
Access to Care Under Physician Payment Reform: A Physician-Based Analysis

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This article reports physician-based measures of access to care during the 3 years surrounding the 1989 physician payment reforms. Analysis was facilitated by a new system of physician identifiers in Medicare claims. Access measures include caseload per physician and related measures of the demographic composition of physicians' clientele, the proportion of physicians performing surgical and other procedures, and the assignment rate. The caseload and assignment measures were stable or improving over time, suggesting that reforms did not harm access. Procedure performance rates tended to decline between 1992 and 1993, but reductions were inversely related to the estimated fee changes, and several may be explainable by other factors.

INTRODUCTION

In 1993, the Health Care Financing Administration (HCFA) created a new physician-level claims file with Medicare payment research needs in mind—particularly the study of access impacts of physician payment reforms instituted in 1992 (Gornick, 1993). Much access research takes a patient or delivery system perspective. In contrast, physician-based analysis offers insight into certain supply behaviors that can dominate observed access outcomes. A well-known example is the poor access of Medicaid recipients to private-office physician services, where external fee levels exceeded those of the public pro-

gram (Perloff, Kletke, and Neckerman, 1987). But conducting physician-based analyses has often entailed expensive primary data collection, foreclosing the option of "routine" monitoring and tracking. The arrival of Medicare's unique physician identifiers, combined with advances in claims availability afforded by Medicare's National Claims History (NCH), has made periodic monitoring relatively simple and efficient.

This article presents results of ongoing monitoring studies prompted by physician payment reform.¹ The studies are one element of a larger HCFA evaluation effort that takes a variety of analytic approaches. After reviewing the key elements of the reform, this article presents the analytic concepts underlying the physician-based analyses. Then the administrative background of the new physician identifiers is summarized, as is the process we used to assemble a sample of physicians for study. Following an overview of the analytic and statistical methods, we present the findings. They concern changes in several key access indicators during a 3-year period surrounding the implementation of the new payment policies. This study illustrates the unique perspectives a physician-based analysis can add to the access-monitoring effort.

BACKGROUND

Elements of Physician Payment Reform

Physician payment reform occasioned an obvious need for access monitoring. The policy's centerpiece is a schedule of

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¹Some of the findings reported here have been part of Congressionally mandated studies performed by HCFA and reported in Meadow (1994) and (1995).

prices for physician services based on resource-based relative values (RBRVs). No longer would Medicare payments be based on individualized physician fees. Pre-reform Medicare payments for a given service varied widely, particularly across geographic areas and physician specialties. Congress concluded that, over time, fees for some technically oriented services, such as certain surgeries, had risen excessively, and that physicians in some areas and specialties were under-compensated. A schedule of national fees, adjusted for differences in local costs, was intended to ameliorate fee inequities and facilitate control of physician expenditure growth. For some individual physicians, this could mean sharp changes in the Medicare reimbursement for some services. It could also mean a realignment of fees under which Medicare payments might be lower than other payers' fees. The fee changes led to concern that Medicare beneficiaries might be turned away by physicians unwilling to provide services at the new prices (Physician Payment Review Commission, 1991).

Another element of reform was restrictions on billing for amounts above the Medicare-determined fee. Although individualized "balance-billing" limits date back to 1987, in 1991 a new limiting charge began phasing in. By 1993, a uniform constraint was in effect, whereby a non-participating physician could charge no more than 109.25 percent of the fee schedule amount. The balance-billing limit reportedly caused a sizable decline in Medicare revenues for some physicians (American Medical Association, 1994). The limits were thus another source of concern that some physicians might restrict their Medicare caseloads.

A final feature of the policy change was volume performance standards, which tied the size of fee updates to conformance

with preset target rates of growth in Medicare physician expenditures. This mechanism was intended to facilitate control of Medicare outlays while providing incentives to the medical profession to provide services more efficiently and appropriately (Physician Payment Review Commission, 1994).

