Medicare Costs in Urban Areas and the Supply of Primary Care Physicians

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Background. The supply of primary care physicians may be important determinants of health care costs. We examined the association between primary care physician supply and geographic location with respect to variation in Medicare Supplementary Medical Insurance (Part B) reimbursement.

Methods. We performed an analysis of data from all US metropolitan counties. Physician supply data were derived from the American Medical Association Masterfile. Medicare Part B reimbursements and enrollment data came from the Health Care Financing Administration. Physician supply was calculated for family practice, general practice, general internal medicine, and non–primary care specialties. Linear regression was used to test the association of physician supply and Medicare costs and to adjust for potential confounding variables.

Results. The average Medicare Part B reimbursement per enrollee was $1283. After adjusting for local price differences and county characteristics, a greater supply of family physicians and general internists was significantly associated with lower Medicare Part B reimbursements. The reduction in reimbursements between counties in the highest quintile of family physician supply and the lowest quintile was $261 per enrollee. In contrast, a greater supply of general practitioners and non–primary care physicians was associated with higher reimbursements per enrollee.

Conclusions. These results add to the evidence that an increased supply of primary care physicians is associated with lower health care costs. If this association is causal, it supports the theory that increasing the number of primary care physicians may lower health care costs.

Key words. Physicians, family; primary health care; health care costs; Medicare. (*J Fam Pract 1996; 43:33-39*)

Much has been written recently about the specialty distribution of physicians in the United States and its effect on health care costs. One recent editorial called the specialty distribution "the invisible driver of health care costs."[1] Of all the developed nations, the United States has the lowest proportion of primary care providers in its medical workforce and the highest health care costs. Some people believe that part of the answer to the problem of high medical care costs is to increase the proportion of primary care physicians.[2,3]

There are several mechanisms by which increases in the primary care workforce, as well as increased access to and use of primary care, may reduce medical costs. Early detection of illness and primary prevention through primary care may prevent subsequent serious, catastrophic, and often expensive illnesses.[4,5] Primary care physicians may provide services similar to those of specialists at a lower cost. Finally, primary care physicians may act as either formal or informal "gatekeepers," potentially reducing inappropriate use of specialists.[6] Several studies have shown that primary care physicians, particularly family physicians, use comparatively fewer medical resources.[7-16] A recent study comparing metropolitan statistical areas (MSAs) showed an inverse association between Medicare physician reimbursement and the proportion of primary care physicians in a given area.[17] This

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study, however, did not adjust for differences other than physician supply among MSAs and did not differentiate among different types of primary care physicians.

To examine the association between physician supply and Medicare expenditures from a system-wide perspective and to generalize from the findings of other studies, we decided to examine aggregate professional services expenditures, Medicare supplementary insurance reimbursements (Part B) in different urban geographic areas of the United States, and their association with the supply of physician specialty groups.

Methods

Data

The primary data source for this analysis is the Area Resource File (ARF), a data source that combines information from several different data sources, making county-level data available for almost every county in the United States.[18]

The ARF derives estimates of physician supply for the entire United States from the 1990 American Medical Association Masterfile. The AMA surveys physicians annually for practice specialty, major professional activity, and location of practice. Practice specialties are self-designated by the respondents. Nonfederally employed physicians involved in patient care but not in fellowship or residency programs were included in this analysis. Physicians were categorized into four types, based on their first-listed specialty: family practice (FP), general practice (GP), general internal medicine (GIM), and all other non–primary care physicians. The ARF assigns physician supply at the county level; however, because the availability of physicians in urban areas might better be assessed by the number of physicians in the aggregate of counties comprising an MSA, we combined counties to generate physician supply for an entire MSA. Each county was assigned physician supply values for the MSA in which it was located.

