

Medicare expenditures and utilization under State hospital rate setting

by Jerry Cromwell and Helene Hewes

In this study we analyzed the National Hospital Rate-Setting Study findings concerning the effects of State prospective reimbursement (PR) programs on Medicare expenditures and utilization; we used Medicare beneficiary-based data compiled from a sample of approximately 1,300 counties in States with and without rate-setting programs for the 5-year period 1974-78.

The statistical evidence suggests that stringent PR programs have not resulted in hospitals using Medicare to cross-subsidize losses elsewhere. In addition, it appears that Medicare has been a passive recipient of the same kinds of regulatory benefits accruing to PR-covered patients (i.e., costs and intensity of care have been constrained).

Introduction

Ever since the introduction of Medicare and Medicaid in 1966, health costs have been rising at an annual rate of more than 12 percent. Expenditures for the hospital sector alone have been climbing at approximately the same rate. Since 1966, both private and public health spending have gone up, with Medicare/Medicaid costs rising, from \$1-\$2 billion initially to nearly \$50 billion in 1981 (Freeland and Schendler, 1981), and private spending quadrupling. The health care sector claimed 6.2 percent of gross national product (GNP) in 1965 and 10.8 percent in 1984. Over the same period, the proportion of the Federal budget devoted to health rose from less than 2 percent to 10 percent.

In response to high rates of increase in hospital expenditures, prospective reimbursement (PR) programs have been instituted by over 30 State, industry, and payer groups. Most of these programs are quite distinct and have undergone significant changes over time, reflecting differing objectives and differing political environments. Above all, the diversity of programs reflects the certainty that better reimbursement incentives are needed and uncertainty about what form of change is best.

Of the 30 or so State PR programs, 15 were selected for evaluation by the Health Care Financing Administration (HCFA), either because they had been operating for several years, or they were administered by an independent State agency or rate-setting commission: Arizona, Colorado, Connecticut, Indiana, Kentucky, Massachusetts, Maryland, Minnesota, Nebraska, New Jersey, New York, Rhode Island, Washington, Wisconsin, and Western Pennsylvania (an area rather than a State). These programs also vary along key policy dimensions such as voluntary versus mandatory participation, use of cost screens, and scope of payer coverage.¹

The main objective of these PR programs has been to encourage prudent management by putting hospitals at risk for the consequences of expenditure decisions. To a lesser extent, the programs have tried to make reimbursements more predictable and to unify reimbursement approaches across payers, eliminating unwarranted price differentials. This is done by establishing approved budgets or payment rates before each fiscal year begins; hospitals are allowed to keep some, or all, of any year-end surplus and to absorb part, or all, of any deficit.

Two key policy questions

Previous studies prepared as a part of the National Hospital Rate-Setting Study have considered the impact of State hospital PR programs on the rate of cost inflation (Coelen and Sullivan, 1981), both at the hospital and the county level. Several more specific studies have even considered the impact of PR programs on Medicare patients (e.g., Gaumer and Cromwell, 1984). This study extends the work of previous studies by addressing two key policy questions. The first: What impact have State PR programs had on Medicare reimbursements to hospitals on a per beneficiary basis? None of the other studies have been able to answer this particular question because of the lack of beneficiary-specific information. With HCFA's assistance, we have assembled a data base that allows us (1) to measure total hospital reimbursements per beneficiary per year and (2) to decompose reimbursements into utilization and payment effects. The second key policy question is broader than the Medicare program, although Medicare data were used to answer it as well. It asks this: Have State PR programs shifted expenditures from hospital to outpatient settings, and, if so, how much of a shift has occurred and where? If State programs have constrained payments, it is reasonable to expect some change in the locus of care; however the direction is ambiguous for the following reasons: (1) Some programs engender positive incentives to increase admissions and prolong stays, a response that could conceivably reduce outpatient activity. Other programs might show the opposite, particularly

¹ For a more extensive review of the 15 programs, see Hamilton (1979) and Hamilton, Walter, and Cromwell (1980).

Reprint requests: Jerry Cromwell, Health Economics Research, 824 Boylston Street, Chestnut Hill, MA 02167

for selected services. (2) Not all outpatient care is substitutable (in the economic sense) for hospital care; some is complementary. More inpatient care should lead to more specialist activity, for example, and vice versa. Thus, the effects of PR payments on nonhospital utilization and expenditures should vary by type of outpatient service. We tested this hypothesis by evaluating Medicare expenditures on home health agencies (HHA's) services, hospital outpatient departments, (OPD's), skilled nursing facilities (SNF's), physicians, and other suppliers.

Conceptual model

Our approach is in two parts, based on a simple dichotomy of Medicare reimbursements per beneficiary ($REIM/B$):²

$$(1) \frac{REIM}{B} = \frac{HREIM}{B} + \frac{NHREIM}{B}$$

where $HREIM$ = Medicare hospital reimbursements and $NHREIM$ = total nonhospital reimbursements.

PR effects on hospital expenditures

Medicare hospital expenditures (or reimbursements) can be thought of as the product of three ratios:

$$(2) \frac{HREIM}{B} = \frac{ADM}{B} \cdot LOS \cdot \frac{HREIM}{MID}$$

where ADM/B = average Medicare inpatient admissions per beneficiary, LOS = average length of stay, and $HREIM/MID$ = Medicare reimbursements per Medicare inpatient day. Payments per beneficiary can rise either because (a) admission rates increase, (b) beneficiaries spend more days in the hospital when admitted, or (c) Medicare per diem reimbursements rise.

Aggregate admission rates and LOS have already been analyzed by Kelly (1984), using total population and all hospital inpatients as the units of analysis. Differences in PR effects on the smaller Medicare population may occur either because of random sampling errors or systematically different treatment patterns within institutions. Advantages to hospitals of treating Medicare patients differently arise where Medicare is not covered by the State program, which was true everywhere in the previous decade except in Western Pennsylvania (beginning in 1974), Maryland, and Washington (both beginning in 1978). Under per diem systems like New York's and New Jersey's, hospitals have incentives to lengthen stays when marginal costs for an extra day are low. They also

² All analysis is done on a per beneficiary basis to adjust for unequal numbers of beneficiaries per county in the Medpar data base. Any statistically significant savings per beneficiary can always be multiplied by total enrollees to approximate total system savings.

have incentives to readmit patients—particularly where occupancy rates are low. (See Kelly, 1984, for more detailed modeling and empirical evidence of this behavior.) Hence, Medicare may “absorb” part of hospitals’ response to State rate-setting through indirect positive effects on beneficiary utilization. Note that this may occur even though no explicit cross-subsidization is taking place across Medicare and non-Medicare patients.

Under rate setting, hospitals can also offset losses on covered patients by cross-subsidizing. How can this happen if Medicare pays costs, not charges, in the final analysis?³ An abstruse cost-finding method, called the Ratio-of-Charges-to-Charges-Applied-to-Costs (RCCAC) is used. Simply put, this method (1) determines Medicare’s share of each hospital department’s total charges, based on individual bills; (2) estimates “allowable” departmental costs (including allocated overhead); and (3) weights these costs by the Medicare-charge shares to derive Medicare-generated “costs.” All noncovered charges (e.g., television, excess days), patient deductibles, and copays are then subtracted to arrive at reimbursements.

In a simple world, without any patient out-of-pocket payments or Medicare disallowances, Medicare reimbursements per day, $HREIM/MID$, can be written as a simple function of average costs and intensity:⁴

$$(3) \frac{HREIM}{MID} = AC_r + AC_a \cdot I,$$

where AC_r = average (loaded) routine costs, AC_a = average ancillary services costs, and $I = U^m/MID$ = an index of average Medicare ancillary services intensity per Medicare inpatient day.