Analytic Concepts and Their Measurement

In a precursor to the present studies, McCall (1993) outlined a number of access measures from the provider perspective and placed them in a theoretical framework traceable to the work of Aday and Anderson (1975) and others. The framework, which has been adopted by recent analysts of Medicare access (Gillis, Lee, and Willke, 1992; Gornick, 1993; Lee and Gillis, 1993; Physician Payment Review Commission, 1993), posits two basic dimensions of access—potential access and realized access. Potential access concepts refer to structural characteristics of the health care environment that set conditions for access. Potential access also includes health and socioeconomic population characteristics that influence people's use of care. Realized access is captured by measures of a population's actual service utilization, taking into account underlying need for care.

Potential access measures predominate in our physician-based studies. Two fundamental ones are caseload per Medicare physician and related measures of the demographic composition of physicians' clientele. Although caseload size is closely related to utilization, we interpret changes in caseload as an indicator of physicians' willingness to see Medicare patients, and therefore a reflection of potential access. In the physician sample

claims, we measure caseload by the number of unique beneficiary identifiers associated with a given physician.² Thus, a patient is counted as a distinct individual each time he or she participates in a patient relationship with a different sample doctor within a year.³

Physician performance of detailed classes of procedures may proxy an aspect of supply for the Medicare population and, therefore, is included under potential access. We define the performance rate as the proportion of the sample delivering at least one procedure in a category in a year. When analyzing a fixed panel of physicians, this is reported as a change in the percent of physicians performing in the category.

An additional concept of potential access is the assignment rate, which reflects financial burdens encountered by beneficiaries. To obtain a weighted assignment rate, we compute total assigned allowed charges divided by total allowed charges for the physician sample as a whole. When computed from the sample, this measure approximates assignment statistics reported by HCFA (1994). It differs from an unweighted assignment rate, which is the average of the physicians' individual ratios. Although the weighted version suggests the actual liabilities faced by physicians' patients in the aggregate, the average of ratios is a better gauge for individual physician behavioral change. The percentile distribution of the individual physician assignment rates portrays beneficiaries' ease in finding physicians who always accept the Medicare-determined fee.

²All caseload statistics exclude patients whose relationship with a physician entailed an electrocardiogram (EKG) alone. From 1992 to 1993, Medicare did not permit separate payment for an EKG delivered in conjunction with an office visit. This biased comparisons of recorded caseload between 1991 and 1992, so EKG-only patients are removed from the data.

³In some small States, this can mean that one-half of the patients in the data file are members of the caseload of more than one sample physician within a year.

METHODS

Sample Selection and Data Assembly

The physician-based approach to monitoring access depended on administrative changes in bill-processing operations to incorporate new physician identifiers. In 1988, a system of unique physician identifiers was established under provisions of the Consolidated Omnibus Budget Reconciliation Act (COBRA) of 1985 (P.L. 99-272). The system is known as the Medicare Physician Identification and Eligibility System (MPIES). In establishing the new identifier, Congress sought to prevent Part B payment to residents and interns in the teaching hospital setting.

The advantage of a unique identifier from a research point of view is that it permits measurement of service delivery at a natural analytic level—that of the individual physician providing services. Before MPIES, it was not possible to reliably assemble an individual physician's claims stream. This was problematic not only because physicians billing through several Part B carriers had multiple, unrelated identifiers. Even within a single carrier, a physician could use various billing numbers signifying different practice sites, specialties, payment localities, or other practice variations. Moreover, a given identifier could be used by many physicians, as when billing from a group practice. To add to the confusion, carrier numbering practices were not uniform. As a result, studies of physician service delivery often analyzed claims at aggregated levels—for example, summarizing procedures within an entire geographic unit or specialty. Alternatively, they could analyze at the so-called "practice" level, without understanding the makeup of the observational unit. When seeking to draw inferences about individual physician behavior, such analyses are potentially biased (Maddala, 1977).

