United States General Accounting Office

GAO

Report to the Honorable
Richard H. Bryan, U.S. Senate

February 1992

HEALTH CARE SPENDING

Nonpolicy Factors Account for Most State Differences

GAO/HRD-92-36

GAO

United States
General Accounting Office
Washington, D.C. 20548

Human Resources Division

B-246979

February 13, 1992

The Honorable Richard H. Bryan
United States Senate

Dear Senator Bryan:

The rise in health spending is a growing concern as it absorbs more and more of our national income. In 1990, personal health care expenditures in the United States totalled $585 billion, or $2,255 per capita. Personal health care represented 10.7 percent of the U.S. gross national product (GNP) in 1990, compared with 8.0 percent in 1980 and 6.4 percent in 1970.

To better understand what drives U.S. health spending, you asked us to compare health spending at the state level. Specifically, this report responds to your request that we determine (1) the per capita spending for health services in each state, (2) the reasons for the differences in spending levels from one state to the next, and (3) the extent to which state cost-containment policies have contributed to lowered health spending.

Results in Brief

In most states, per capita spending on personal health care is near the U.S. average. In over half the states, spending levels are within 10 percent of the national average. Many states with higher spending levels are concentrated in the Northeast, Midwest, and Far West, while many states with lower per capita spending are in the South and Rocky Mountain regions. Estimates for 1990 indicate that Massachusetts had the highest health expenditures per capita—over $3,000; South Carolina had the lowest expenditures—less than $1,700 per capita.

Our analysis indicates that the differences among states in per capita health spending result largely from factors that state governments can do little to control. Most state differences in per capita personal health spending result from variations in personal income, health care services' capacity (including the number of physicians and hospital and nursing home beds), the concentration of hospital services in urban areas, and health status. Generally, health care spending per capita was higher in states with higher personal income, greater hospital bed capacity, and a larger number of physicians per capita. For example, New York's relatively high personal income and greater supply of physicians and hospital beds per capita contributed to its having the third highest health spending per capita in the nation. In contrast, Utah's lower personal income, fewer per capita health

resources, and healthier population contributed to its health spending per capita being among the lowest in the nation. Other factors, in particular geographic variations in medical practice patterns, may also cause state differences in health spending.

Many states established policies to control their overall level of health spending, but met with limited success. Mandatory hospital rate regulation and all-payer systems appeared to reduce the level of health spending in the few states that implemented these policies in the 1970s and early 1980s.[1] However, personal income, healtth status, and other nonpolicy factors that strongly influence health spending per capita limit the ability of a state's health policies to constrain the state's level of health spending.

Scope and Methodology

In theory, state differences in health spending per capita may reflect differences in economic and demographic factors, characteristics of a state's health care delivery system, and public policies aimed at controlling spending. To help identify the many elements that contribute to state differences, we analyzed 14 factors that potentially influence health spending. We focused our analysis on seven factors that explained most of the health spending differences among the states. (See app. II, tables II.1 and II.5.) Our analysis covers personal health care expenditures in 1982 in the 50 states.

Data limitations hampered the identification of the sources of the state disparities in health spending. The Health Care Financing Administration (HCFA), which had calculated state-level data on personal health care expenditures regularly since 1966, discontinued reporting data after 1982.[2] More recent data, such as Lewin/ICF's 1990 state health spending rankings, are estimates constructed from the 1982 HCFA state-level

[1]States with mandatory rate regulation programs have established an external review organization with the legal authority to review and set hospital rates and budgets. An all-payer system is a variation of mandatory rate regulation in which the state obtains a federal waiver on Medicare rates. The rates that the state review body then sets for hospital reimbursement for Medicare are also applied to Medicaid, Blue Cross, and private health insurance plans.

[2]Personal health care expenditures include spending for personal health services and goods, but differ from national health expenditures by not including spending for public health programs, insurance administration, research, or construction of health facilities. In 1990, national health expenditures totalled $666.2 billion (12.2 percent of GNP), or $2,566 per person.

spending figures, more recent national-level health spending data, and state demographic changes.[3] These estimates, however, do not fully reflect some important changes in the health market—including the growth of alternative delivery systems, the rapid increase in the number of acquired immunodeficiency syndrome (AIDS) cases, and recent state health care policies- -that may have altered states' relative health spending since 1982.

Furthermore, HCFA data are distorted somewhat by state transfers of health services. HCFA calculates personal health expenditures per capita by the place of service, rather than patients' place of residence. All health spending is attributed to the state where the health care provider is located, whether the care is provided to an in-state or an out-of-state resident. States that provide a large amount of care to out-of-state residents have higher measured personal health expenditures per capita than if health spending was calculated by the state of residence.[4]

In this study, we report state personal health expenditures per capita from both the 1982 HCFA data and the 1990 Lewin/ICF estimates. The statistical analysis of the sources of state differences in health spending is based on the 1982 HCFA data to avoid inaccurate results caused by using constructed estimates. The 1990 Lewin/ICF estimates were analyzed to get a rough indication of how well our analysis carried over to more recent years. (See app. II, table II.7.)

We conducted our review between February and October 1991, in accordance with generally accepted government auditing standards.