If intensity of ancillary services rose faster for Medicare than other patients, it would affect the PR daily rate because Medicare would become responsible for more of the hospital’s ancillary costs. This is true even though Medicare’s “discount” on total charges would most likely fall. As ancillary intensity rises, both Medicare total charges and costs rise. Where routine markups exceed ancillary markups, Medicare ancillary intensity is positively related to d , Medicare’s discount factor. Where relative routine markups are less, greater ancillary intensity decreases the ratio. It is generally known (Harris, 1979) that hospitals mark up ancillaries more than routine services, making d an inverse function of intensity (i.e., greater intensity raises Medicare charges more than reimbursements). Overall outlays rise, nevertheless, as Medicare bears a greater net

³ The Medicare intermediary applies an interim percentage-of-charges ratio, one based on historical Medicare cost experience for each hospital, to actual bills. These ratios are continually adjusted during the year to minimize any year-end retroactive disallowances.

⁴ Later, we drop these simplifying assumptions to show how hospital pricing and patient payments affect the results. Eq. (3), for example, does not include the potential gains from selective pricing within hospital departments.

burden for ancillary costs. Hospitals clearly have an extra incentive, therefore, to raise all forms of Medicare utilization (either admissions, lengths of stay, or ancillary services) relative to PR-covered patients.⁵

Besides intensity growth in ancillary services, various accounting and pricing techniques also exist to maximize cross-subsidization between charge- and cost-based payers, effectively raising average Medicare costs. By law, hospitals cannot charge different prices for the same service (i.e., price discrimination per se is illegal), but discrimination can occur because of the different methods used to determine reimbursement. The hospital accounting literature generally perceives "cost reimbursement [as] a form of taxation, and recommends that health care managers should use every legal technique at their disposal to minimize this tax, i.e., maximize their cash reimbursement under each cost contract." (Balachandran and Dittman, 1978).

There are two general areas identified in the literature where accounting methods can be manipulated to maximize cost-based reimbursement: (1) in the definition of allowable costs; and (2) in overhead allocation schemes (Balachandran and Dittman, 1978). The literature contains many suggestions pertinent to the definition of allowable costs in such areas as defining and measuring bad debts, emergency room admissions, physician costs, and capital depreciation accounting methods; all of these can raise Medicare's share of "allowable" costs.⁶

The most widely used approach for the second area, allocating overhead costs, is the "step-down method."⁷ As costs are stepped down through the overhead and revenue centers, judicious ordering can triage the maximum amount of hospital costs into "Medicare-intensive" revenue centers. Once the ordering of overhead centers has been selected, hospital management determines the "optimal" statistical bases (from a reimbursement perspective) for overhead cost allocation. Because no specific allocation basis is required, the hospital is able to choose any combination of bases to achieve the greatest possible reimbursement (e.g., square feet, personnel, pounds of laundry, or charges).

Finally, because of the way the RCCAC is calculated, relative prices are important for cost-finding purposes *within*, but not across, departments. Each department's RCCAC can be thought of as an amalgam of separate service prices (e.g., chest X-ray, brain scan), each with different rates of Medicare utilization. Because charges are used to identify

⁵ This incentive would be considerably attenuated in programs like Connecticut's that employ total revenue caps, which adjust future prices for excessive Medicare revenues.

⁶ See Cleverley (1977) for an in-depth discussion of these schemes with accounting examples as illustrations to clarify the advantages to each approach.

⁷ Because cost-reimbursers like Medicare require that a hierarchical ordering be chosen, the step-down procedure is most relevant. Balachandran and Dittman (1978) do discuss an alternative approach, the "reciprocal cost allocation" method.

Medicare costs, selectively raising prices for Medicare-intensive services within a department will increase the total RCCAC for each department.⁸

Summarizing so far, State PR programs may have resulted in significant Medicare savings, even if Medicare was not an active participant, if (1) costs were controlled, or (2) utilization fell across-the-board. Alternatively, if hospitals differentially increased Medicare utilization or engaged in accounting or pricing practices that substantially raised Medicare's share of costs, then Medicare would not have shared in program savings—at least not to the same extent as PR-covered payers.

PR effects on nonhospital expenditures

In the study of nonhospital systemwide costs, we assume that PR does not directly affect nonhospital utilization, which is changed only in response to changes in hospital admission rates, lengths of stay, and outpatient visits, if any. In short, Medicare nonhospital reimbursements per beneficiary are assumed to be PR-related, if at all, through changes in real utilization rates on the inpatient side.

Medicare nonhospital reimbursements (*NHREIM*) can be decomposed several ways, but available Medicare data constrains the decomposition to the following five services: (1) home health agency services (HHA's); (2) hospital or clinic outpatient departments (OPD's); (3) skilled nursing facilities (SNF's); (4) Part B physician services; and (5) Part B supplier services. Thus

$$(4) \quad \frac{NHREIM}{B} = \frac{HHREIM}{B} + \frac{OPDREIM}{B} + \frac{SNFREIM}{B} + \frac{MDREIM}{B} + \frac{SUPREIM}{B}$$

where $HHREIM/B$ = Medicare home health reimbursements per beneficiary, $OPDREIM$ = outpatient department reimbursements, $SNFREIM$ = SNF reimbursements, $MDREIM$ = all Part B physician reimbursements, and $SUPREIM$ = Part B supplier reimbursements, including appliances and durable medical equipment (DME). Each of the five services, in turn, can be thought of as the product of beneficiary use rates (U_i) times reimbursements per day, visit, or service (R_i):⁹

$$(5) \quad (NHREIM/B)_i = U_i \cdot R_i \quad i = 1, \dots, 5$$

In theory, for any PR program to show a statistically significant effect on any of the five services' utilization rates, two things must happen: (1) PR must have had an observable effect on hospital admission rates or LOS's; and (2) these effects must have resulted in measurable increases or decreases in outpatient use. Where complementary relationships

⁸ For a proof, see Hellinger (1975).

⁹ Note that we have suppressed prices, or charges per unit of service, in each equation. This is because hospital PR should have little or no direct (or even indirect) effect on outpatient care prices.

between hospital and nonhospital use exist, PR should show "same sign" effects; where substitutions exist, "opposite signs" are predicted.

Based on the literature (Feldstein, 1971; Davis and Russell, 1972; Russell, 1973; Hellinger, 1977), OPD and SNF use should be substitutes for hospital use; conversely, HHA use and hospital-based physician use, should both rise with greater hospital use, reflecting the complementary relationship among the three.¹⁰ Other physician use is ambiguous, rising for specialists but probably falling for primary care physicians (Newhouse and Phelps, 1976; Sloan and Steinwald, 1980; Pauly, 1980). Practically nothing is known on hospital use versus supplies and DME.¹¹

Both the nonhospital utilization and reimbursement rates per beneficiary can be written as reduced-form functions of exogenous demand (D) and supply (Z) factors plus PR. It is not enough to find a statistically significant PR coefficient in any U_i or $NHREIM_i$ equation, PR must have affected hospital use as well in a particular State.