Under MPIES, beginning in 1989, Medicare's Part B carriers enumerated Medicare physicians and forwarded personal and professional data to a national clearinghouse, the MPIES Registry. The MPIES Registry then assigned the Unique Physician Identification Number (UPIN) to each enumerated individual. By October 1995, the MPIES Registry had uniquely identified 760,928 Medicare physicians, a group defined to include medical doctors, osteopaths, dentists, optometrists, chiropractors, and podiatrists.⁴

In 1991, Medicare directed that Part B claims records report the UPIN of the physician providing each line item service. This step installed the critical link between the identifier and Medicare's rich research resource, its claims data base.⁵

To select the physician sample used in this study, pairs of terminal digits of the UPIN were chosen randomly and then used as selection rules in drawing physicians. We searched 1991-93 NCH files for all claims bearing target physicians' UPINs. A subset of 15 States was selected for a 3-year access analysis because UPIN reporting rates on claims in those States were relatively high, even in 1991, when the UPIN system was being phased in. Physicians from a larger group of 35 States and the District of Columbia (including the 15-State subset) provided data for 1992 and 1993.

To date, a 3-year series of claims is available for some physicians in the 15-State subset, implying that those physicians treated Medicare beneficiaries for 3 consecutive years, 1991-93. Other physicians in those States contribute data for 1 or 2 of the 3 years. Only claims with non-zero allowed charges are included among the

sample files. This rule implies that each yearly file provides a representative cross-section of the Statewide physician populations delivering Medicare-covered services to program beneficiaries, even if some of the physicians do not participate for 3 consecutive years.⁶ Table 1 shows the sample sizes by State and year.

The MPIES Registry file was linked to the physician claims to provide descriptive information about a sample physician. Important for the validity of comparisons over time, the file provides the UPIN assignment date, so that some physicians with partial-year data could be culled from the physician sample. However, we have not attempted, similarly, to delete sample members suspected of terminating Medicare practices. The reason is that the Part B Carriers, who are responsible for updating physician information on the MPIES Registry, are often unable to establish changes in physician practice status quickly and reliably. This means that changes in physician affiliation with Medicare cannot be tracked as definitively as changes in enrollment for beneficiaries. Deleting physicians who obtained a UPIN during an observation year means that the study sample may underrepresent some groups of physicians. Most notably, the sample may underrepresent new physicians who entered practice during the year, applied for a UPIN, and began to treat Medicare patients. However, such physicians would be included the following year.

Because the physician sample was designed to support a variety of analyses, a wide array of variables are retained on the claims, including physician, beneficiary, and service descriptors, as well as administrative variables that describe outlays or aid in data assembly, such as processing dates. For the access study, we

⁴The Technical Note at the end of this article provides background about data maintained by the MPIES Registry that supported methods used in this study.

⁵The Technical Note at the end of this article details the mechanisms for appending identifiers to claims and gives an assessment of the implications of those operations for the completeness of the data.

⁶The Technical Note at the end of this article provides further technical information about the sampling plan.

Table 1
Number of Physicians in the Study, by State: 1991-93

State	Number of Physicians		
	1991	1992	1993
Alabama	—	383	399
Alaska	320	362	390
Arizona	559	629	659
Delaware	—	294	321
District of Columbia	—	327	329
Florida	504	551	578
Hawaii	353	397	413
Idaho	—	341	375
Illinois	—	655	671
Indiana	462	495	512
Iowa	—	492	508
Kansas	600	643	649
Kentucky	331	367	374
Louisiana	—	490	515
Maine	—	340	376
Maryland	—	467	480
Massachusetts	—	540	558
Montana	349	377	375
Nebraska	—	462	485
Nevada	326	400	418
New Jersey	—	478	501
New Mexico	—	416	451
New York	—	819	842
North Carolina	403	414	452
North Dakota	—	287	291
Ohio	—	383	417
Oklahoma	375	409	423
Oregon	397	443	477
Pennsylvania	—	595	610
South Carolina	338	356	400
South Dakota	—	307	314
Tennessee	407	440	467
Texas	—	568	585
Utah	406	444	464
West Virginia	—	374	415
Wyoming	—	242	252

NOTES: Physicians include doctors of medicine, osteopathy, dental surgery, dental medicine, and optometry; chiropractors, and podiatrists. There are 35 States, plus the District of Columbia, in the study.

