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DataWatch

This DataWatch section contains two studies: first, Walter McClure and Dale Shaller of the Center for Policy Studies present data on variations in Medicare expenditures per beneficiary; next, Joseph Restuccia, Paul Gertman, and fellow authors from the Boston University Medical Center provide a comparative analysis of appropriateness of hospital use.

Variations In Medicare Expenditures Per Elder

Increasing national concern over rising health expenditures has generated substantial interest in assessing the efficiency of medical care providers. A growing body of research suggests that provider efficiency varies greatly. If this is true, then policies encouraging more cost-effective practice styles can lead to expenditure restraint without restricting the quality or availability of medical care. Hence, research and data bearing on the extent of provider inefficiency in the health care system are of crucial interest to national cost-containment efforts.

In this article we present data on variations in Medicare expenditures per beneficiary among selected metropolitan areas. These data are consistent with evidence of wide variations in provider practice style and efficiency. We briefly review the nature of provider efficiency and possible explanations why per capita medical expenditures vary among populations. The data on Medicare expenditure variations are then presented, followed by a short discussion and summary of their implications.

Efficiency As Expenditure Per Capita

Provider efficiency can best be measured as the average expenditure per capita necessary to produce a given level of health improvement in a population. Service prices alone or utilization rates alone are misleading as measures of health care expenditures because one can be high when the other is low. Hence, it is average expenditure per capita, which captures both service prices and the quantity and mix of services, that is most useful in comparing and assessing provider efficiency.

Many experts have attributed variations in per capita utilization and expenditure rates solely to differences in population health status and quality of care, rather than to differences in provider efficiency. Hadley

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has shown convincingly that health status and quality of care (measured as a reduction in mortality rates) are important in explaining variations in per capita expenditures.¹ However, a number of other researchers have suggested that differences in provider practice, style and efficiency may be at least as important as, or perhaps even more important than, health status or quality of care in explaining such variations.²

Only recently have studies become available which compare utilization and expenditure rates while simultaneously controlling for health status and quality of care in actual practice settings. Britt found variations in length-of-stay for both intensive and routine care of heart attack patients after controlling for disease severity and patient outcome.³ McClure, Nobrega, and Shaller have found a 40 percent difference in hospital admission rates for cancer patients between Olmsted County and the nation after controlling for incidence.⁴ Brewster has shown twofold differences in average cost per case between different physicians at the same hospital⁵ after controlling for patient severity at admission as well as patient outcome.

These studies suggest that provider practice style and efficiency may be at least as important in explaining differences in per capita expenditure and utilization rates as are health status and quality of care. The Medicare data presented below also seem consistent with this notion.

Variations In Medicare Reimbursement

The Medicare program maintains one of the few data systems in the country which allows calculation of population-based expenditures per capita for the same age group receiving the same benefits nationwide. Each year the Health Care Financing Administration (HCFA) compiles data on beneficiary enrollment and reimbursement by place of residence (rather than by place of service) under the Medicare hospital insurance (HI) and supplementary medical insurance (SMI) programs. Unfortunately, these data cannot be used directly for comparing expenditure rates per beneficiary because they are not adjusted for area health status and medical input costs, and because they do not include Medicare reimbursements to health maintenance organizations (HMOs). However, calculation of adjusted population-based expenditures per Medicare beneficiary (that may be fairly compared) is possible by combining Medicare statistical system printouts for both fee-for-service and HMO reimbursements.⁶

Exhibit 1 presents our calculations of Medicare expenditures per elder by selected metropolitan area (SMSA) after adjustment for area age, sex, and wage factors. These adjustments help minimize variations in expenditures due to health status and area input costs, and thus allow a fairer comparison of expenditure rates across areas. Age and sex are used as a