Spending in Most States Is Near the U.S. Average

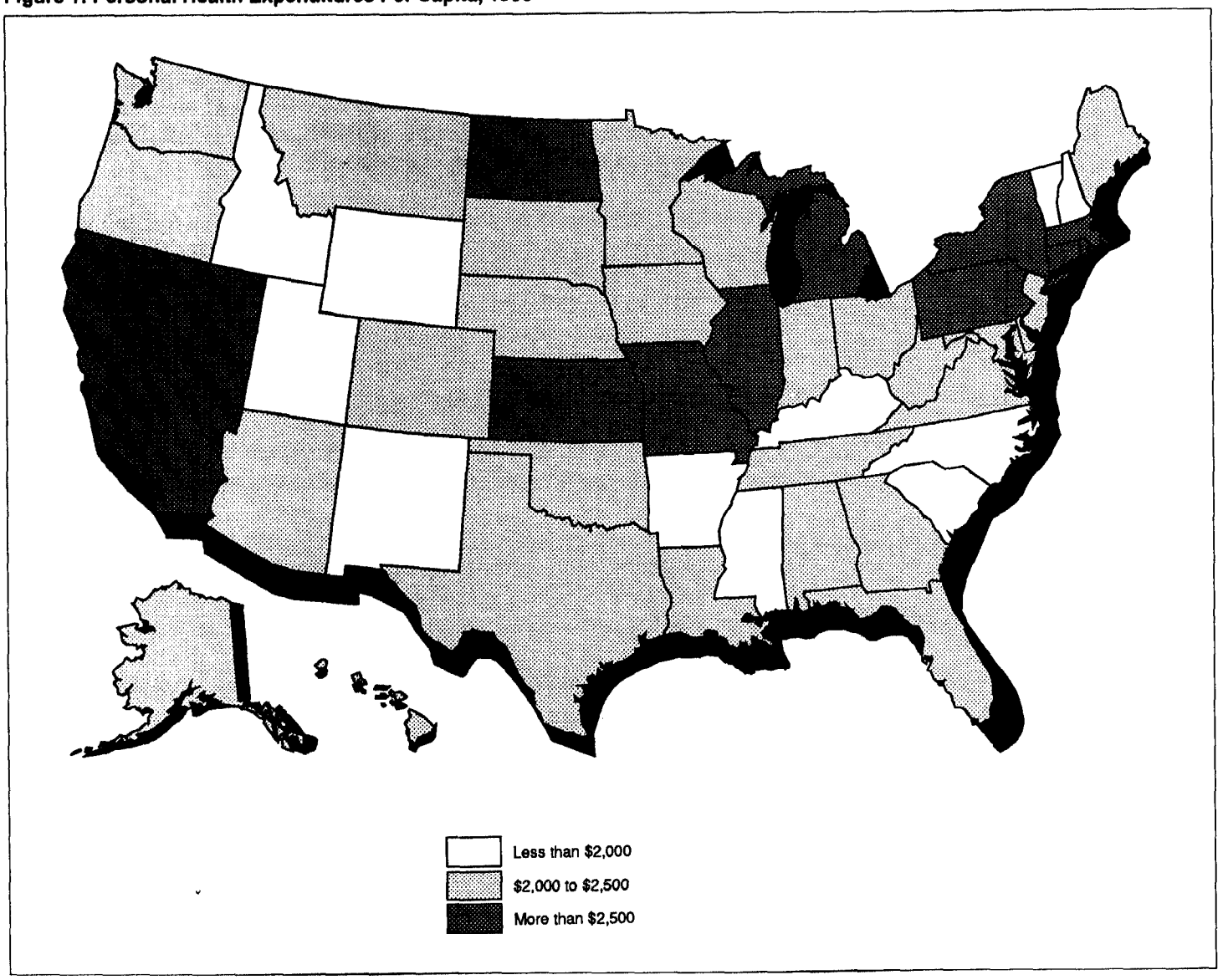
Health spending per capita varies among the states, but spending in most states is near the U.S. average. In over half of the states, spending is within 10 percent of the U.S. average personal health care expenditure per capita. (See app. I.) Most of the states with the highest health spending are concentrated in the Northeast, Midwest, and Far West, while Southern and Rocky Mountain states tended to spend less than the U.S. average. (See fig. 1.) Personal health expenditures per capita in the state with the highest

[3]Lewin/ICF, a division of Health and Sciences International, Inc., "Per Capita Health Spending 1980-2000" in Emergency!: Rising Health Costs in America 1980-1990-2000, Families USA Foundation, October 1990. The Lewin/ICF estimates are not directly comparable with the 1982 HCFA state data because the Lewin/ICF estimates include the costs of administration of private insurance in addition to personal health care expenditures.

[4]For this reason, this study did not include the District of Columbia in its analysis. Spending by patients from Maryland and Virginia greatly inflates the District of Columbia's health spending per capita as reported by HCFA.

spending, Massachusetts, are nearly 80 percent more than the state with the lowest spending, South Carolina. Between 1982 and 1990, annual personal health expenditures per capita in the United States nearly doubled, from $1,220 to $2,255. During this period, the Lewin/ICF estimates indicate that the relative ranking of states in health spending remained similar to the ranking in 1982.

Figure 1: Personal Health Expenditures Per Capita, 1990



A Few Factors Explain Most Spending Differences

A small number of factors account for much of the variation in health care spending among states. State differences in personal income, the supply of health care resources (including the number of physicians and hospital and nursing home beds per capita), the concentration of hospital services in urban areas, and health status explain over 80 percent of the differences in health spending among the states in 1982. The estimated influence of each of these factors on individual state's personal health spending per capita, relative to the U.S. average, is illustrated in figure 2. Appendix II contains further details and technical information regarding our statistical analysis.