SOURCE: Health Care Financing Administration: Part B Monitoring System, National Claims History Physician Sample file, 1991-93.

focused on State and specialty⁷ of the physician and race of the beneficiary as key attributes for analysis. Service descriptors—coded using the HCFA Common Procedure Coding System (HCPCS)—were used to summarize the physician services into categories known as the Berenson/Eggers Types of Service (BETOS). BETOS typology classifies services and procedures into categories that

are especially clinically meaningful for Medicare beneficiaries.

Statistical Methods

We computed the access-monitoring indicators on an annual basis and examined year-to-year changes. The statistical tests of mean differences use standard errors adjusted for correlation in the data of the physicians observed more than once (Kish, 1965). This approach offers fidelity to the population of interest—all physicians treating Medicare beneficiaries in a given year—while yielding efficiency

⁷Physicians with multiple specialties shown among their claims were assigned to their specialty of highest reimbursement. This method of specialty assignment was used for physicians observed for a year or more, so that a physician's specialty is constant in all the study data. However, if the resulting specialty was "multiple specialty group" or "unknown," a specialty was found by matching the UPIN against the national UPIN Registry file.

gains that are due to the paired data. An alternative approach, following a fixed panel of physicians, results in change measures that are notably larger but more limited for our purposes.⁸

To examine changes in measures by physician specialty, State data were pooled and weighted in accordance with the fraction of Medicare physicians practicing in each State. Because distributions of physician measures are often skewed, medians are reported but without testing. The performance rate analysis was conducted on paired observations using tests for correlated data, as well as on the complete samples (allowing for correlation), but the estimates are not weighted ones. To analyze results for the subset of 15 States with 3 years of data, we tested changes for two pairs of consecutive years—1991-92 and 1992-93.

The study is limited by the absence of accurate measures of price changes confronting the individual physician, as well as by missing variables for local demand-and-supply factors that help explain the outcomes. Because our fundamental concern per se is monitoring for adverse shifts in access, this weakness in the explanatory power of the analyses is not crucial; evidence of dislocations can be followed up by more detailed studies. However, for the caseload and performance rate indicators, we did compare changes across areas experiencing differing fee adjustments. This permits some cautious inference

about price-change effects on the outcome variables. The fee-change measure was HCFA's 1991 forecast of the State-level percent change in average price per service between 1991 and 1996 (*Federal Register*, 1991). In analyzing caseload, we also factored in the role of Medicare enrollment, by controlling for enrollment growth in a descriptive regression predicting caseload and by examining whether the race-specific caseload growth kept pace with non-HMO Medicare enrollment growth.