Data sources and methods

Sample

The principal data source for the analysis was the Medicare 5 Percent Medical History Sample File. HCFA maintains this file on a beneficiary basis, merging Part A institutional bills with Part B Supplementary Medical Insurance claims for physicians and other noninstitutional services. All of a sampled beneficiary's utilization and expenditure history appears on these files.¹²

Even though the file is only a 1-in-20 sample, there were still too many observations for efficient analysis at the beneficiary level. Thus, we aggregated the file to the county level for the 1,300 counties in the 15 rate-setting and control States for each year, 1974-78.¹³ Roughly 700 "control" counties were selected, based on a one-quarter random sample of U.S. short-term general hospitals. These 700 counties were then supplemented by an additional 600 counties in the rate-setting States. The county-year became the unit of analysis. To adjust for size differences, each county's data were then weighted by the number of beneficiaries. Because all counties in the PR States were included, the county sample is not strictly representative of the United States as a whole, a fact that should be kept in mind when reviewing descriptive material on the sample at large.

¹⁰ A complementary relationship between hospital length of stay and HHA's services is taken from Hellinger (1977). This seems counter-intuitive. One explanation may be that HHA's services are simply more available in "long-stay" States.

¹¹ Janssen and Saffran (1981) provide one of the few published studies of DME for Medicare, but only in a descriptive sense.

¹² Disabled and renal disease enrollees were not included.

¹³ This 5-year period was the maximum time span available.

Variable construction

Many utilization and reimbursement variables were analyzed, all based on the Medicare population alone. Each variable is a county average based on the sum of reimbursements or utilization divided by the number of sampled beneficiaries. All analyses are population-based, defined as the county of beneficiary residence. As a final step, a large number of exogenous demand and supply characteristics of each county were used to control for other factors that might explain intercounty differences in medical care costs and utilization.

Four-way, quasi-experimental design

The analysis includes a combination of tabular trends and econometric methods using a four-way, quasi-experimental design. To scientifically determine whether State PR programs have had an impact on hospitals, a much more rigorous approach than simple tabulations is needed to factor out contemporaneous changes in a hospital's environment. Simple time-trend comparisons may show that reimbursements have indeed been slower in New York than elsewhere in the previous decade, but can we ascribe all the reduction to the PR program, or could other factors, like slower-than-average population growth, explain the lower rate?

A large cross-sectional time-series data base on over 6,000 county years was constructed to support a four-way, quasi-experimental design; confounding variables were controlled for in three ways:

- A study/control group contrast to control for trends in factors that have been affecting all hospitals nationwide, not just those in rate-setting States.
- A pre/post-program contrast to adjust for unique, base-period differences between study and control States.
- An extensive set of exogenous demand/supply variables to further adjust for any county-specific differences in levels and trends.

The measures used to represent PR programs are generally dummy variables. One dummy variable is used to represent each version of each PR program being studied. Since most programs have undergone significant changes over time, the use of separate dummy variables for each version of a program allows for the possibility that new methodologies may have greater effects on hospital expenditures than did earlier, more rudimentary approaches.¹⁴

Descriptive findings

National Medicare hospital reimbursements, charges, and utilization rates per beneficiary for the period 1974-78 are presented in Table 1. All values have been weighted by the number of Medicare Part

¹⁴ See Coelen and Sullivan (1981) for a more detailed discussion of earlier evaluation methodologies used to assess rate-setting effects.

Table 1

National trends in Medicare hospital reimbursements, charges, and utilization rates, by beneficiary and day: 1974-78

Type of measure	Year					Annual percent compound change
	1974	1975	1976	1977	1978	
Total reimbursements per beneficiary	\$321	\$392	\$490	\$558	\$615	16.3
Total charges per beneficiary	427	525	661	767	859	17.5
Charges per day	127	156	182	209	238	15.7
Reimbursements per day	95	117	135	153	171	14.7
Ratio of reimbursements to charges	0.75	0.75	0.74	0.73	0.72	-1.0
Length of stay in days	12.14	11.85	11.67	11.42	11.24	-1.9
Inpatient days per beneficiary	3.40	3.42	3.67	3.70	3.66	1.8
Inpatient admissions per beneficiary	0.29	0.29	0.32	0.33	0.33	3.6

A beneficiaries per county; this adjusts for sampling error as well as permits an approximate national estimate.

Total hospital reimbursements rose steadily from \$321 per beneficiary in 1974 to \$615 in 1978 for a 16.3 percent annual compound rate of change. Two of the components show declining rates per year: Medicare length of stay, -1.9 percent, and the reimbursement/charge ratio, -1.0 percent. Lengths of stay actually fell one day over the 5-year period (from 12 to 11 days). Inpatient days per beneficiary increased 1.8 percent yearly; hence, the decline in lengths of stay (-1.9 percent) was more than offset by the rising admissions rates (3.6 percent annually).

More significant is the 15.7 percent compound growth in charges per inpatient day, rising from \$127 per day to \$238. This increase is partly due to pure cost inflation and partly to increases in intensity of ancillary services.¹⁵ Total charges per beneficiary doubled over time (\$427 to \$859) for an annual growth of 17.5 percent.

A finer decomposition of the aggregate expenditure trends shown in Table 1 is provided in Table 2.¹⁶ Hospital reimbursements far outweigh those in nonhospital settings. For example, in 1978, hospital reimbursements were \$615 per beneficiary, more than double the total amount for all nonhospital care (\$294). In any one year, nonhospital reimbursements represented only about one-third of total Medicare outlays.

In terms of growth, Medicare hospital reimbursements rose 16.3 percent per year compared with 15 percent for nonhospital reimbursements, with an overall increase in total reimbursements of 15.8 percent annually. Although OPD's, HHA's and supplier services were reimbursed at much lower absolute levels, these three services showed much

higher annual growth rates compared with physician services. Both OPD's and HHA's reimbursements increased 25 percent annually, compared with just 13.5 percent for physicians. Annual compound changes in supplier reimbursements were nearly as great, over 19 percent, rising from \$7.86 in 1974 to nearly \$17 in 1978. SNF reimbursements rose at a far slower rate (3.9 percent) because of the negative utilization trend.

Practically all of the hospital expenditure growth has been due to higher costs per day. The same cannot be said of the nonhospital reimbursement components. Physician, supplier, and HHA's services per beneficiary all rose much faster than unit charges. HHA's payments, while growing in toto at exactly the same rate as OPD payments, were fueled by 16 percent annual utilization growth. (In fact, OPD's and HHA's are almost the mirror image of each other.) A similar relationship between use and charges also holds for physicians (9.6 percent utilization growth; 4 percent growth in payments per service) and supplier payments (15 percent utilization growth versus only 4.4 percent for prices).

A summary of the annual growth in beneficiary reimbursements experienced in each of the 15 PR States is provided in Table 3. For the control group of 704 counties in other States, see the bottom line of Table 3; both hospital and nonhospital expenditures generally grew faster than in the PR States: 17.3 percent (hospital) and 15.4 percent (nonhospital). PR states with noticeably lower hospital inflation rates were Connecticut (9.9 percent), Minnesota (13 percent), and New York (13.3 percent). Conversely, Medicare hospital expenditure growth in New Jersey (21 percent) was well above the control group; however, Western Pennsylvania, Nebraska, and Maryland were all a point or two higher than the control group.

PR States with relatively high nonhospital expenditure growth included Western Pennsylvania (18.7 percent) and Maryland (16.3 percent). Several rate-setting States exhibited lower-than-average growth: Nebraska (11.1 percent), Minnesota (11.8

¹⁵ Hospital services' intensity may affect the overall quality of care as well as have significant cost and expenditure implications. See Gaumer and Cromwell (1984) for a detailed discussion of PR and hospital intensity of care.