Personal Income

States with higher personal incomes per capita generally have higher personal health expenditures per capita. Personal income influences health spending in several ways. Individuals with higher personal incomes are more likely to receive comprehensive health insurance coverage through employment or other sources, thereby increasing the demand for health services. Also, they are more likely to spend more out of pocket for health care services when their insurance coverage is not complete. In addition, high wage rates may be reflected in higher personal incomes per capita, and high wage rates also may increase labor costs for the health industry.

The state rankings in personal income per capita reflect the strong relationship with health spending. Five of the 10 states with the highest personal incomes per capita in 1982 (California, Connecticut, Illinois, Massachusetts, and New York) are among the 10 states with the highest health spending per capita, while 6 of the 10 states with the lowest personal incomes per capita (Idaho, Kentucky, Mississippi, North Carolina, South Carolina, and Utah) are among the 10 states with the lowest health spending per capita.[5]

[5]Between 1980 and 1988, personal per capita income increased less quickly than per capita health spending. Nominal personal per capita income increased at an average annual rate of less than 7 percent, increasing most in the Northeast and least in the West, while nominal personal health expenditures increased by over 9 percent.

Figure 2: Estimated Influence of Factors on States' Personal Health Expenditures, 1982

State	Personal Income	Number of Physicians	Number of Hospital Beds	Number of Nursing Home Beds	Health Ranking	Urban Hospital Beds
1. Massachusetts	●	●				
2. California	●	●	○			●
3. New York	●	●				
4. Nevada	●		○			
5. Rhode Island	●		○			
6. Connecticut	●	●	○			
7. North Dakota		○	●			○
8. Illinois						
9. Missouri		○	●			
10. Michigan		○				
11. Pennsylvania						
12. Kansas			●			○
13. Ohio						
14. Maryland	●	●	○			
15. Minnesota			●		○	
16. Florida						
17. Hawaii		●	○		○	
18. Wisconsin						
19. Nebraska			●	●	○	
20. Colorado	●					
21. Alaska	●	○	○			○
22. Iowa		○	●	●		○
23. Washington			○			
24. Oregon		●	○			
25. South Dakota	○	○	●	●		○

● Factor increased state's personal per capita health expenditures by at least $50 above U.S. average.

○ Factor decreased state's personal per capita health expenditures by at least $50 below U.S. average.

Note: Table positions without a symbol indicate that the factor's influence on a state's personal per capita health spending relative to the U.S. average was less than $50 in 1982.

State	Personal Income	Number of Physicians	Number of Hospital Beds	Number of Nursing Home Beds	Health Ranking	Urban Hospital Beds
26. Delaware			○			
27. Tennessee	○	○	●			
28. New Jersey	●					●
29. Arizona	○		○			
30. Texas		○				
31. Louisiana		○				
32. Indiana	○	○				
33. Maine	○					○
34. Oklahoma		○				
35. West Virginia	○	○	●			○
36. Virginia						
37. Georgia	○	○				
38. Montana	○		●			○
39. Alabama	○	○	●			
40. Arkansas	○	○				○
41. New Hampshire			○		○	○
42. Vermont	○					○
43. Kentucky	○	○				○
44. North Carolina	○	○				○
45. New Mexico	○		○			○
46. Mississippi	○	○	●			○
47. Utah	○		○		○	
48. Wyoming	●	○	○			○
49. Idaho	○	○	○			○
50. South Carolina	○	○	○			

Health Resources

Health spending per capita increases with the size of a state's health infrastructure. Hospital and physicians' services account for approximately two-thirds of total personal health spending.[6] States with greater health resources, including physicians as well as hospital and nursing home beds, have higher health care spending on average. Some analysts have suggested that physicians are able to induce demand for their services and that an increase in the number of hospital beds increases the utilization of hospital services.[7] Additionally, states that have large medical centers, such as Massachusetts, may attract patients from other states. States that serve many out-of-state patients may have greater health resources and health spending per capita than states that do not attract many out-of-state patients.

In 1981, California had more physicians per capita than any other state—1.65 physicians per 1,000 population compared with a U.S. average of 1.24 per 1,000—and had the second highest personal health expenditures per capita. Similarly, North Dakota, which had more hospital beds per capita than any other state in 1982, ranked seventh in health spending per capita. In contrast, Alaska had less than 1 physician per 1,000 population and ranked 21st in health spending per capita in 1982 despite having the highest personal income per capita. Likewise, Utah and New Mexico were among the bottom 10th of states in both hospital beds and health spending per capita. As with hospital beds, the number of nursing home beds per capita affects health spending per capita positively, although less strongly.

[6]The 1980s witnessed a shift in the utilization of health care resources, partially attributable to the implementation of the prospective payment system (PPS). PPS, instituted in 1983, reformed Medicare's hospital reimbursement to a prospectively set fee schedule, encouraging a shift from inpatient to outpatient care. From 1980 to 1988, the number of hospital beds per 1,000 population fell by 13 percent. During the same time, the number of physicians per 1,000 population in the United States increased by nearly 18 percent. In 1990, hospital care accounted for 44 percent of total personal health care spending; physicians' services were the second largest component, consuming 21 percent of personal health care spending. Less than 10 percent of personal health care spending provided for nursing home care.

[7]See, for example, Jerry Cromwell, and J.B. Mitchell, "Physician Induced Demand for Surgery," Journal of Health Economics, 1986, Vol. 5, No. 4, pp. 293 to 313; and Milton Roemer, "Bed Supply and Hospital Utilization: A Natural Experiment," Hospitals, November 1, 1961.