The ARF also provides per-county Medicare enrollment numbers, reimbursements for hospital insurance (Part A), and supplementary medical insurance (Part B). Part B represents physician services and other outpatient services and supplies covered by Medicare. These reimbursements are attributed to the counties of the enrollees' residence, not the county of the provider. About 70% of Part B reimbursements goes to physicians and suppliers, and 20% goes to outpatient facilities. Much smaller amounts are allocated to independent laboratories and home health agencies.[19] County reimbursements were divided by the number of Part B enrollees in each county. We did not use Part A reimbursements because there were no data available to adjust for local price differences.

Other variables used in the analysis that were available from the ARF or the US census were county-level demographic characteristics, including age, sex, race, income, percentage of households headed by women, percentage of college graduates, percentage of owner-occupied housing, and unemployment rate. In addition, we included variables to account for possible regional differences and population size differences among MSAs, the presence of a medical school within the MSA, and the number of short-term hospital beds per capita in the MSA.

Regional differences in Medicare prices were accounted for by using the 1984 Medicare Prevailing Charges Index, which is an overall measure of a county's Medicare charges compared with the national average. It is based on charges for procedures that comprise the top 85% of Part B expenditures at the national level. Assuming that the proportions of different services between counties are roughly constant and that price differences of the procedures included in the index are representative of prices not included in the index, the index provides a weighting factor by which a county's Medicare reimbursements can be adjusted for local price differences. This variable was obtained from the ARF.

Analysis

Although physician supply and certain other variables were aggregated at the MSA level, the unit of analysis in this study is the county, which allows for the use of more specific county-level data available for many of the covariates. The analysis included 738 counties that are part of the 322 MSAs. The dependent variable was Medicare Part B reimbursements per enrollee. The regression was performed in two steps using ordinary least-squares. In the first step, the dependent variable was regressed on patient age (<65, 65 to 74, 75 to 84, and ≥ 85 years) and sex categories and the Medicare price index. In the next step, the dependent variable was regressed on the physician supply variables for the three primary care physician types and all other non–primary care physicians, county socioeconomic characteristics, and the predicted values of Medicare reimbursement based on the first-step regression. This technique allows the age, sex, and price index variables to account for variation before any of the other variables, resulting in conservative estimates of the association between the dependent variable and the variables included in the second step. We weighted the regressions using a factor of the square root of the county population to account for the population size of each county.

Table 1. Medicare Part B Reimbursement Levels and Physician Specialty Distribution by Specialty Groupings

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value	% of Total Physicians
Medicare Part B, $	1283	277	572	2267	—
Physicians per 100,000					
Family practice	14.6	6.05	4.23	47.65	8.0
General practice	7.9	3.23	2.03	26.69	4.4
General internal medicine	23.3	9.98	5.22	124.0	12.9
Non–primary care	135.5	40.4	35.5	719.5	74.7

NOTE: *Analysis includes 738 US counties in 322 metropolitan statistical areas.*

Results

Table 1 shows several summary descriptive statistics generated from the data. The mean primary care supply was 15, 8, and 23 physicans per 100,000 population for FP, GP, and GIM, respectively. There was, however, great variation between MSAs in the supply of each physician type. For example, Orange County, New York, had the lowest per capita supply of FPs at 4 per 100,000 population, and Sioux Falls, South Dakota, had the highest at 48 per 100,000 population. This is more than a 10-fold difference. There was no significant correlation between the number of FPs or GPs per population and non-primary care physicians per population (r=−.18, r=.16, respectively). The number of GIMs per population correlated highly with the supply of non–primary care physicians (r=.85). Thus, the supply of GIMs across MSAs in the United States is strongly associated with the supply of non–primary care physicians. The supply of FPs and GPs is not related to the supply of non–primary care physicians.

A graph of unadjusted Medicare Part B costs per enrollee by different specialty supply shows a strong negative relation between medical care costs and the supply of FPs (Figure). Medicare Part B reimbursement per enrollee in the lowest FP supply population quintile was $1430, and in the highest FP supply population quintile, $1050. The positive association between costs and the supply of GIMs closely mirrors that of other non–primary care physicians, reflecting the previously noted high correlation between GIMs and other physicians.