¹⁶ Comparisons made between our data and the 1977 estimated Medicare reimbursements provided in HCFA's *Medicare Summary* (1982) showed only minor differences.

Table 2

National trends in Medicare total; hospital and nonhospital reimbursements, charges, and utilization rates per beneficiary: 1974-78

Type of service and measure	Year					Annual percent compound rate of change
	1974	1975	1976	1977	1978	
Total reimbursements ¹	\$482.19	\$583.90	\$715.96	\$823.82	\$908.62	15.8
Hospital						
Reimbursements	321.00	392.00	490.00	558.00	615.00	16.3
Days	3.40	3.42	3.67	3.70	3.66	1.8
Charges per day	127.00	156.00	182.00	209.00	238.00	15.7
Nonhospital						
Reimbursements	161.19	191.90	225.96	265.82	293.62	15.0
Physician:						
Reimbursements	121.93	143.04	161.97	190.05	209.65	13.5
Services	2.45	2.86	3.05	3.37	3.59	9.6
Reimbursement per service	50.73	50.91	53.71	57.12	59.23	3.9
Outpatient:						
Reimbursements	13.29	18.68	26.48	31.86	36.05	24.9
Visits	0.53	0.57	0.57	0.71	0.75	8.7
Reimbursement per visit	26.16	34.51	41.20	47.11	50.61	16.5
Home health agency:						
Reimbursements	6.41	8.90	11.95	15.13	17.40	25.0
Visits	0.36	0.44	0.54	0.63	0.68	15.9
Reimbursement per visit	18.40	20.79	22.86	24.40	25.98	8.6
Supplier:						
Reimbursements	7.86	9.74	11.71	14.22	16.85	19.1
Services	0.27	0.34	0.40	0.46	0.50	15.4
Reimbursement per service	29.68	29.91	30.90	32.71	35.44	4.4
Skilled nursing facility:						
Reimbursements	11.70	11.54	13.85	14.56	13.67	3.9
Reimbursement per day	29.28	30.94	32.80	34.22	37.86	6.4
Stays	0.021	0.020	0.022	0.022	0.021	0.0
Days per stay	21.08	20.23	21.68	21.82	20.26	-1.0

¹ All reimbursements figures are on a per beneficiary basis, as are volume statistics (e.g., days per beneficiary).

Table 3

Total Medicare hospital and nonhospital beneficiary reimbursement growth rates, by selected States: 1974-78

State	Total	Hospital	Nonhospital	Physician	Supplier	Outpatient department	Skilled nursing facility	Home health agency
Arizona	14.6	15.7	12.8	13.4	13.7	21.1	-6.9	15.8
Colorado	15.2	15.8	13.8	12.0	18.2	21.3	0.2	24.5
Connecticut	10.7	9.9	12.3	11.6	19.7	24.3	-15.0	23.9
Indiana	16.2	16.5	15.3	13.7	19.4	25.7	7.2	26.6
Kentucky	14.7	14.4	15.6	15.2	15.7	31.5	6.2	11.8
Massachusetts	13.5	13.3	13.3	13.0	23.5	22.5	-14.3	23.5
Maryland	17.5	18.1	16.3	15.5	22.4	20.7	4.2	30.6
Minnesota	12.7	13.0	11.8	11.2	14.2	19.7	0.6	19.7
Nebraska	16.1	18.2	11.1	9.7	21.0	19.0	6.1	28.4
New Jersey	18.6	21.0	15.0	13.2	18.6	34.7	0.7	21.9
New York	13.6	13.3	14.0	12.7	17.1	24.7	3.1	21.7
Rhode Island	16.5	17.1	15.4	14.6	20.0	22.3	12.9	8.2
Washington	15.7	16.5	14.1	13.0	16.1	23.6	1.7	32.6
Wisconsin	14.2	14.4	13.7	12.6	20.4	19.5	9.0	21.8
Western Pennsylvania	19.1	19.2	18.7	16.2	22.4	29.1	12.3	27.2
Other States	16.7	17.3	15.4	13.9	19.2	25.2	6.2	26.6

percent), Connecticut (12.3 percent), Arizona (12.8 percent), and Massachusetts (13.3 percent). In all, 11 of 15 States with PR programs had lower rates of growth in Medicare nonhospital expenditures than the control group average.

Trends in hospital and nonhospital expenditures per beneficiary move together: high growth in one is

associated with high growth in the other and vice versa. This would suggest that hospital and nonhospital care are complementary; control one, and the other is also reduced. On the other hand, underlying factors may be fueling both types of inflation simultaneously.

Econometric analysis

Dependent variables

Nine dependent measures of Medicare hospital and nonhospital utilization and reimbursements were selected for multivariate regression analysis, using three reimbursement and six utilization variants, all on a per beneficiary basis. The dependent variables are the following:

- Total Medicare reimbursements (LNTOT).
- Total Medicare hospital reimbursements (LNHREIM).
- Total Medicare nonhospital reimbursements (LNNHREIM).
- Part A hospital inpatient days (LNINPDAY).
- Part B physician services (LNMDSV).
- Part B supplier services (LNSUPSV).
- Part A and B home health agency (HHA) visits (LNHHVS).
- Part A hospital outpatient department (OPD) services (LNOPDVS).
- SNF Medicare covered days (LNCOVDAY).

In addition to being specified on a beneficiary basis, all variables are in natural logs, hence the LN prefix before the variable abbreviations. Small counties with beneficiaries not showing any utilization or reimbursements present a problem in this respect because the log of zero is undefined. Rather than drop counties with no utilization in a given year, we set the rate equal to .01 and then took the natural log. The only service having a significant number of zeroes was SNF's, and care should be taken in interpreting results for this service.

None of the reimbursement figures were deflated or adjusted for interarea cost of living differences. Instead, time, State, and urban/rural dummies were used to statistically control for price differences across space and time.

Finally, the nonhospital reimbursement variable was constructed by summing across all five services (HHA's, OPD's, SNF's Part B physician services, and Part B supplier services), giving total, nonhospital Medicare reimbursements per beneficiary. Where sector-specific results are conflicting, this variable will show the net PR result on nonhospital care. As physician services are two-thirds of total nonhospital reimbursements, results for this variable dominate the others in the "Total" analysis.

Independent and PR variables

To control for confounding influences that might result in spurious PR effects, an extensive list of exogenous variables has been included in all multivariate analyses. Definitions and (geometric) means are provided in Table 4. All are defined at the county level (e.g., mean per capita income in the county), with global means weighted by beneficiaries in each county.

Based on the medical care demand literature, variables have been selected that control for medical

need (BIRTH, EDUC), demand (AFDC, CAPINC, COMINS, POPT18, MCAIDP, WHITE, UNEMRT), availability of medical resources (NHBPOP, PHYPOP, SPMD),¹⁷ market structure (HMOPOP, GOVPCT, PROFPCT, COTHPCT), general county characteristics (POPDEN, P, DSMSA, PC-CPI), other regulatory programs (CON, PSROPCT), and secular time trends (D75-D78) (Table 4). To the extent these variables successfully proxy such factors as need, demand, and supply, there can be greater confidence in interpreting the PR coefficients as true program effects. Nonetheless, because of the limited period of analysis, special care should be taken in ascribing results to any program. Significant random reporting error may still remain, particularly for smaller States. A theoretical understanding of potential program effects and lag structures, as well as overall stringency suggests a more conservative interpretation of some of the findings, as discussed below.

