as well.

Enabling variables, however, were not significant predictors of either hospital utilization or expenditures. The Medicaid full-year enrollees in this sample were usually fully covered for hospitalization through either Medicaid or Medicare. Financial resources were, thus, not a barrier to obtaining hospital care for these individuals.

As shown in the hospital expenditure regressions, the number of hospital days and presence of surgery increased annual hospital expenditures for Medicaid enrollees. Among enrollees with one hospital stay or more, conditions responsible for hospitalization were the most important predictors of number of hospital days and probability of surgery. As a result, diagnosed conditions had a major indirect effect on hospital expenditures.

In many of the studies cited in the literature review, it was found that inpatient care utilization increased with age. However, the multivariate analyses presented in this article indicate that age was often either not significant or negatively related to utilization when other variables, such as SSI aged enrollment group, Medicare recipient dummy, health status, and employment, were included as predictors. Because these predictors are correlated with age, they may have caused a suppressor effect, attenuating the direct effect of age on utilization and expenditures even if no extreme multicollinearity was present (Gordon, 1968).

In bivariate descriptive analyses, enrollment group differences often appear to be important predictors of utilization and expenditures for Medicaid enrollees. In contrast, the multivariate analysis presented here confirmed few significant enrollment effects on either hospital utilization or expenditures once related demographic and health status variables were controlled for. The enrollment group effects attaining statistical significance were rather weak.

In the data presented here, the effects of several State dummy variables remained significant even though dummy variables for enrollment group membership were included in the analysis. Thus, the effects observed for States indicate real differences in costs of care, supply of hospital beds, practice patterns, State Medicaid programs, or other State-specific factors that influence utilization and expenditure patterns. As a result, one cannot simply claim that differences in Medicaid inpatient utilization and expenditures are artifacts of variation in enrollment group composition within each State.

Dummy variables are limited because they are measures only of gross effects of State Medicaid program differences. Contextual factors representing specific program differences, economic differences, or other relevant factors should be introduced if one desires to control for these effects when examining the effects of interstate variation in Medicaid programs on utilization and expenditures at the individual level.

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