Table 2 shows all the regression coefficients for the physician supply variables and other covariates except for the variables previously adjusted for: age, sex, and price index. The coefficients are negative and significant for both FP supply and GIM supply, indicating that Medicare Part B reimbursements per enrollee are lower in areas with greater numbers of FPs and GIM physicians, after adjusting for the supply of other physicians and county demographic and socioeconomic characteristics. Note that the direction of association for GIM is now reversed from the association evident in the figure because of the apparent confounding caused by the high correlation between GIM and non–primary care physician supply. The coefficients are positive for GPs and all other non–primary care physicians. Because the numbers of GPs are much smaller than the number of FPs and GIMs, combining all three primary care specialties into one variable produces a negative coefficient substantially close to the coefficients for FPs and GIMs.

Multiplying the coefficients for physician supply by filling in representative numbers helps clarify the magnitude of the coefficients and the difference between the adjusted analysis and the crude analysis. The difference in supply between the lowest quintile of family physician supply (7.2 FP/100,000) and the highest quintile (24 FP/100,000) results in an adjusted difference of $261 expenditures per enrollee. This is less than the $380 observed in the unadjusted analysis, indicating some confounding effects caused by socioeconomic characteristics of the counties and other physician supply variables. In the complete model, which includes all variables and the first-step regression, the adjustments for age, sex, and

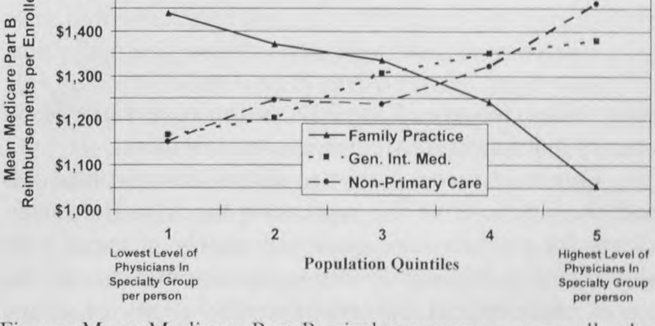

Figure. Mean Medicare Part B reimbursements per enrollee by supply of different specialty groups in US metropolitan counties. Counties are aggregated differently for each specialty group. Each quintile represents approximately 39,000,000 persons.

Table 2. Second-Stage Regression Results for Medicare Part B Reimbursements per Enrollee

Variable	Regression Coefficient	Standard Error	*P* Value
Physicians per 100,000 population			
Family practice	−15.6	1.35	<.001
General practice	14.2	2.53	<.001
General internal medicine	−15.1	1.77	<.001
Nonprimary care	3.39	0.37	<.001
Region*			
Mid-Atlantic States†	−11.9	31.5	NS
South Atlantic‡	10.8	36.0	NS
East North Central§	−0.5	32.0	NS
East South Central¶	−93.8	42.6	.028
West North Central//	−50.3	40.9	NS
West South Central**	5.4	40.8	NS
Mountain††	−89.8	42.3	.034
Pacific‡‡	−157.6	40.0	<.001
Race ethnicity, %			<.001
White	6.7	1.5	
Black	8.2	2.0	<.001
Hispanic	1.6	0.9	NS
% Owner-occupied housing	2.4	1.2	.045
% Female headed households	−75.9	13.2	<.001
% Families with married heads of household	−76.1	12.2	<.001
Per capita income ($1000)	13.2	2.7	<.001
% Unemployed in 1990	34.7	5.3	<.001
% College graduates (age ≥25 y)§§	−0.57	1.7	NS
Medical school in MSA	−33.2	18.6	NS
Short-term hospital beds per 1000 population in MSA	−0.0	0.9	NS
MSA population¶¶			
<250,000	−148.6	30.2	<.001
≥250,000–500,000	−87.1	26.7	.001
>500,000–1,000,000	−76.3	21.4	<.001
>1,000,000–2,000,000	−63.7	18.8	.001