Collinearity was generally low in the majority of the exogenous variables. Highly correlated variates were included, given the concern over left-out variables biasing the PR estimate—a concern that outweighed the desire to produce independent estimates for each covariate. Account is made of excessive collinearity where it appears to be giving spurious findings.

Holding all other factors constant, dummy variables have been used to test for PR effects. Each program has at least one dummy, *D*, sometimes more if the program changed materially during the 1974-78 period. Because of the short time period and the lack of a preprogram benchmark, Arizona, Colorado, Indiana, and Kentucky had to be dropped from the multivariate analysis. The New York, Wisconsin, and Western Pennsylvania programs also began before 1974, but program changes in these States allowed us to compare the earlier with the later program variant. For New York, then, the 1978 and 1976 *D*-State-year coefficients should be interpreted as relative effects compared with the earlier program dummy, for example, DNY78 versus DNY76 versus DNY71 (with DNY71 being captured in the New York State intercept). This may produce some underestimate of aggregate program effects if the program was effective early on.

Functional specification and estimation

All continuous variables have been expressed in natural logs, and their regression coefficients can be interpreted as elasticities. Because the dependent variables are all in natural logs, all dummy variable coefficients can be interpreted as percentage differences from a reference group. The time dummies have been defined in such a way that their coefficients are additive and represent the marginal

¹⁷ Hospital beds per capita (BEDS) were not included in the main regressions in spite of past success with this variable because PR may be retarding the rate of bed growth. (See Cromwell and Burstein, 1984.) Regressions with BEDS had absolutely no statistical effect on the PR results.

Table 4

Definitions and means of independent variables, total county sample: 1974-78

Variable	Definition	Geometric county mean
AFDC	Percent of county population enrolled in Aid to Families with Dependent Children	4.38
BIRTH	Birth rate per 100,000 population	1,404.0
CAPINC	County per capita income	\$5,592.00
COMINS	Percent of State population covered by insurance (excluding Medicare)	85.54
NHBPOP	Nursing home beds per 100,000 population	563.0
PHYPOP	Patient care physicians per 100,000 population	133.0
SPMD	Percent of physicians who are specialists	71.0
POPDEN	Population per square mile	613.0
P	County population	395,537.0
DSMSA	1 if county in an standard metropolitan statistical area (SMSA)	.80
POPT18	Percent of population covered by Title 18 Medicare	10.68
EDUC	Median school years completed	11.78
PC-CPI	Annual percent change in Consumer Price Index	7.68
HMOPOP	Percent of population enrolled in an Health Maintenance Organization county (rural) or SMSA (urban)	.16
MCAIDP	Medicaid recipients unduplicated as a percentage of the State population	8.77
WHITE	Percent of county population white	86.57
UNEMRT	SMSA unemployment rate; State average in rural areas	6.92
CON	Certificate of need program present	.78
PSROPCT ^a	Percent of hospitals in county having Professional Standards Review Organization	25.0
GOVPCT ^a	Percent of beds in public hospitals in county	15.94
PROFPCT ^a	Percent of beds in proprietary hospitals in county	14.16
COTHPC ^a	Percent of beds in Council of Teaching Hospitals in county	10.65
D75-D78	Annual TIME dummies = 1 for all years beginning with two-digit date	
DAL-DWY	49 State dummies for Alabama through Wyoming (Illinois arbitrarily omitted to avoid perfect collinearity with intercept)	
DCT75	Equals 1 for Connecticut from 1975-78; otherwise 0.	.0161
DMA75	Equals 1 for Massachusetts from 1975-78; otherwise 0.	.0333
DMA76	Equals 1 for Massachusetts from 1976-78; otherwise 0.	.0252
DMD75	Equals 1 for Maryland from 1975-78; otherwise 0.	.0117
DMD78	Equals 1 for Maryland for 1978; otherwise 0.	.0031
DMN75	Equals 1 for Minnesota from 1975-78; otherwise 0.	.0212
DNB78	Equals 1 for Nebraska for 1978; otherwise 0.	.0020
DNJ75	Equals 1 for New Jersey from 1975-78; otherwise 0.	.0383
DNJ77	Equals 1 for New Jersey from 1977-78; otherwise 0.	.0196
DNY76	Equals 1 for New York from 1976-78; otherwise 0.	.0692
DNY78	Equals 1 for New York for 1978; otherwise 0.	.0239
DR175	Equals 1 for Rhode Island from 1975-78; otherwise 0.	.0055
DWA76	Equals 1 for Washington for 1976-78; otherwise 0.	.0141
DWA78 ¹	Equals 1 for Washington for 1978; otherwise 0.	.0049
DWI77	Equals 1 for Wisconsin for 1977-78; otherwise 0.	.0127
DWP77	Equals 1 for Western Pennsylvania for 1977-78; otherwise 0.	.0129

¹ Refers to a continuation of the prior Washington program in one-third of the State's hospitals; a similar proportion was put under new X and Y programs in that year.

NOTE: All continuous variables, except those denoted by an a, were entered in log form (with the prefix *ln*).

year-to-year change in the dependent variable over the previous year, other things being equal. Hospital beds per capita were included in preliminary runs but had no effect on any PR coefficient; hence, these results are not reported to avoid any PR endogeneity problems.

All regressions were run using weighted least squares, with the number of beneficiaries per county as weights. This was done for two reasons: (1) County statistics based on more beneficiaries should have a smaller standard error, and, therefore, are more reliable. (2) Behavioral relationships among rate-setting programs, the other exogenous variables, and Medicare utilization and payments in large Medicare counties should be weighted more to reflect the larger expenditures involved.

Out of 6,558 possible county years, 553 were dropped because of missing values. Ninety-two variables (including nearly 50 State dummies) were

entered, leaving 5,913 degrees of freedom. Illinois is the left-out State; its State effect is given by the overall regression intercept. For the PR rate-setting coefficients, the reference group is the State itself, either prior to the date of program adoption or to an earlier program (for example, New York).

Exclusive reliance is placed on reduced-form estimation rather than specifying a complete structural model. Other literature on the topic has included variables like hospital charges and utilization as direct tests of substitution and complementarity. We have purposely excluded such endogenous variables because they are the principal means through which rate setting is hypothesized to affect nonhospital payments. If such endogenous variables were included, the interpretation of the nonhospital program effects would be limited to only those above-and-beyond any coming from changes in inpatient utilization. Clearly, we desire a gross effect

of rate setting on nonhospital use rather than a net effect of utilization impacts through rate setting.

Results

In Figure 1, coefficients (in bar-chart form) are shown for three multivariate analyses of Medicare expenditures per beneficiary: total, hospital, and nonhospital. The coefficients give the average percentage difference in Medicare reimbursements per beneficiary for the years after program adoption, holding constant time trends and intercounty variations in demand and supply. Each bar represents a State-year abbreviation where a PR coefficient was significant at the 10-percent level or better.¹⁸ Percentages above or below the bar reflect positive or negative deviations from predicted levels for the years the program was in effect. For States showing two significant coefficients, the second bar reflects the cumulative or net program effect over the latter periods only (explained below).

States showing significant negative PR effects on total Medicare reimbursements include:

- Connecticut, 19.6 percent below predicted levels.
- Massachusetts, 7.8 percent lower in 1975.
- Minnesota, 13.0 percent lower.
- New York, 6.7 percent lower in 1976-77, another 5.2 percent lower in 1978 (or 11.9 percent lower overall by 1978).
- Washington, 6.7 percent lower.
- Wisconsin, 6.3 percent lower by 1977.