Concentration of Hospital Services in Urban Areas

Per capita spending for health services in states with a large proportion of hospital beds in urban areas in 1982 was higher than states with relatively fewer urban hospitals.[8] Urban hospitals, however, may serve as a proxy for other factors that increase health spending, including higher poverty and violent crime rates, higher wages and costs of living, and greater proportions of technologically sophisticated health services and teaching hospitals. Federal policy provides another potential factor for higher spending in states with a greater share of urban hospital beds, but only after 1983. In that year, Medicare's PPS was introduced, and it included a differential for urban hospitals.

Health Status

Differences among the states in health outcomes, such as disability, mortality, and disease incidence rates, and personal behaviors influencing health, such as the prevalence of cigarette smoking, the violent crime rate, and motor- vehicle safety, also influence the level of a state's health spending per capita. Although higher health spending per capita may improve a state's health status over the long term, states with less healthy residents require more health services and have higher health spending in the near term than states with more healthy residents. The neighboring states of Nevada and Utah provide a dramatic contrast in health status and health spending. Nevada ranks very low in health, according to many behavioral and outcome measures, and it has the fourth highest health spending among the 50 states. Utah, however, ranks among the healthiest states and among the lowest in health spending. Although income and other factors also differ between Nevada and Utah, we estimate that the difference in health status accounted for over 20 percent of the difference in the two states' health spending per capita in 1982.[9]

[8]The proportion of hospital beds located in metropolitan areas increased only slightly during the 1980s, from 76 percent in 1982 to 78 percent in 1989. The trend toward more centrally located hospital services was strongest in the Northeast and South, while the Midwest and West had virtually no change.

[9]Health outcomes and health-related behaviors change very slowly. The advent of the AIDS epidemic during the 1980s, however, is an exception to this trend. Nationally, the cost of health care for people with AIDS consumes less than 2 percent of total health spending, but the proportion could be higher in states with disproportionate shares of AIDS cases. New York, Florida, New Jersey, California, Maryland, Texas, and Georgia accounted for two-thirds of AIDS cases reported in 1990, but less than 40 percent of the total U.S. population. Geographic regions also vary in hospital charges for AIDS patients. A recent study found that total charges per hospitalization from 1986 to 1987 for a patient with AIDS were higher than the national average in the South and Northeast, but below average in Western states. See Judy K. Ball, and Barbara J. Turner, "AIDS in U.S. Hospitals, 1986- 1987: A National Perspective," Hospital Studies Program Research Note 15, July 1991, Agency for Health Care Policy and Research, Department of Health and Human Services.

Factors That Did Not Explain Spending Differences Among the States

A number of other state factors, including the proportions of elderly and uninsured individuals, were not statistically significant factors in explaining state personal health expenditures per capita in our statistical model. Although states with a large elderly population may have higher personal health care spending relative to other states, this influence dissipates after controlling for variations in health rankings, the number of physicians, and the number of hospital and nursing home beds. Similarly, because uninsured individuals use fewer health services than insured individuals, states with large uninsured populations may tend to have lower health spending per capita. After controlling for a state's average personal income and other factors, however, the proportion of people uninsured does not have a distinguishable effect.

In addition, we did not find state border-crossing to be a statistically significant factor in accounting for per capita spending differences among the states. Some states, particularly those with large medical centers or adjoining a large metropolitan area in a neighboring state, attract many out-of-state patients. As previously discussed, HCFA calculates state personal health care expenditures by place of service rather than place of residence. "Exports" of health care services to other states' residents increase the provider states' health spending per capita in the 1982 HCFA data. In 1980, nearly one-fourth of the District of Columbia's total Medicare hospital charges resulted from net exports of hospital services to residents of other states. Tennessee was second highest with net exports accounting for 10 percent of total Medicare hospital charges, followed by North Dakota, Utah, Colorado, Missouri, and Nevada. In contrast, a large portion of Wyoming's Medicare beneficiaries received hospital care out of state, accounting for nearly 25 percent of Medicare hospital charges by Wyoming residents in 1980. Medicare recipients in Idaho and Vermont also received more than 10 percent of their hospital care from out-of-state providers. Although these state transfers of health services were not statistically significant in explaining state spending levels in our statistical analysis, this factor may be reflected in other variables, including the proportion of urban hospital beds and the number of physicians and hospital beds per capita.

Other Factors May Also Contribute to Spending Differences Among the States

Some factors that may influence state health spending differences were not included in our statistical model. In particular, more intensive styles of medical practice in some areas of the United States may increase health spending relative to other areas with less intensive medical practice styles, but this phenomenon is not easily measurable. Recent studies indicate that

large variations in medical practice styles exist even in demographically similar areas.[10] Studies attribute Massachusetts' high level of spending for hospital care in part to the intensity of medical care practiced in Massachusetts' teaching hospitals.[11]

Some factors that may influence health spending among the states today were less significant in 1982. For example, health maintenance organizations (HMOs) and other forms of managed care grew substantially during the 1980s. In 1982, less than 5 percent of the population was enrolled in HMOs. By 1989, HMO enrollment had nearly tripled. Yet the penetration of HMOs has been far from even: In California and Minnesota, HMOs enrolled 31 and 28 percent of the state populations, respectively, more than twice the national average. A recent study has identified states with high HMO enrollment as having lower rates of growth in hospital expenditures per capita between 1986 and 1989 than the U.S. average.[12]

State Policies Play a Limited Role in Reducing Spending Differences

In addition to the demographic, behavioral, and economic factors that influence health spending levels, states have implemented a number of policies, including policies to regulate hospital rates and encourage competition among health care providers, in an attempt to contain health care costs and spending. The lack of state level data on personal health spending since 1982 makes rigorously assessing the effectiveness of most of these policies difficult.