**Reference: New England states (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut).*
†New York, New Jersey, Pennsylvania.
‡Delaware, Maryland, Washington, DC, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida.
§Ohio, Indiana, Illinois, Michigan, Wisconsin.
¶Kentucky, Tennessee, Alabama, Mississippi.
//Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.
***Arkansas, Louisiana, Oklahoma, Texas.*
††Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada.
‡‡Washington, Oregon, California, Alaska, Hawaii.
§§Bachelor's degree or above.
¶¶Reference: MSA population > 2,000,000.
MSA denotes metropolitan statistical area.

price index accounted for 71% of the total variation in county differences in Medicare reimbursements.

Our results were robust to several different methods and formulations of the regression models. The coefficients for primary care physician supply changed only slightly using different county socioeconomic characteristics as adjusters and different functional forms for several variables. Using county-level estimates of physician supply rather than MSA level estimates did not qualitatively change the results. When we included physicians in residency training programs in the analysis, the correlation between GIM supply and all other non–primary care physicians increased to over .95. This caused collinearity problems: the independent association of GIM supply on costs was unstable and would vary widely depending on the specific model. The association between reimbursements and FPs and GPs, however, was essentially unchanged.

In contrast to an analysis that includes all variables in one regression, our method of performing successive regressions is a conservative method of testing the association of physician supply on costs because it allows the variation in medical costs to be attributed first to age and sex differences and the Medicare price index. When the analysis was repeated with all variables included in one model, there were no major differences in the direction and magnitude of the coefficients of the physician supply variables.

Discussion

Our results show lower expenditures per Medicare Part B enrollee in metropolitan areas with greater population densities of FPs and GIMs. This association is apparent for GIMs only after adjusting for the supply of other non–primary care physicians, age distribution, local differences in Medicare charges, and several other socioeconomic and health factors that are thought to be related to medical care utilization.

Our findings confirm and extend those of other researchers who have usually grouped primary care physicians. These results are consistent with those of Welch et al,[17] who showed lower Medicare physician expenditures in MSAs with a greater proportion of primary care physicians. Our categorization into separate primary care specialties, however, shows that this geographic effect is associated with the geographic distribution of FPs. Because the supply of GIMs is highly correlated with the non–primary care physician supply, a higher number of GIM physicians is usually accompanied by a higher number of all non–primary care physicians: the proportion is relatively constant. Therefore, differences between geographic regions in the proportion of primary care physicians are largely attributable to differences in FP supply. This study also shows that the association remains after adjusting for several confounders.

These results are also consistent with those of Dor and Holahan,[20] although their study also grouped FPs and GPs and included rural areas. Although rural and urban areas have the greatest contrast of physician specialty distributions, unmeasured cultural, economic, and other differences between urban and rural areas might explain some of the Dor and Holahan findings. Our results replicate their findings in urban areas, which are more homogeneous with respect to these characteristics.

Our results and those of others could be explained by incomplete control of confounding variables, such as case mix or health-seeking behavior characteristics; eg, areas with a greater supply of primary care physicians might be areas where medical utilization would have been less anyway. Although we adjusted for county demographic and socioeconomic characteristics, these characteristics only partially predict the propensity to use or need medical care. It is still possible that more thorough adjustment of confounding for these characteristics could cause the association to weaken further. If specialist non–primary care physicians locate preferentially in areas with people who are sicker or who otherwise wish to consume more health care, and if primary care physicians locate preferentially in areas with healthier people, we might expect to see a strong negative correlation between the two supply measures. As described previously, however, the correlation of GIM physicians and specialty non–primary care physicians is highly positive, and the correlation of FPs to specialty non–primary care physicians is only slightly negative. Other investigators have managed this potential problem with two-stage regression models in an attempt to adjust the physician supply variables to account for this bias.[20,21] In these other studies, the association between primary care physician supply and expenditures or medical care utilization remained negative. Differences in population factors related to physician expenditures would have to be great enough to account for the nearly 40% greater expenditures per Medicare enrollee in areas with the lowest quintile of FP supply, compared with the highest quintile of FP supply in the unadjusted analysis.