RESULTS

Physician Caseload

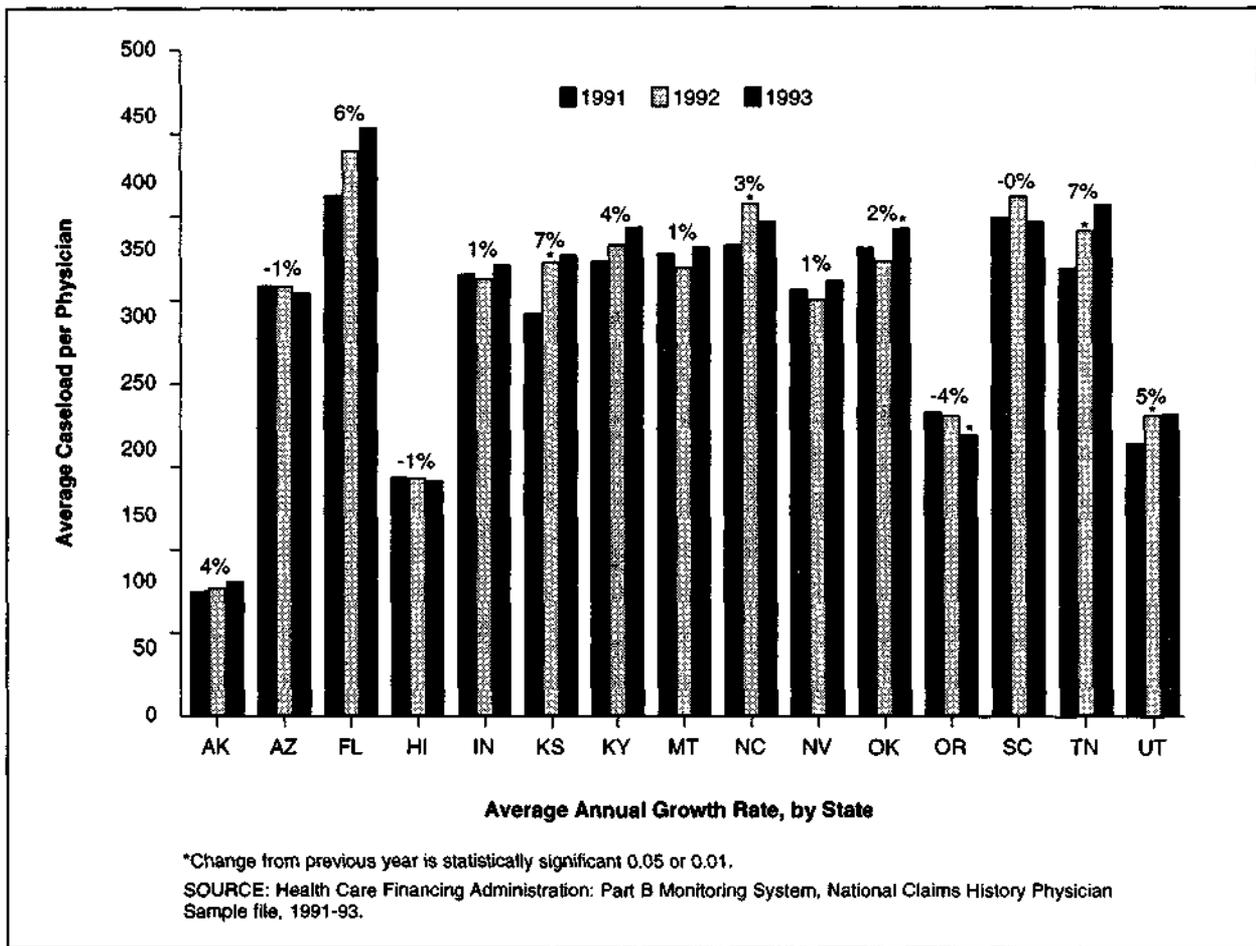
Caseload in Total and by State

Figure 1 shows the 3-year caseload averages for 15 States from 1991 to 1993. The 15 States accounted for 24 percent of the national non-HMO Medicare enrollment in 1993. Several levels of physician Medicare caseload are evident. Florida has a notably high average caseload (about 400 beneficiaries or more), regardless of year, and Alaska has a low one (about 100 beneficiaries). The State contrasts illustrate that variations in the concentration of the elderly population affect Medicare physician caseload. Other factors in caseload variation may include health status differences, physician practice styles, and Medicare HMO penetration. Urbanization may also play a role: A comparison of caseload across categories of practice-site urbanicity suggested that physicians at both extremes of the urbanization continuum—large-core metropolitan areas and rural areas—had lower average caseloads than others (Meadow, 1995).

Important for access-monitoring purposes, the average caseloads within each State usually changed little. The four statistically significant mean changes in 1991-92 were

⁸Of the total sample, 14,685 physicians were observed during both years. These physicians account for about 90 percent of the total sample in each year. When data from all physicians in the study sample are compared, average caseloads appear higher for physicians in a fixed sample by about 5 to 10 percent. Twice as many State physician populations experienced average gains of approximately 20 to 35 patients. There were no significant declines in mean caseload. (Data are available from the author upon request.) It was concluded from this comparison that a dynamic sample allowing for entry and exit into Medicare practice offers a more conservative and unbiased analysis of caseload changes. One reason is that fixing a panel probably builds in caseload growth that is due to naturally rising levels for newly practicing physicians.

Figure 1
1991-93 Average Caseload, by State and Annual Average Growth Rate



positive, ranging from 20 to 40 patients, or about 8-13 percent. Four States—Utah, Tennessee, North Carolina, and Kansas—were among those with the highest annual average growth rates in caseload over the 3-year period 1991-93—growth rates that ranged from 3-7 percent.