Any policy's effectiveness in reducing a state's health spending relative to other states is constrained by state differences in personal income and other influences outside of the health care system. Per capita spending in states with the highest personal incomes would probably still tend to be higher despite state policies. State policy may succeed in changing the strength of the relationship between income and health spending, but state differences in personal income and other nonpolicy factors will continue to be major determinants of health spending variations among the states.

[10]See John Holahan, Robert Berenson, and Peter G. Kachavos, "Area Variations in Selected Medicare Procedures," The Urban Institute, November 1989; and John E. Wennberg, Jean L. Freeman, Roxanne M. Shelton, and Thomas A. Bubolz, "Hospital Use and Mortality Among Medicare Beneficiaries in Boston and New Haven," The New England Journal of Medicine, Vol. 321, No. 17, October 26, 1989, pp. 1168-1173.

[11]See, for example, Alan Sager, Deborah Socolar, and Peter Hiam, "The World's Most Expensive Hospitals: One-fifth of Massachusetts Hospital Costs Appear Unjustified," Access and Affordability Monitoring Project, Boston University School of Public Health, February 1, 1991.

[12]Lewin/ICF, "Analysis of Hospital Expenditures and Revenues, 1979-1989," April 1991.

States can attempt to limit health care resources and personnel, a significant contributor to state variations in health spending, through health care professional licensing requirements and certificate of need (CON) programs for capital expansion of hospitals or nursing homes. Few states, however, have explicitly used licensing standards as a cost-containment tool, maintaining the requirements predominantly to enforce quality standards. Federal law in the 1970s required state development of CON programs, but federal requirements were dropped in 1986 once a consensus developed that CON programs were largely ineffective in reducing capital expansion and health spending.

State Rate Regulation and All-Payer Systems

Despite these constraints, most states have attempted to implement policies to control their health care spending. By the mid-1980s, 35 states had established hospital rate regulation programs. Many of these programs, however, provided only for voluntary review of hospital rates or targeted only Medicaid rates with little or no regulation of rates by other third-party payers. Only Maryland, New Jersey, New York, Massachusetts, Connecticut, and Washington maintained comprehensive mandatory rate regulation programs during the 1980s. Until 1982, only Maryland and New Jersey had all-payer systems that regulated hospital rates paid by all public and private health insurers; New York and Massachusetts joined Maryland and New Jersey in receiving federal waivers to include Medicare reimbursement in all-payer rate regulation in 1982.[13] Connecticut and Washington's mandatory rate regulation programs did not cover Medicare reimbursement.

All-payer and mandatory rate regulation programs appear to have succeeded in reducing hospital costs in the states that have implemented these programs. Studies document a 2- to 13-percent reduction in hospital costs from all-payer rate regulation programs, and other analysts also find hospital cost reductions from mandatory rate regulation programs.

Less consensus exists, however, on the effect of hospital rate regulation on overall health care spending. While stringent regulation programs may succeed in reducing hospital costs, some analysts argue that health spending in outpatient settings may increase in response. The increase in outpatient spending following the implementation of Medicare's PPS may support this cost-shifting response. Other analysts contend, however, that physician services may act as complements to hospital care rather than substituting

[13]In GAO's statistical analysis of 1982 per capita personal health care expenditures, only Maryland and New Jersey are categorized as all-payer systems for 1982. Other analysts have determined that only mature all-payer and mandatory rate regulation programs, in effect for at least 2 or 3 years, have significant results on hospital costs.

for hospital services; successful constraints on hospital spending, therefore, may be able to have significant reductions in overall health spending in a state.

We found evidence that all-payer and mandatory hospital rate regulation programs reduce a state's health spending per capita. After controlling for personal income and other factors, our estimates indicate that Maryland and New Jersey's personal health expenditures per capita were approximately $175 lower in 1982 than if they did not have an all-payer system.[14] (See app. II, table II.2.) These states and the other four states with mandatory hospital rate regulation programs also had an estimated reduction in health spending per capita of $80. (See app. II, table II.3.)

Other states, however, may not be able to achieve the apparent success of these mandatory rate regulation and all-payer systems. These policies have been enacted largely by Eastern states, several of which have among the highest health spending per capita in the United States. The reductions in overall health spending that we identified may also indicate the combined effects of other factors unique to these states, such as policies other than hospital rate-setting that these states have implemented.

States have recently addressed the problems of cost-containment and access to health services through a number of measures, including reforms of health insurance markets, innovative payment system strategies, and comprehensive health care system proposals. We have a forthcoming report that will discuss these state initiatives for increasing access to health care coverage and constraining health costs.

Conclusions

Personal health care expenditures per capita in most states are near the U.S. average. Most of the differences that exist among the states are explained by differences in personal income and other factors. Many of these factors would not be influenced by state policies to contain health costs, thereby limiting the ability of states to reduce their health spending per capita relative to other states. Some states' policies appear to have been effective in reducing health spending, notably mandatory and

[14]Only Maryland maintains a federal waiver from Medicare's PPS for an all-payer system. In order to maintain the waiver, states must demonstrate that overall Medicare outlays to hospitals are equal or less under the all-payer system than it would be under PPS. The criteria for a waiver is difficult for many states to meet because PPS specifically excludes reimbursement for uncompensated care, whereas most all-payer systems incorporate uncompensated care in their reimbursement. Although New York, New Jersey, and Massachusetts continued mandatory rate regulation programs after their federal waivers expired, the rigors of the federal waiver may impede state experimentation with all-payer systems.

all-payer hospital rate regulation systems, but in other states these policies may not be as effective or feasible. Other more recent policies cannot be evaluated because of the lack of data on state personal health care expenditures since 1982.