Exhibit 1

Medicare Expenditures Per Elder By Place Of Residence, Selected SMSAs, 1981

SMSA	<u>Age/Sex adjusted</u>		Wage Index ^a	<u>Age/Sex/Wage adjusted</u>	
	Reimb/ Elder	(% of NA)		Reimb/ Elder	(% of NA)
Miami	\$2304	166%	0.999	\$2306	166%
Los Angeles	2270	163	1.156	1964	141
Boston	1782	128	1.022	1744	125
Baltimore	1663	120	0.984	1690	122
Chicago	1868	134	1.149	1625	117
Detroit	2013	145	1.252	1608	116
San Francisco	1801	130	1.174	1534	110
Des Moines	1499	108	0.996	1505	108
Portland	1592	115	1.060	1502	108
New York	1804	130	1.208	1493	107
Tampa-St. Petersburg	1294	93	0.871	1486	107
Honolulu	1415	102	0.957	1479	106
Phoenix	1489	107	1.010	1474	106
Flint	1900	137	1.308	1453	105
Pittsburgh	1588	114	1.109	1432	103
Cleveland	1595	115	1.119	1425	103
Minneapolis-St. Paul	1481	107	1.057	1401	101
New Orleans	1432	103	1.027	1394	100
National Average (NA)	1390	100	1.000	1390	100
Albuquerque	1309	94	0.944	1387	100
St. Louis	1452	104	1.049	1384	100
Newark	1532	110	1.148	1335	96
Denver-Boulder	1401	101	1.118	1253	90
Lansing-East Lansing	1342	97	1.079	1244	89
Rochester, Minn.	1225	88	1.017	1205	87
Houston	1507	108	1.256	1200	86
Dallas-Ft. Worth	1205	87	1.080	1116	80
Seattle-Everett	1288	93	1.196	1077	77
Davenport-Rock Island-Moline	1200	86	1.120	1071	77
Rochester, N.Y.	1192	86	1.117	1067	77
Salt Lake City	1055	76	0.988	1067	77

^aBased on ratio of area wage and salary earnings per job to U.S. average. Data source is the Bureau of Economic Analysis, *Regional Economic Profile, 1976-81*.

Note: Medical expenditures refer to hospital insurance (HI) and supplementary medical insurance (SMI) reimbursements per beneficiary age 65 and over for covered services only. Data are from the Health Care Financing Administration, Bureau of Data Management and Strategy.

reasonable proxy for health status; adjusting all areas to a single standard age-sex mix changes the unadjusted data by less than 4 percent and usually less than 1 percent. The area all-wage index is used as a simple proxy for area input costs because labor accounts for a majority of provider input costs. [Note that the (exogenous) all-wage index is chosen rather than the (endogenous) medical-wage index, since medical wages are controlled by providers.] The all-wage adjustment is crude and produces significant changes in the data; hence Exhibit 1 shows expendi-

tures per elder with and without the wage adjustment. The areas selected in Exhibit 1 were chosen on the basis of geographical distribution and other factors of interest.

Exhibit 1 shows indisputably that large differences exist in adjusted Medicare reimbursement per elder among metropolitan areas. Due to limitations in the Medicare data system, the variations observed in Exhibit 1 are accurate to within only plus or minus 5 percent, but the differences in expenditure rates are far larger than can be accounted for by this apparent statistical noise. The adjusted expenditure per elder in 1981 ranged among the selected areas from a high in Miami of more than \$2,300 (or 66 percent above the national average) to a low of less than \$1,100 (or 23 percent below the national average) in Seattle, Salt Lake City, and Rochester, New York. This represents a twofold variation from the highest to the lowest areas. Even metropolitan areas within closer geographic proximity exhibit wide variations in Medicare expenditures per elder. For example, Tampa-St. Petersburg is less than 250 miles from Miami yet expenditures per elder are only 7 percent above the national average. Similar though less extreme variations can be observed between Portland and Seattle (8 percent above versus 23 percent below the national average), Los Angeles and San Francisco (41 percent versus 10 percent above the national average), and Minneapolis-St. Paul and Rochester, Minnesota (1 percent above versus 13 percent below the national average).

It is possible but doubtful that expenditure differences as great as those in Exhibit 1 can be explained solely by differences in the health status of the elderly population in these metropolitan areas or in the quality of their medical care. For example; it is highly unlikely that the elderly in Miami are so much more sick or that medical care is so much better as to justify an expenditure rate 40 percentage points greater than that observed in Boston. In comparing Miami to Seattle (two SMSAs of comparable size), a simple sensitivity analysis shows that, even assuming the per capita cost of chronically high-risk elders to be ten times higher than the national average, there would need to be four times as many high-risk elders in Miami as in Seattle to account for the twofold variation observed in expenditures. Such wide swings in the health status of the elderly among these areas seem unlikely. It is equally unlikely that such variations are due to gross differences in quality of care between the two areas. A more plausible explanation, consistent with the existing research evidence, is that these variations are due at least as much to differences in provider efficiency as they are to differences in health status or quality of care. The importance of provider efficiency in explaining expenditure variations is further suggested by the trend and composition data presented in Exhibit 2.