Two statistically significant changes occurred between 1992 and 1993. In Oklahoma, average caseload increased by 24 patients per physician, or 7 percent. In a second State, Oregon, physicians registered a statistically significant decline of 13 fee-for-service Medicare patients on average, or 6 percent. Medicare enrollment files show that in Oregon, fee-for-service Medicare enrollment actually declined 3

percent between 1992 and 1993—the largest relative decline of only four States experiencing any decrease. At the same time, HMO enrollment increased by more than 18,000, or 20 percent. One-quarter of Oregon beneficiaries were enrolled in an HMO by mid-year 1993. It seems likely that a shift to HMO enrollment helps explain the decline in mean caseload in Oregon.

Table 2 shows caseload means, percent changes, and medians in 36 States during the first and second years of payment reform. These areas represent 69 percent of the national non-HMO Medicare enrollment during 1993. The weighted average caseload change for all 36 areas was 11 patients, on a base of 322 patients in 1992.

Table 2
Mean Caseload per Physician, Change and Percent Change in Mean, and Median, for 35 States
and the District of Columbia: 1992-93

State	1992 Mean Caseload	1993 Mean Caseload	1992-93 Change in Mean	1992-93 Percent Change in Mean	1993 Median Caseload	1992-93 Percent Change in Median
Total ¹	322	333	**11	3	178	7
Alabama	416	437	21	5	294	11
Alaska	96	101	5	6	56	-8
Arizona	323	317	-6	-2	142	0
Delaware	334	333	-2	0	219	-1
District of Columbia	223	225	3	1	117	10
Florida	425	442	17	4	229	11
Hawaii	179	177	-2	-1	90	0
Idaho	311	297	-15	-5	145	-19
Illinois	298	301	3	1	161	-1
Indiana	328	338	10	3	236	3
Iowa	372	381	9	2	258	4
Kansas	341	346	5	1	197	-2
Kentucky	354	366	13	4	231	5
Louisiana	343	343	0	0	210	0
Maine	379	366	-13	-4	224	1
Maryland	282	317	**35	12	179	28
Massachusetts	302	305	3	1	135	0
Montana	337	352	15	5	211	3
Nebraska	403	397	-6	-2	226	-8
Nevada	313	326	13	4	182	5
New Jersey	293	309	*16	5	172	2
New Mexico	256	266	10	4	123	-6
New York	260	274	*15	6	143	2
North Carolina	384	371	-13	-4	246	-5
North Dakota	399	408	9	2	262	6
Ohio	338	359	21	6	200	0
Oklahoma	341	365	*24	7	216	1
Oregon	225	212	*-13	-6	108	-14
Pennsylvania	354	354	1	0	178	2
South Carolina	390	370	-20	-5	237	-14
South Dakota	336	348	12	4	245	11
Tennessee	363	384	20	6	256	0
Texas	274	304	**31	11	160	13
Utah	225	227	1	1	114	-6
West Virginia	413	427	14	4	263	5
Wyoming	185	183	-3	-1	111	-3

* Statistically significant at 0.05 level.

** Statistically significant at 0.01 level.

¹Means for total weighted based on estimated Medicare physician populations of the 36 States. Median for total based on a self-weighting 2 percent sample from the 36 States.

SOURCE: Health Care Financing Administration: Part B Monitoring System, National Claims History Physician Sample file, 1992-93.