We are sending copies of this report to the Secretary of Health and Human Services and interested congressional committees. Copies also will be made available to others upon request.

Please call me on (202) 275-6195 if you or your staff have any questions about this report. Other major contributors are listed in appendix III.

Sincerely yours,

Mark V. Nadel
Associate Director, National and
Public Health Issues

Personal Health Expenditures Per Capita, by State, Using 1982 HCFA Data and 1990 Lewin/ICF ESTIMATES

Ranking	1982 HCFA data		1990 Lewin/ICF estimates[a]	
1	Massachusetts	$1,508	Massachusetts	$3,031
2	California	1,451	California	2,894
3	New York	1,417	New York	2,818
4	Nevada	1,380	Nevada	2,757
5	Rhode Island	1,351	Rhode Island	2,707
6	Connecticut	1,348	Connecticut	2,699
7	North Dakota	1,325	North Dakota	2,661
8	Illinois	1,308	Illinois	2,619
9	Missouri	1,285	Michigan	2,569
10	Michigan	1,281	Missouri	2,568
11	Pennsylvania	1,273	Kansas	2,548
12	Kansas	1,271	Pennsylvania	2,536
13	Ohio	1,247	Ohio	2,493
14	Maryland	1,232	Minnesota	2,480
15	Minnesota	1,229	Hawaii	2,469
16	Hawaii	1,228	Nebraska	2,452
17	Florida	1,228	Wisconsin	2,449
18	Wisconsin	1,219	Maryland	2,436
19	Nebraska	1,216	Florida	2,427
20	Colorado	1,209	Colorado	2,415
21	Alaska	1,187	Alaska	2,367
22	Iowa	1,176	Iowa	2,351
23	Washington	1,165	South Dakota	2,322
24	Oregon	1,165	Oregon	2,312
25	South Dakota	1,154	Washington	2,311
26	Delaware	1,153	Alabama	2,286
27	Tennessee	1,144	Delaware	2,268
28	New Jersey	1,115	Tennessee	2,262
29	Arizona	1,112	New Jersey	2,224
30	Texas	1,110	Arizona	2,211
31	Louisiana	1,106	Indiana	2,201
32	Indiana	1,101	Texas	2,192
33	Maine	1,091	Louisiana	2,185
34	Oklahoma	1,086	Maine	2,175
35	West Virginia	1,057	Oklahoma	2,139
36	Virginia	1,054	West Virginia	2,088
37	Georgia	1,048	Virginia	2,076
38	Montana	1,036	Georgia	2,072
39	Alabama	1,033	Montana	2,059
40	Arkansas	994	New Hampshire	1,981
41	New Hampshire	986	Vermont	1,956

(continued)

Ranking	1982 HCFA data		1990 Lewin/ICF estimates[a]	
42	Vermont	978	Arkansas	1,944
43	Kentucky	957	Kentucky	1,875
44	North Carolina	931	North Carolina	1,833
45	New Mexico	904	New Mexico	1,792
46	Mississippi	897	Utah	1,784
47	Utah	896	Wyoming	1,756
48	Wyoming	873	Mississippi	1,751
49	Idaho	868	Idaho	1,726
50	South Carolina	857	South Carolina	1,689
U.S. average		**$1,220**		**$2,425**

[a]The Lewin/ICF estimates are not directly comparable with the HCFA data because the Lewin/ICF estimates also include administrative costs for private insurance which are excluded from HCFA's data on personal health care expenditures. HCFA estimates that 1990 U.S. personal health expenditures per capita averaged $2,255.

Summary and Technical Description of GAO's Regression Analysis

We conducted a multiple regression analysis to identify factors that account for state differences in personal health care expenditures per capita. We used the Health Care Financing Administration's data on state personal health care expenditures per capita in 1982, the final year that HCFA collected such data, as the dependent variable. Personal health care expenditures include spending for hospital care, physician and dental services, drugs, eyeglasses, and nursing home care. In contrast to national health care expenditure data, personal health care expenditures do not include spending for public health programs, insurance administration, research, or construction of health facilities.

The relatively small number of observations in an analysis of state differences (50) limits the number of independent variables that it is prudent to include in the model. To preserve degrees of freedom, we estimated a simple model consisting of the variables generally considered to be most important in determining the level of expenditures. The seven independent variables used are summarized in table II.1. We used the standard ordinary least- squares technique, assuming a linear relationship between the independent and dependent variables, to obtain estimates of the coefficients in the multiple regression model. All seven parameter estimates were statistically significant at the 95-percent confidence level. Table II.2 summarizes these results.

We also estimated a second simple model replacing the dummy variable indicating states with an all-payer system (Maryland and New Jersey) with a dummy variable indicating states with mandatory rate regulation of third-party payers (Connecticut, Maryland, Massachusetts, New Jersey, New York, and Washington). This model provided coefficient estimates with the same sign and general magnitude as the first model; in addition, the coefficients are again statistically significant, including a significant negative coefficient for the rate regulation variable. (See table II.3.)

The all-payer and rate regulation variables raise several concerns. These dummy variables, which are intended to indicate the presence of an all-payer or mandatory rate regulation policy, may also serve as a proxy for other regulatory policies in these states. Because these states have implemented relatively stringent regulation of hospital rates, these same states may also be more likely to have imposed regulation on physicians, capital expansion, and other sources of health spending, but this could not be tested due to lack of data.