Connecticut, for example, shows total Medicare expenditures per beneficiary averaging about 20 percent less than predicted over the 1975-78 period, when the rate-setting program was in effect. This percent amounts to roughly \$150 less per beneficiary per year, or \$51,100,000 on 344,000 enrollees. Both New York coefficients also proved significant, implying a 6.7 percent reduction over 1976-77, followed by an additional 5.2 percent reduction in 1978, for a cumulative 12 percent reduction in expected levels by 1978, the last year in the study. This amounts to \$120 less per beneficiary in 1978, or \$276 million on 2.3 million enrollees.

The one State with positive results on total Medicare expenditures was New Jersey, because of the very large unexplained jump in hospital admissions rates in 1975 (discussed below). Lower nonhospital payments attenuated the perverse admissions effect, but did not entirely eliminate it. Medicare hospital outlays fell in 1977-78 relative to 1975-76, but the cumulative effect was still 14 percent above predicted levels in the latter period.

Neither Maryland's, Nebraska's, Rhode Island's, nor Western Pennsylvania's program is associated with any statistically significant PR effect on total Medicare reimbursements. This is not because savings on the hospital side have been offset by increases elsewhere, but that no hospital effects were found to begin with.

In Figure 1, hospital expenditures findings follow closely the total Medicare expenditures results. Again, the same seven States (Connecticut, Massachusetts, Minnesota, New Jersey, New York, Washington, and Wisconsin) were significant in the same direction although hospital effects were somewhat larger—New Jersey being the one notable exception. Consider the New York results. They imply that by 1978, Medicare hospital reimbursements were 13.6 percentage points below what they would have been in the absence of the program. According to our analysis, Medicare in New York spent \$677 per enrollee on hospitalizations in 1978. Assuming Medicare would have spent 13.6 percent more without the rate-setting program in place, the figure could have been as high as \$769, or \$92 more. When applied to the (approximately) 2.3 million enrollees in the State (Muse and Sawyer, 1982), the 1-year Medicare savings (even though it was not an active participant) amount to \$212 million.

Connecticut is another example. Applying a 23-percent adjustment to the 1975-78 average expenditure of \$500 per enrollee, the savings are estimated to be \$115 per enrollee per year, or \$39 million. Again, these savings accrued to Medicare even though Medicare was not an active participant in Connecticut's rate-setting program.

The 1978 coefficients for Maryland and Washington are of special interest, for Medicare came under the States' PR program in 1978, the last year of the study time period. In the detailed regressions, both coefficients are positive, implying higher expenditures than if Medicare had not been an active participant. The Maryland coefficient is insignificant, however, while Washington's is significant only at the 10-percent level. In the latter State, this increase apparently offset the savings achieved over 1976-77 (note the trivial $-.1$ percent for WA78 in Figure 1). Medicare may have paid more than it would have by being responsible for more hospital costs (e.g., bad debts) than under Medicare reimbursement principles. Medicare still may have enjoyed savings after participating if it enhanced the PR program's effectiveness over time. Unfortunately, the study time period is too short to address this possibility.

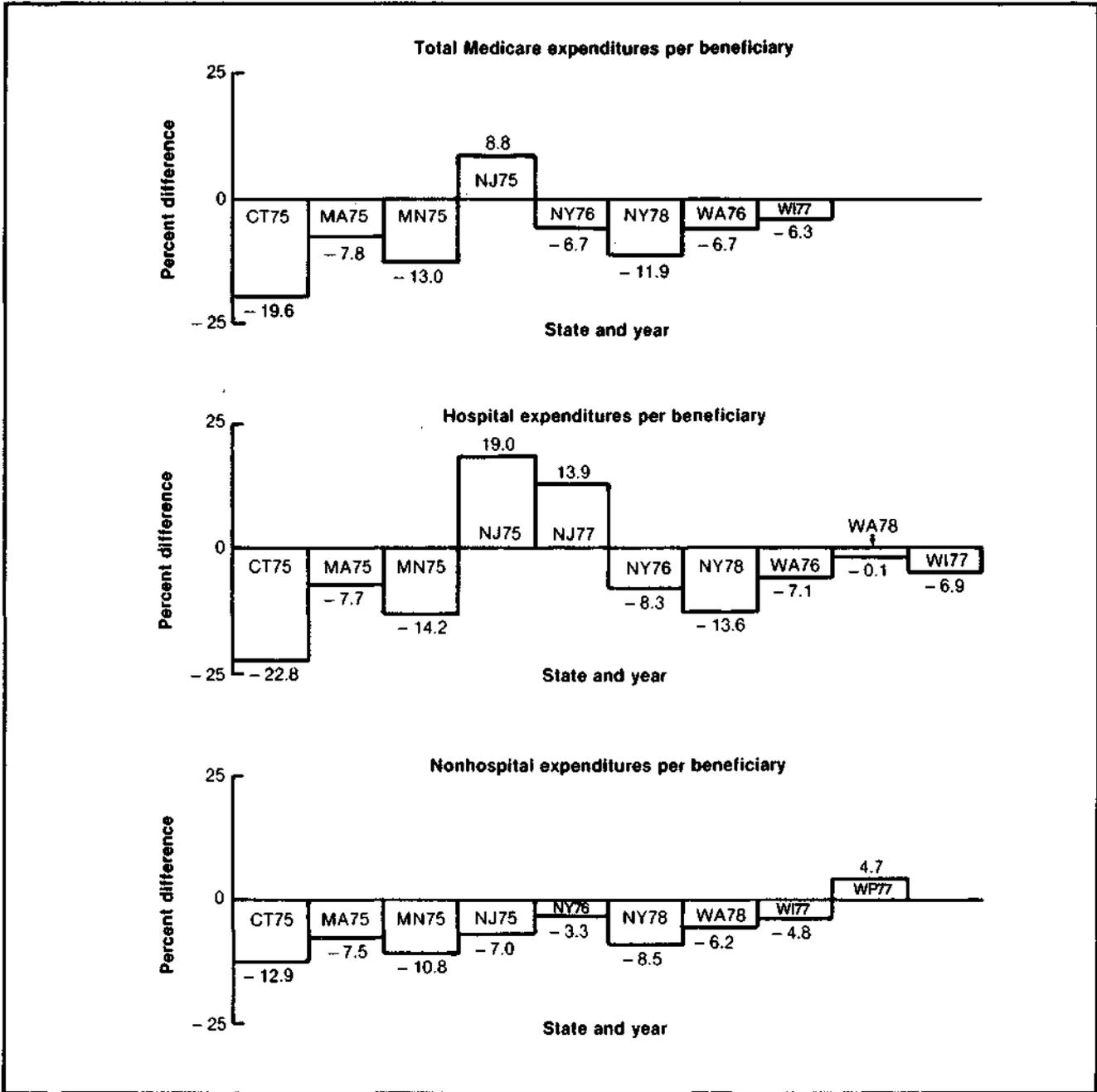
Finally, nonhospital expenditures were also negative in the six States (Connecticut, Massachusetts, Minnesota, New York, Washington, and Wisconsin) with negative hospital effects. Note, too, that New Jersey also exhibited a negative effect, partially offsetting the large positive hospital result. Connecticut's 12.9 percent reduction amounts to roughly \$35 per beneficiary, or \$12.6 million aggregated across all enrollees. For New York, the reduction is \$28 per beneficiary, or \$64 million overall.

One of the more interesting findings is the frequency of "same-sign" effects of PR on hospital and nonhospital reimbursements. Of the eight State instances of negative, significant hospital PR coefficients in Figure 1, seven also exhibited negative

¹⁸ Please write to the author if you would like to see these detailed regressions.