Exhibit 2 shows the trend in adjusted Medicare expenditures per elder over time, as well as the composition of these expenditures by hospital

Exhibit 2
Trend In Medicare Reimbursement Per Elder By Place Of Residence,
Selected SMSAs (age, sex, and wage adjusted) 1974-82

Location		1974 (% of NA)	1976 (% of NA)	1978 (% of NA)	1980 (% of NA)	1982 (% of NA)
National average (NA)	HI	\$344(100%)	\$509(100%)	\$625(100%)	\$827(100%)	\$1146(100%)
	SMI	131(100%)	189(100%)	253(100%)	367(100%)	499(100%)
	Total	475(100%)	698(100%)	878(100%)	1194(100%)	1645(100%)
Miami	HI	498(145%)	799(157%)	978(156%)	1226(148%)	1752(153%)
	SMI	281(215%)	417(221%)	569(225%)	750(204%)	972(195%)
	Total	779(164%)	1216(174%)	1547(176%)	1976(165%)	2724(166%)
Boston	HI	500(145%)	715(140%)	861(138%)	1037(125%)	1419(124%)
	SMI	145(111%)	212(112%)	277(109%)	430(117%)	592(119%)
	Total	645(136%)	927(133%)	1138(130%)	1467(123%)	2011(122%)
Minneapolis- St. Paul	HI	440(128%)	592(116%)	700(112%)	866(105%)	1195(104%)
	SMI	135(103%)	183(97%)	235(93%)	324(88%)	405(81%)
	Total	575(121%)	775(111%)	935(106%)	1190(100%)	1600(97%)
Rochester, Minn.	HI	237(69%)	316(62%)	381(61%)	482(58%)	618(54%)
	SMI	267(204%)	344(182%)	408(161%)	535(146%)	679(136%)
	Total	504(106%)	660(95%)	789(90%)	1017(85%)	1297(79%)
Seattle- Everett	HI	246(72%)	370(73%)	492(79%)	635(77%)	827(72%)
	SMI	114(87%)	160(85%)	239(94%)	311(85%)	401(80%)
	Total	360(76%)	539(76%)	731(83%)	946(79%)	1228(75%)
Rochester, N.Y.	HI	296(86%)	472(93%)	595(95%)	712(86%)	815(71%)
	SMI	107(82%)	145(77%)	182(72%)	286(78%)	379(76%)
	Total	403(85%)	617(88%)	777(88%)	998(84%)	1194(73%)

Note: Medicare reimbursement per elder refers to reimbursements per beneficiary age 65 and over for covered services only. Data are from the Health Care Financing Administration, Bureau of Data Management and Strategy. Wage and salary earnings per job were available for 1976-81 only. The wage index calculated for 1976 is used here for 1974; the 1981 index is used for 1982. Data source is The Bureau of Economic Analysis, *Regional Economic Profile*. 1976-81.

(HI) and physician (SMI) reimbursements. (Age- and sex-adjusted data without the wage adjustment are shown in Exhibit 3.) Consider first the trend in these adjusted expenditures by area relative to the national average for the period 1974 to 1982. Both in Miami (the highest cost area) and in Seattle (one of the lowest cost areas) expenditures increased at roughly the national average rate. On the other hand, expenditures in Boston (a higher cost area), Minneapolis-St. Paul (a more average cost area), and Rochester, New York and Rochester, Minnesota (both lower cost areas), have all escalated measurably less than the national average. In Boston, a major medical center with moderate hospital regulatory controls, Medicare expenditures per elder declined from 36 percent to 22 percent above the national average between 1974 and 1982. In Minneapolis-St. Paul, a medical system active in both planning and competitive market innovations, a still larger decline took place from 21 percent above the national average in 1974 to 3 percent below in 1982. In

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Exhibit 3

Trend In Medicare Reimbursement Per Elder By Place Of Residence,
Selected SMSAs (age and sex adjusted) 1974-82