Also, although our statistical analysis suggests that these states' regulatory policies have effectively reduced health spending, the states that have implemented these policies are among the highest spending in the United States. Our analysis assumes that these policy variables are exogenous.[1] If, however, the rate regulation and all-payer variables are endogenous, the coefficient estimate may be biased. Other analysts, using reduced-form equations to estimate state personal health expenditures per capita, have concluded that coefficient estimates for mandatory rate regulation are negative and significant whether they are considered to be endogenous or exogenous; considering mandatory rate regulation as an endogenous variable leads to a slightly larger parameter estimate of the effects of regulation than if it is considered to be an exogenous variable, as we have done.[2]

To allow for possible nonlinearities, we also estimated an ordinary least-squares equation in logarithmic form. Coefficient estimates in this form also have the advantage of being interpreted as elasticities, illustrating the percentage change in health expenditures resulting from a 1-percent increase in the independent variable. In this specification, the nursing-home-bed variable lost its significance at the 95-percent confidence level; the other variables remained significant and had the expected signs. (See table II.4.)

Although the small number of observations (50 states) compelled us to specify a simple regression model with relatively few variables, we also estimated a more complete model with seven additional possible sources of interstate variation in health spending. (These variables are identified in table II.5.) These additional variables were not significant when they were included with the seven variables in the simple model; the nursing-home-bed and urban hospital variables also lost their significance when the additional variables were included. The additional variables add very little explanatory power, as measured by the adjusted R-squared. These results are summarized in table II.6.

Since the HCFA data for state health spending are from 1982, we also estimated a statistical model based on the Lewin/ICF estimates of personal health expenditures per capita by state in 1990. The Lewin/ICF estimates

[1]The ordinary least-squares technique assumes that the endogenous dependent variable is a function of exogenous independent variables. If, however, an independent variable is also endogenous—that is, it is determined simultaneously with the dependent variable—then ordinary least-squares result in biased parameter estimates for the endogenous explanatory variable.

[2]See Joyce A. Lanning, Michael A. Morrisey, and Robert L. Ohsfeldt, "Endogenous Hospital Regulation and Its Effects on Hospital and Non-hospital Expenditures," Journal of Regulatory Economics, June 1991, Vol. 3, No. 2, pp. 137-154.

are calculated based on recent Medicare and Medicaid data, overall U.S. health spending, and state demographic features, adjusting for the 1982 HCFA data on personal health expenditures by state. Regression analysis of constructed data can lead to biased coefficient estimates, and therefore, the Lewin/ICF data should be interpreted with caution. The coefficient estimates from the regression analysis of the 1990 Lewin/ICF estimates have the same signs and roughly the same magnitude as those in the 1982 simple model. Health ranking, physicians per 1,000 population, and hospital beds per 1,000 population are no longer significant at the 95-percent confidence level. These results are summarized in table II.8.

Table II.1: Variables Included in GAO's Statistical Analysis of 1982 HCFA Data

Dependent variable	
HCE	Personal health care expenditures per capita, by state, 1982, HCFA.
Independent variables	
INC	Personal income per capita, by state, 1982, U.S. Department of Commerce, Bureau of Economic Analysis.
PHYS	Active, nonfederal physicians per 1,000 population, by state, 1981, American Medical Association.
HOSP	Community hospital beds per 1,000 population, by state, 1982, American Hospital Association.
NURS	Nursing home beds per 1,000 population, by state, 1980, National Center for Health Statistics.
HLTH	State health rankings, 1990, Northwestern National Life Insurance Company.[a]
URB	Percentage of community hospital beds located in metropolitan areas, 1982, calculated from American Hospital Association data.
ALLPAY	States with all-payer rate regulation systems (MD and NJ), 1982.
REG	States with mandatory rate regulation (CT, MD, MA, NJ, NY, and WA), 1982.

[a]Northwestern National Life Insurance Company's state health rankings are constructed from both behavioral and health outcome factors in five categories: lifestyle, access, disability, disease, and mortality. The state health rankings are estimated from data ranging from 1980 to 1990. GAO assumes that relative differences between the states in the health rankings change only over the long-term; to the extent that the relative state scores would differ for the year analyzed (1982), the regression analysis would tend to understate the influence of health status on per capita health spending.

Table II.2: Multiple Regression Estimates Simple Model, Linear Form

Dependent variable: Personal health care expenditures per capita, 1982

Variable	Estimated coefficient	Standard error	T-statistic	Mean value
INC	0.05	0.01	7.27[b]	$10,743.70
PHYS	344.23	66.82	5.15[b]	1.16
HOSP	74.56	12.35	6.04[b]	4.37
NURS	10.91	4.92	2.22[a]	6.75
HLTH	-3.05	1.16	-2.64[a]	101.96
URB	2.97	0.51	5.88[b]	63.66
ALLPAY	-174.83	47.92	-3.65[b]	0.04
CONSTANT	-28.12	127.40	-0.22	-

Mean of dependent variable: $1,144.80
Number of observations:50
Adjusted R-squared: 0.85
F-statistic: 40.80

[a]Significant at a 95-percent confidence level.

[b]Significant at a 99-percent confidence level.