Ecologic analyses such as this may be flawed by the ecological fallacy, wherein associations observed at a group level are not observed at the individual level, most often due to unmeasured confounding variables. There could be some systemic factor that causes differences in both physician supply distribution and Medicare reimbursements. The causal interpretation of the results is further limited by the cross-sectional nature of the data. In certain instances, however, the phenomenon under study might truly be considered an ecologic or environmental variable, and the corresponding individual level analysis is not clearly defined. Such might be the case in this analysis. Comparing how specialists and primary care physicians in one setting treat patients presenting with a single condition such as heart disease, as has been done with individual level data, is a different type of study than observing how patients with heart disease and other conditions might be treated in environments where there is a greater or lesser number of primary care physicians. Individual level studies also may fail to detect inefficiencies in the medical care system, such as when patients see specialists for primary care problems.

Although our analysis suggests that an increased supply of primary care physicians is associated with lower medical costs, several questions remain. Our analysis does not reveal the mechanisms by which this cost-lowering occurs. As stated in the introduction, the causes could be (1) early detection and prevention of serious illness, (2) substitution for specialist care, and (3) gatekeeping. More detailed studies are needed to examine these issues. Recently, Bindman and associates[22] have shown a relationship between perceived access to care and hospitalization rates for certain conditions, suggesting that primary care might prevent expensive hospitalization. Escarce[21] also found a negative relationship between the supply of primary care physicians and the utilization of certain surgical services, suggesting that primary care physicians provide an alternative source of care that reduces surgical utilization.

The mechanisms may be less direct, however. Areas with greater numbers of primary care physicians may be the same areas in which managed care or utilization review has been more effective in reducing costs. Alternatively, areas with organizations that reduce costs may have recruited or retained more primary care physicians. Currently, Medicare is not a managed care system, and in order to explain our results, these behaviors would have to carry over into the Medicare population. Regardless, primary care physicians are a crucial link. Our study shows what the potential aggregate effect of these separate mechanisms might be; however, it is important to realize that the associations we found are only for Medicare patients in urban areas and for Part B reimbursements.

The opposite association of GP supply and costs is somewhat difficult to interpret because GPs could conceivably provide similar primary care services. Physicians self-designated as GPs are, however, most likely non–board-certified, older physicians who may not provide the full breadth of services offered by those who designate themselves as FPs or GIMs. Regardless of the mechanisms by which FPs and GIMs affect medical costs, GPs may not be as effective. At any rate, the number of GPs is dwindling and their impact on future health policy may soon be moot.

It is not surprising that the supply of other physicians has a relatively smaller positive effect on Medicare costs, as Welch et al[17] also found no effect of overall physician supply on Medicare physician reimbursements. The definition of market area boundaries for physician services is necessarily arbitrary, and non–primary care physicians are more likely than primary care physicians to provide services to patients outside their local community. Thus, in areas with high concentrations of non–primary care physicians, it is more likely that these physicians are serving many patients living outside the MSA rather than having greatly increased patient volume or intensity of services within the area.

Although our study shows an association between primary care physician supply and medical care costs, it does not address the question of health care outcomes. Health outcomes were not the objective of the study, and it would be difficult to address this issue without data on baseline and follow-up health status in different areas. However, if increased primary care services reduce cost by preventing illness, health care outcomes and status are presumably improved. If substitution for specialists or gatekeeping is the mechanism, then the effect on health outcomes depends on the types of specialist services that are being kept from patients. However, if health care outcomes are equivalent and the association of primary care physician supply and health care costs is causal, policies that attempt to increase the number of primary care physicians may improve the efficiency of the US health care system.

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