Location		1974 (% of NA)	1976 (% of NA)	1978 (% of NA)	1980 (% of NA)	1982 (% of NA)
National average (NA)	HI	\$344(100%)	\$509(100%)	\$625(100%)	\$827(100%)	\$1146(100%)
	SMI	131(100%)	189(100%)	253(100%)	367(100%)	499(100%)
	Total	475(100%)	698(100%)	878(100%)	1194(100%)	1645(100%)
Miami	HI	501(146%)	803(158%)	957(153%)	1214(147%)	1750(153%)
	SMI	282(215%)	419(222%)	557(220%)	742(202%)	971(195%)
	Total	783(165%)	1222(175%)	1514(172%)	1956(164%)	2721(165%)
Boston	HI	523(152%)	747(147%)	882(141%)	1055(128%)	1450(127%)
	SMI	151(115%)	222(117%)	283(112%)	437(119%)	605(121%)
	Total	674(142%)	969(139%)	1165(133%)	1492(125%)	2055(125%)
Minneapolis- St. Paul	HI	465(135%)	625(123%)	736(118%)	915(111%)	1263(110%)
	SMI	142(108%)	193(102%)	247(98%)	343(93%)	428(86%)
	Total	607(128%)	818(117%)	983(112%)	1258(105%)	1691(103%)
Seattle	HI	282(82%)	423(83%)	573(92%)	756(91%)	989(86%)
	SMI	130(99%)	183(97%)	278(110%)	371(101%)	479(96%)
	Total	412(87%)	606(87%)	851(97%)	1127(94%)	1468(89%)
Rochester, Minn.	HI	238(69%)	317(62%)	389(62%)	495(60%)	629(55%)
	SMI	268(205%)	345(183%)	416(164%)	549(150%)	690(138%)
	Total	506(107%)	662(95%)	805(92%)	1044(87%)	1319(80%)
Rochester, N.Y.	HI	333(97%)	531(104%)	656(105%)	795(96%)	911(79%)
	SMI	120(92%)	163(86%)	201(79%)	319(87%)	423(85%)
	Total	\$53(95%)	694(99%)	857(96%)	1114(93%)	1334(81%)

Source: Health Care Financing Administration, Bureau of Data Management and Strategy.

Note: Medicare reimbursement per elder refers to reimbursements per beneficiary age 65 and over for covered services only.

Rochester, New York, with a unique system of voluntary hospital budget ceilings, expenditures fell from 15 percent to 27 percent below the national average over the eight-year period. Expenditures per elder in Rochester, Minnesota, a unique fee-for-service system comprised by the Mayo and Olmsted Clinics, fell from 6 percent above to 21 percent below the national average.

It is possible but doubtful that large changes in health status or medical care quality have occurred in Boston, the Twin Cities, and the two Rochesters that have not occurred in Miami and Seattle. To the contrary, it seems far more plausible to ascribe these reductions in expenditure growth to changes in provider efficiency. This notion is further supported by inspection of the composition data, discussed next.

Exhibit 2 shows that each area not only appears to vary greatly in adjusted expenditures per elder, but these expenditures appear to be distributed very differently between hospital (HI) and physician (SMI) reimbursement between areas and within certain areas over time. For the

nation as a whole, the composition of Medicare expenditures per elder splits 70 percent to hospitals and 30 percent to physicians (or 70 percent/30 percent for short); this composition has changed little over time.

In Miami, however, despite the fact that hospital expenditures are 50 percent above the national average, physician expenditures are even higher (100 percent above the national average), so that the composition of expenditures (64 percent/36 percent) in this high-cost area is more physician-intensive than the national average. Expenditure composition in Miami has not changed over time. In contrast, Boston (also a high-cost area) originally had a much more hospital-intensive style than either Miami or the national average (78 percent/22 percent in 1974). The observed expenditure restraint in Boston over the eight-year period was apparently achieved by substituting ambulatory care for inpatient care, so that the present expenditure composition (71 percent/29 percent in 1982) is now close to the national average. The composition of expenditures in Boston has changed measurably over time.

Like Boston, Minneapolis-St. Paul was originally hospital-intensive (77 percent/23 percent in 1974) but unlike Boston it remains almost as hospital-intensive today (75 percent/25 percent in 1982) despite an even greater restraint in total expenditures per elder. Thus Minneapolis-St. Paul apparently achieved its overall expenditure restraint by reducing inflation equally among hospital and physician expenditures.