Figure 1

Prospective reimbursement regression coefficients: Medicare hospital, nonhospital and total reimbursements in percent, by State and year program started or changed



and significant nonhospital effects. Assuming no variable has been left out that could explain similar PR effects on both types of expenditures, this implies that hospital and nonhospital services are complements in the broad sense. Because physician reimbursements constitute 70 percent of Medicare nonhospital payments, any complementarity is likely to apply between hospitals and physicians as a group. This was borne out to some extent in the detailed regressions, where PR effects on inpatient days and physicians' services had the same signs in 10 of 16

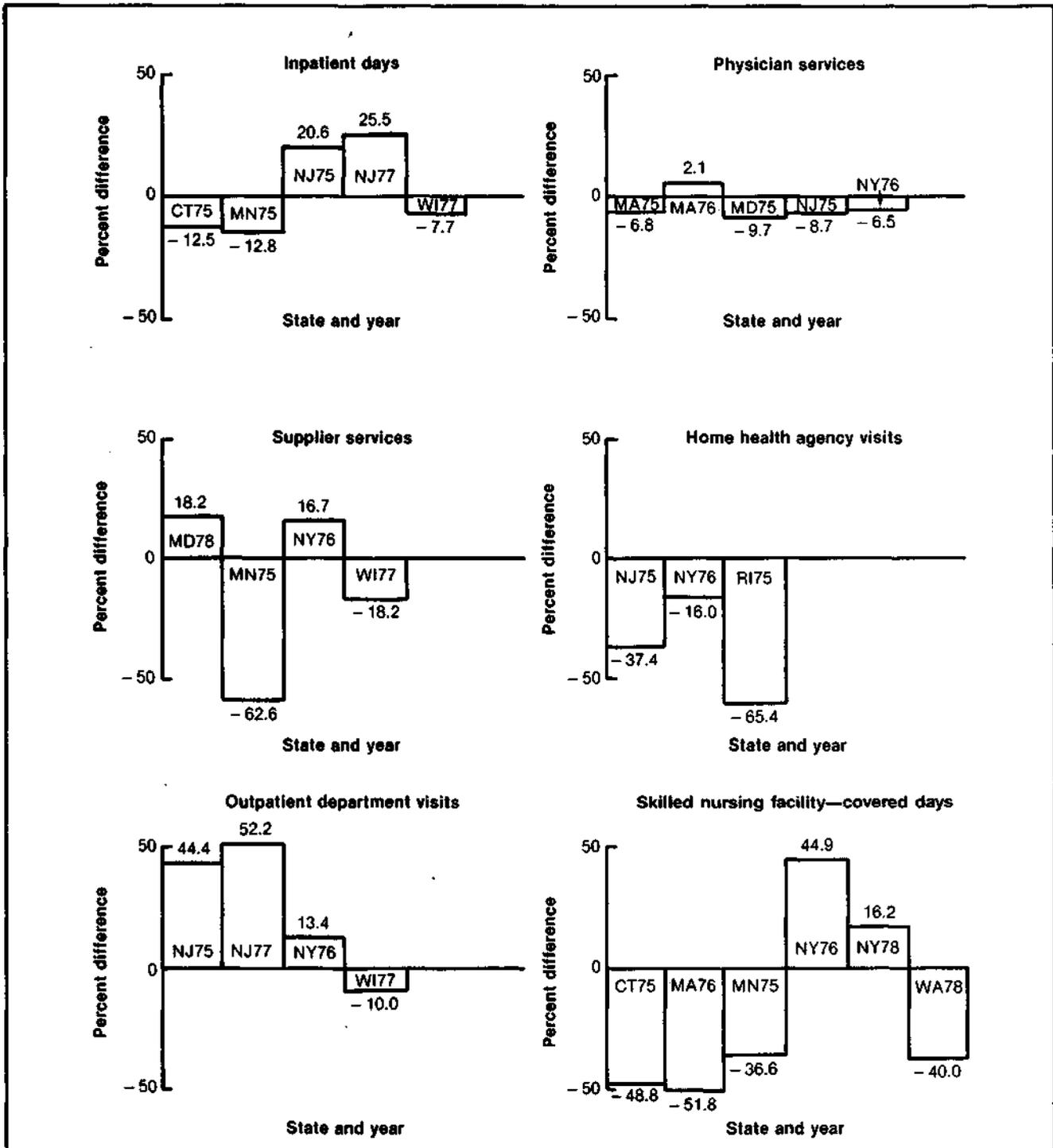
instances, including Connecticut, Massachusetts, New York, Washington, and Wisconsin.¹⁹

Extra hospital admissions or days or both imply greater opportunities for more inpatient physician billings for ancillary services (e.g., radiologists and pathologists), routine bed visits, surgery (including anesthesiologists and surgeon assistants), and specialist consultations (e.g., cardiologists,

¹⁹ This is consistent with Feldstein's (1971) very early work which showed a positive elasticity (.40) of hospital admissions on Medicare Part B expenditures.

Figure 2

Prospective reimbursement regression coefficients: Medicare hospital and nonhospital utilization per beneficiary, by State and year program started or changed



neurologists, urologists). Very little of this care appears elsewhere in the system when these days (or admissions) are eliminated.

Significant (at 10 percent) PR regression coefficients for five nonhospital utilization variants are presented in Figure 2. Also included in the upper left panel are the significant results from a regression explaining total inpatient days per beneficiary. If

PR has affected nonhospital utilization, it should manifest itself, first, through important changes in inpatient use rates.

Where Medicare is not participating, theory hypothesizes that PR programs encourage more Medicare hospital utilization as hospitals try to shift costs to Medicare patients. With the exception of New Jersey, no evidence is found supporting this

hypothesis of greater hospital utilization (see upper left panel in Figure 2). Only four States showed statistically significant effects on Medicare inpatient days, and three are negative: Connecticut (down 12.5 percent from predicted levels); Minnesota (-12.8 percent); Wisconsin (-7.7 percent); with New Jersey up over 25 percent by 1977-78. Connecticut's and Wisconsin's results derive from lower-than-expected admission rates; Minnesota's lower levels come about equally from admissions and length-of-stay reductions.

New Jersey's case is peculiar. In 1975, the year the PR program was introduced, Medicare admissions jumped nearly 24 percent, holding other factors constant. There is no reason to associate such a large jump with the program's introduction; it may well be an artifact of the data although there do not appear to be any reporting problems. Extensive checking of our data sources and methods as well as private conversations with HCFA staff did not provide a simple explanation. The additional 5-percent jump in 1977-78, however, comes from longer stays, which may well be a perverse program effect of per diem payment. Why a similar effect was not found in New York or Massachusetts is surprising, given the same per diem incentives.

With such limited inpatient utilization effects, one would not expect to find a large number of outpatient PR effects, assuming rate regulation affects nonhospital care through higher (lower) hospital use; nor do we find many. Those that do appear certainly do not support a large shift to outpatient activity.

Summarizing by State:

- Connecticut: a significant reduction in SNF-covered days with no increases in other nonhospital use.
- Massachusetts: reductions in SNF use with a slight positive increase in physician use between 1976-78.
- Maryland: a significant reduction in physician services (-9.7 percent) but a large jump in supplier services (18.2 percent).
- Minnesota: predicted level dramatically lower for supplier (down 63 percent) and SNF services (down 37 percent).
- New Jersey: declines in physician and HHA's services, offset by large jumps in OPD services (up 50 percent).
- New York: significant reductions in physician services over expected levels (down 6.5 percent) and in HHA's services (-16 percent); contrasted with positive increases in supplier, SNF, and OPD services.
- Wisconsin: a reduction in both OPD services (10 percent) and supplier services (18 percent).