Table II.3: Multiple Regression Estimates Simple Model, Linear Form

Dependent variable: Personal health care expenditures per capita, 1982

Variable	Estimated coefficient	Standard error	T-statistic	Mean value
INC	0.05	0.01	6.53[b]	$10,744.70
PHYS	384.17	78.05	4.92[b]	1.16
HOSP	68.94	13.37	5.16[b]	4.37
NURS	14.98	5.32	2.82[b]	6.75
HLTH	-3.60	1.27	-2.84[b]	101.96
URB	2.85	0.55	5.19[b]	63.66
REG	-78.21	36.90	-2.12[a]	0.12
CONSTANT	-5.67	140.32	-0.04	-

Mean of dependent variable: $1,144.80
Number of observations: 50.
Adjusted R-squared: 0.82
F-statistic: 33.34

[a]Significant at a 95-percent confidence level.

[b]Significant at a 99-percent confidence level.

Table II.4: Multiple Regression Estimates Simple Model, Logarithmic Form

Dependent variable: Log (personal health care expenditures per capita, 1982)

Variable	Estimated coefficient	Standard error	T-statistic	Mean value
Log (INC)	0.54	0.07	7.40[b]	9.27
Log (PHYS)	0.33	0.08	4.29[b]	0.13
Log (HOSP)	0.28	0.05	5.30[b]	1.45
Log (NURS)	0.05	0.03	1.60	1.85
Log (HLTH)	-0.28	0.12	-2.39[a]	4.62
Log (URB)	0.10	0.02	4.40[b]	-0.54
ALLPAY	-0.14	0.05	-2.91[b]	0.04
CONSTANT	2.85	0.84	3.41[b]	

Mean of dependent variable: 7.03
Number of observations:50
Adjusted R-squared: 0.81
F-statistic:31.57

[a]Significant at a 95-percent confidence level.

[b]Significant at a 99-percent confidence level.

Table II.5: Additional Variables Included in GAO's Statistical Analysis of 1982 HCFA Data

Independent variables	
INS	Uninsured persons as a percentage of state population, 1980, Lewin/ICF calculations based on 1980 and 1987 Current Population Survey.
ELD	Persons aged 65 years or older as a percentage of state population, 1982, U.S. Department of Commerce, Bureau of the Census.
PRIM	Primary care physicians as a percentage of all active, nonfederal physicians, 1985, Health Resources and Services Administration.
PUBL	State and local hospital beds as a percentage of all short-term community hospital beds, 1982, calculated from American Hospital Association data.
MCD	State per capita Medicaid expenditures, 1980, calculated from HCFA data.
OCC	Hospital occupancy rate, 1982, calculated from American Hospital Association data.
IMP	Medicare imports-to-exports ratio (ratio of place of residence to place of service Medicare hospital charges), 1980, HCFA.

Table II.6: Multiple Regression Estimates Complete Model, Linear Form

Dependent variable: Personal health expenditures per capita, 1982

Variable	Estimated coefficient	Standard error	T-statistic	Mean value
INC	0.04	0.01	4.57[b]	$10,743.70
PHYS	278.23	99.71	2.79[b]	1.16
HOSP	54.26	19.44	2.79[b]	4.37
NURS	8.18	6.39	1.28	6.75
HLTH	-4.23	1.39	-3.03[b]	101.96
URB	1.96	1.16	1.68	63.66
ALLPAY	-116.40	56.95	-2.04[a]	0.04
INS	-8.32	4.47	-1.86	10.92
PRIM	1.07	3.89	0.28	32.44
ELD	2.90	7.87	0.37	11.28
PUBL	0.04	0.83	0.05	22.20
MCD	0.98	0.80	1.22	$36.98
OCC	-1.55	3.23	-0.48	73.53
IMP	-5.02	3.10	-1.62	101.85
CONSTANT	989.88	580.26	1.71	

Mean of dependent variable: $1,144.70
Number of observations:50
Adjusted R-squared: 0.86
F-statistic:21.68

[a]Significant at a 95-percent confidence level.

[b]Significant at a 99-percent confidence level.

Table II.7:Variables Included in GAO's Statistical Analysis of 1990 Lewin/ICF Estimates

Dependent Variable	
HCE90	Estimates of personal health care expenditures per capita, by state, 1990, Lewin/ICF.
Independent variables	
INC	Personal income per capita, by state, 1988, U.S. Department of Commerce, Bureau of Economic Analysis.
PHYS	Physicians per 1,000 population, by state, 1989, American Medical Association.
HOSP	Hospital beds per 1,000 population, by state, 1989, American Hospital Association.
NURS	Nursing home beds per 1,000 population, by state, 1989, American Association of Retired Persons.
HLTH	State health rankings, 1990, Northwestern National Life Insurance Company.
URB	Percentage of community hospital beds located in metropolitan areas, 1989, calculated from American Hospital Association data.
REG	States with mandatory rate regulation of third-party payers (CT, MD, MA, NJ, NY, and WA), 1989.

Table II.8: Multiple Regression Estimates Simple Model, Linear Form

Dependent variable: Personal health care expenditures per capita, 1990 Lewin/ICF estimates

Variable	Estimated coefficient	Standard error	T-statistic	Mean value
INC (1988)	0.07	0.02	3.45[b]	$15,572.04
PHYS (1989)	269.15	144.83	1.85	1.77
HOSP (1989)	62.68	62.77	1.00	3.50
NURS (1989)	47.14	19.00	2.48[a]	6.93
HLTH (1990)	-5.39	4.35	-1.24	101.96
URB (1989)	4.20	1.98	2.12[a]	65.94
REG (1990)	-294.19	135.64	-2.17[a]	0.12
CONSTANT	553.02	480.40	1.15	

Mean of dependent variable: $2,284.32
Number of observations:50
Adjusted R-squared: 0.60
F-statistic:11.55

[a]Significant at a 95-percent confidence level.

[b]Significant at a 99-percent confidence level.

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