Seattle has maintained a relatively constant composition (67 percent/33 percent) over the eight-year period while remaining one of the lowest cost areas in the nation. Rochester, New York has also maintained a rather constant composition (71 percent/29 percent in 1981); even though it was a low-cost area to begin with (and has become one of the lowest), Rochester, like Minneapolis-St. Paul, has apparently restrained expenditures by controlling hospital and physician expenditures equally. (The sudden drop in hospital expenditures in 1982 may be due to statistical noise or may represent the beginning of a shift toward a less hospital-intensive style.)

Perhaps the most interesting area is Rochester, Minnesota, which has simultaneously one of the most physician-intensive yet least hospital-intensive practice styles of all areas examined. Despite significant restraint of total expenditures, composition has remained constant over time at roughly 48 percent/52 percent.⁷ Apparently, Rochester, Minnesota has restrained overall expenditures by controlling hospital expenditures as much as physician expenditures, even though this area had one of the least hospital-intensive practice styles to begin with (that is, hospital expenditures declined from 31 percent to 46 percent below the national average from 1974 to 1982). It is interesting to note that such expenditure restraint is possible in an area where over half of the physicians are in specialty residency training.

Again, these differences in composition of hospital and physician expenditures seem too large to be a reflection of either health status or quality of care in the selected areas, but rather seem to be more a reflection of differences in the organization and practice style of area providers. Further, the fact that those areas achieving expenditure restraint have done so in different ways (usually by keeping expenditure composition constant) supports the notion that we are observing differences in provider efficiency rather than differences in health status or quality. Moreover, if these observations are correct, we cannot speak of a single elaborate or conservative style of care; the differences between high-cost areas such as Miami and Boston and low-cost areas such as Seattle and the two Rochesters suggest that there are various elaborate and conservative styles of care.

Note that while the discussion above has focused on differences in provider efficiency among areas, the research cited earlier suggests that variation in practice style and efficiency among individual providers within each area is at least as great as the variation across areas.

Conclusion

The data presented in this article demonstrate that large variations exist in Medicare reimbursement per elder among metropolitan areas. After adjusting for differences in age, sex, and area wage costs, significant variations remain which appear unlikely to be explained solely or mainly by differences in quality of medical care or differences in population health status. These data appear consistent with the increasing evidence that differences in provider efficiency may account for much and perhaps the majority of the observed variations in per capita expenditure rates. Clearly, further research is needed to draw any rigorous conclusions.

To the extent that wide variations in provider efficiency are substantiated by further research, it should be possible to constrain costs by improving efficiency rather than by reducing access and quality of medical care. This can be attempted either by controls or incentives that encourage all providers to become at least as efficient as the most efficient providers practicing today.

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NOTES

1. J. Hadley, *More Medical Care, Better Health?* (Washington, D.C.: The Urban Institute Press, 1982). Unfortunately, provider efficiency is hidden in the error term in Hadley's production function. It would be of great interest to reanalyze Hadley's equations for each of the areas selected in this study to determine the sign and magnitude of this error term.
2. J. Wennberg and A. Gittelsohn, "Small Area Variations in the Use of Medical Services," *Scientific American* (April 1982): 120-134; W. McClure, "Toward Development and Application of a Qualitative Theory of Hospital Utilization," *Inquiry* 19 (Summer 1982): 117-135; J. Bunker et al., *Costs, Risks and Benefits of Surgery* (Oxford: Oxford University Press, 1977); C. Lewis, "Variations in the Incidence of Surgery," *The New England Journal of Medicine* 281 (16 October 1969): 880-884; and N. Roos, L. Roos, and P. Henteleff, "Elective Surgical Rates—Do High Rates Mean Lower Standards?" *The New England Journal of Medicine* 297 (18 August 1977): 360-365.
3. M.R. Britt, E.D. Buchanan, N. Goodell, J. Orme, R. Kaplan, A. Brewster, S. Pezzella, and B. Ladon, "Why the Long Length of Stay in the Northeast? A Study of Myocardial Infarction Care," *Clinical Research* 29 (February 1981): 37A.
4. W. McClure, F. Nobrega, and D. Shaller, "Comparison of Incidence Rates and Utilization Rates for Cancer in Olmsted County and the U.S.," (Minneapolis: Center for Policy Studies, 1983), unpublished memorandum.
5. A. Brewster, B. Karlin, L. Hyde, C. Jacobs, R. Bradbury, and Y. Chae, "Medical Illness Severity Grouping System (MEDISGRPSm): A Clinically Based Approach to Classifying Hospital Patients at Admission," (February 1984), to be published.
6. The Medicare expenditure data presented here refer to hospital insurance (HI) and supplementary medical insurance (SMI) reimbursements per beneficiary age sixty-five and over for covered services only. Administrative costs, deductibles, copayments, and services not covered by Medicare are excluded from these calculations. Per capita reimbursements for beneficiaries eligible solely on the basis of disability and End Stage Renal Disease (ESRD) are also not included. The national average refers to average Medicare reimbursement per elder within the fifty states, the District of Columbia, and of residence unknown.