Although some of the increases are indicative of nonhospital substitution, they have not completely offset any inpatient savings. On the contrary, the savings on physician services in New York, for example, more than compensated for the large growth in OPD services.

Conclusions and policy implications

A principal concern of Medicare policymakers has been that stringent PR programs in some States may have resulted in hospitals using Medicare to cross-subsidize losses elsewhere; but we found no systematic evidence to support this hypothesis. Few effects on Medicare admission rates or lengths of stay were uncovered, nor were any found on reimbursements

as a result of charge manipulation or creative accounting. If anything, the evidence is to the contrary: Medicare reimbursements are lower in several States (including New York), even where it was not a participant. From the overall pattern of results, it appears that Medicare has been a passive recipient of the same kinds of regulatory benefits accruing to other PR-covered patients. That is, where overall hospital costs and intensity of care have been constrained, Medicare outlays based on these costs have also been constrained.

There is also no clear evidence to support the widespread fear that any savings in hospital outlays would "slip out the emergency room door" into OPD's, SNF's, and physicians' offices. Although OPD and SNF utilization and payments may have risen in a couple of key States like New Jersey and New York, these trends have been more than offset by declines in physician payments. Whether hospital PR programs have truly been the cause of lower physician expenditures is hard to say, for little direct link was found between inpatient and physician use. Nevertheless, the fact remains that Medicare spent less than expected on physicians in most of the rate-setting States where it spent less on hospital care (for example, Connecticut, Minnesota, New York, Washington). Fewer radiologist, pathologist, consultative, and other bills associated with inpatient use may reflect an overall complementary relationship. Control hospital costs and physician costs are controlled as well, maybe not for each specialty or for every type of PR program, but in general.

Another clear implication of the descriptive findings is that Medicare has two kinds of expenditure problems—one concerning utilization of physician, HHA, and supplier services and another concerning the price of a hospital day or an OPD visit. Per diem constraints, therefore, should work in both hospitals and OPD's, but will fail at controlling the rest of the outpatient services because these constraints ignore volume growth. New ways must be found to slow the growth in nonhospital ancillary services intensity, ways that go beyond price regulation to the bundling of services. Regulation, in fact, has had a poor history at regulating anything other than price (and assuring quality minimums) because of the difficulties in determining medical appropriateness. Reliance on providers and consumers to police utilization will not work under existing arrangements, as both have definite incentives to increase utilization and access. Incentive

structures must be changed in ways that encourage providers and consumers to place a higher value on the "marginal" visit, test, or surgical procedure. Medicare's new PR program, which pays on a diagnosis-related group (DRG) case basis, may already be discouraging longer stays. Physician DRG's would reinforce these incentives by attaching an implicit price to inpatient physician services, bringing the true cost of medical care closer to the ultimate decisionmaker, namely, the attending physician.

Acknowledgments

Richard Yaffe, our HCFA Project Officer, provided many useful comments during the course of the analysis. We would also like to thank John Griffith and David Salkever for their comments on an earlier draft. Neither, of course is responsible for any remaining errors and omissions.

References

Balachandran, V., and Dittman, D.: Cost allocation for maximizing hospital reimbursement under third-party cost contracts. *Health Care Management Review*. Spring 1978.

Cleverley, W.: Reimbursement management. *Topics in Health Care Financing*. Fall 1977.

Coelen, C., and Sullivan, D.: An analysis of the effects of prospective reimbursement programs on hospital expenditures. *Health Care Financing Review*. Vol. 2, No. 3. HCFA Pub. No. 03090. Office of Research, Demonstrations, and Statistics, Health Care Financing Administration. Washington. U.S. Government Printing Office, Winter 1981.

Cromwell, J., and Burstein, P.: *The Impact of State Hospital Prospective Reimbursement Programs on Hospital Capital Formation, Competition and Industrial Structure: An Evaluation*. Contract No. 500-78-0036. Prepared for the Health Care Financing Administration. March 1984.

Davis, K., and Russell, L.: The substitution of hospital outpatient care for inpatient care. *Review of Economics and Statistics* 54(2):109-120, May 1972.

Feldstein, M.S.: An econometric model of the Medicare system. *Quarterly Journal of Economics* 85(1):1-20, February 1971.

Freeland, M.S., and Schendler, C.E.: National health expenditures: Short-term outlook and long-term projections. *Health Care Financing Review*. Vol. 2, No. 3. HCFA Pub. No. 03090. Office of Research, Demonstrations, and Statistics, Health Care Financing Administration. Washington. U.S. Government Printing Office, Winter 1981.

Gaumer, G., and Cromwell, J.: *Patient care impacts of prospective reimbursement programs*. Contract No. 500-78-0036. Prepared for Health Care Financing Administration. January 1984.

Hamilton, D., ed.: Rate regulation. *Topics in Health Care Financing*. Fall 1979.

Hamilton, D., Walter, R., and Cromwell, J.: The National Hospital Rate-Setting Study: A comparative review of nine prospective rate-setting programs. Grants and Contracts Report, HCFA 03061. Office of Research, Demonstrations, and Statistics. Health Care Financing Administration. Washington. U.S. Government Printing Office, August 1980.

Harris, J.: Pricing Rules for Hospitals. *Bell Journal of Economics* 224-243, Spring 1979.

Health Care Financing Administration: *Medicare Summary of Use and Reimbursement by Person, 1976-1978*. HCFA Pub. No. 03137. Office of Research, Demonstrations, and Statistics, Health Care Financing Administration. Washington. U.S. Government Printing Office, August 1982.

Health Care Financing Administration, Statistical Data Systems Data Branch. *Medicare Statistical Files Manual*.

Hellinger, F.J.: Hospital charges and Medicare reimbursement. *Inquiry* 12: 313-319, Dec. 1975.

Hellinger, F.J.: Substitutability among different types of care under Medicare. *Health Serv Res.*: Spring 1977.

Janssen, T.J., and Saffran, G.T.: Reimbursement for durable medical equipment. *Health Care Financing Review*. Vol. 2, No. 3. HCFA Pub. No. 03090. Office of Research, Demonstrations, and Statistics, Health Care Financing Administration. Washington. U.S. Government Printing Office. Winter 1981.

Kelly, N.L.: *An Evaluation of the Effects of Hospital Rate-Setting Programs on Volumes of Hospital Services*. Contract No. 500-78-0036. Prepared for Health Care Financing Administration. 1984.

Muse, D., and Sawyer, D.: *The Medicare and Medicaid Data Book, 1981*. Office of Research and Demonstrations, Health Care Financing Administration. HCFA Pub. No. 03128. Washington. U.S. Government Printing Office. April 1982.

Newhouse, J., and Phelps, C.E.: New estimates of price and income elasticities of medical care services. In Rosett, R., ed. *The Role of Health Insurance in the Health Service Sector*. National Bureau of Economic Research. New York, 1976.

Pauly, M.: *Doctors and Their Workshops: Economic Models of Physician Behavior*. Chicago. University of Chicago Press, 1980.

Russell, L.: An econometric model of the Medicare system: Comment. *Quarterly Journal of Economics*. 1973.

Sloan, F.A., and Steinwald, B.: *Insurance, Regulation and Hospital Costs*. Lexington, Mass. Lexington Books, 1980.