Expenditures per elder in each SMSA were calculated on the basis of the weighted average of HI and SMI reimbursement per elder for each constituent county. The SMSA was chosen as the unit of analysis because central and suburban counties tend to have populations of different health risks; the most chronically sick individuals apparently tend to locate in central counties where providers are concentrated. The SMSA thus allows a fairer and more accurate comparison of local medical care systems than individual counties.

The standard age and sex adjustment used in this study changed the unadjusted expenditure rates by usually less than 1 percent. Adjustments for area wage differences, however, resulted in significant percentage declines in some areas. We have used a quite crude wage adjustment, simply dividing area expenditures by the area wage index. To aid the reader in discerning the effects of the area wage adjustment on relative expenditures per elder, the trend data shown in Exhibit 2 are reproduced in Exhibit 3 without the wage adjustment.

In order to present the data in this article, numerous calculations were necessary to overcome several constraints in the current Medicare data system. The most serious constraint is that Medicare has no data system reporting HMO reimbursements by county of beneficiary residence. We therefore prorated Medicare reimbursements to HMOs on the basis of beneficiary population size in the constituent SMSA counties, using available data on HMO service areas. At present, Medicare reimbursement to HMOs in most metropolitan areas is still relatively small, so that the maximum error in the data presented here is at most less than 5 percent and usually less than 1 or 2 percent. However, if Medicare beneficiary enrollment in HMOs continues to increase, this deficiency in the Medicare

data system will pose serious data problems in the future.

Another apparent problem, revealed by inspection of the trend data, is the appearance of sudden swings greater than 10 percent in a single year; these seem more likely due to statistical noise in data collection procedures than to true differences in expenditures. Hence the noise in these trend data make it difficult to trust single-year fluctuations unless they are greater than plus or minus 5 percent or are consistent over time.

We are grateful to the civil servants in the Medicare bureaucracy who shared our frustration with the constraints of the data system and who did much to help us overcome them. Errors in the data presented here are ours.

7. One reason for the low hospital (HI)/high physician (SMI) reimbursement composition for the resident Medicare population in Rochester, Minnesota is conservative hospital use (see McClure in Note 2 above). A second reason is that Mayo Clinic bills inpatient ancillary services performed by the clinic through SMI rather than HI. While important when comparing composition ratios, this has no effect when comparing areas on the basis of total HI plus SMI Medicare payments, as here. It can slightly affect the comparison of total per elder expenditures between areas if patient payments for HI and SMI cost sharing (that is, copayments and deductibles) are also included along with Medicare payments, because providers with a large SMI component can collect most cost-sharing payment from patients.

A rough estimate shows that were such patient cost-sharing payments included along with Medicare payments when comparing area expenditures in Exhibits 2 and 3, most higher-cost areas would fall at most 1 or 2 percentage points toward the national average. The only major exception is Rochester, Minnesota, which because of its large SMI component might rise 3 to 4 percentage points toward the national average. These small adjustments do not alter the essential conclusion; thus without patient cost-sharing payments included, adjusted Medicare expenditures per elder in Rochester, Minnesota were 13 and 21 percentage points less than the national average in 1981 and 1982, respectively, and even with such patient payments included, were 9 and 17 percentage points less than the national average, respectively, which may indicate substantial efficiencies and savings.