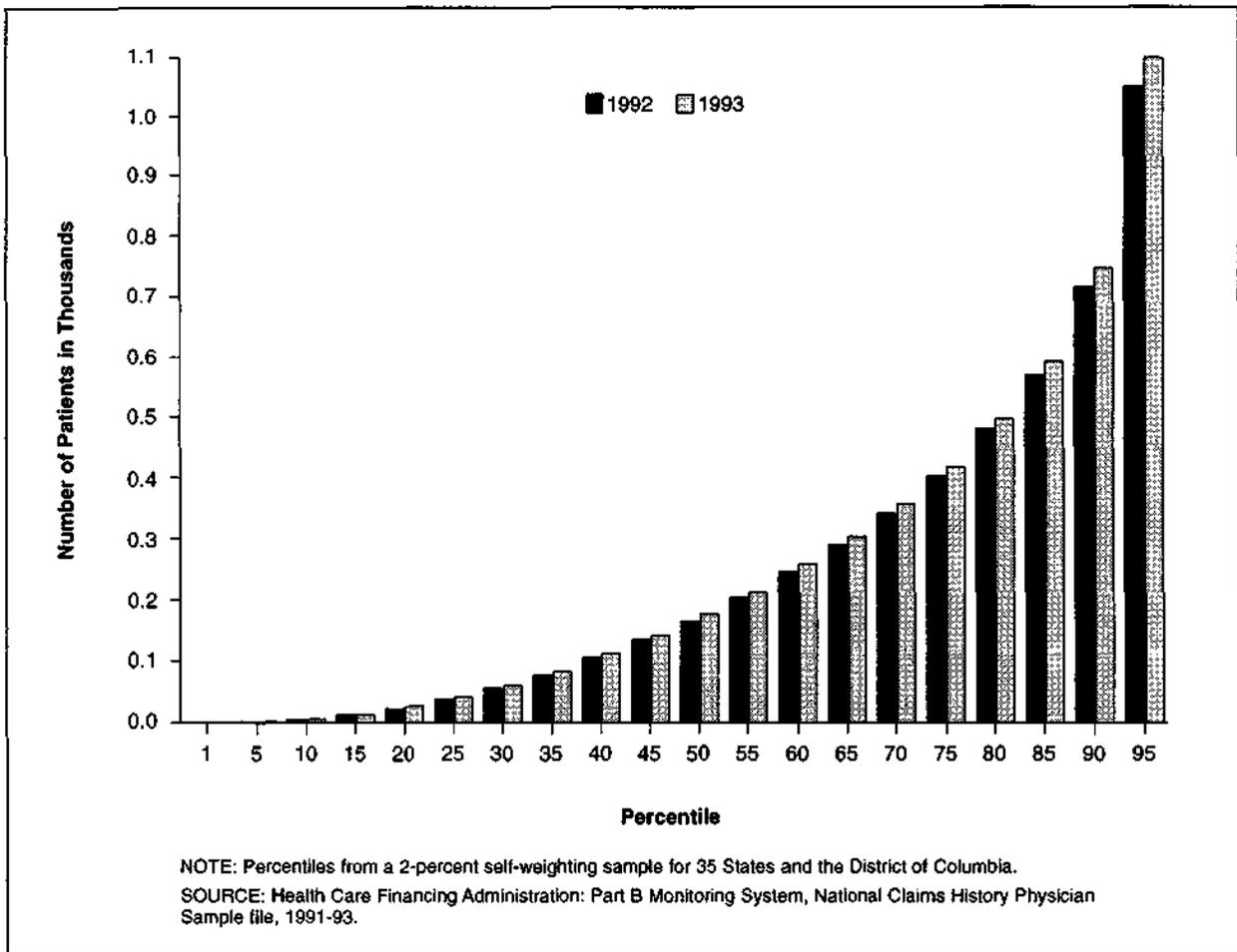
The overall median, computed from a 2-percent self-weighting sample, increased by 7 percent to 178 patients by 1993. As in the 1991-92 period, when analyzed by State, the predominant pattern was apparent stability. The range of positive, statistically significant changes, which occurred in New York, New Jersey, Oklahoma, Texas, and Maryland, was 15 to 35 patients, on average, or 5 to 12 percent. Oregon was the only State to register a

notable decline. Relatively large negative median changes affected two other physician populations—South Carolina's and Idaho's—although each had a statistically-stable average caseload.

Comparison of Caseload Distributions

Medicare caseload size varies greatly among physicians, and cross-sectional differences in part signify differing willing-

Figure 2
Number of Patients at Selected Percentiles: 1992-93



ness to treat Medicare patients. Therefore, in addition to the mean and median statistics, we compared 1992 and 1993 caseload distributions to examine whether the positive change affected physicians at various caseload levels. Based on a self-weighting 2-percent subsample of the overall 36-area study sample, Figure 2 displays a comparison of 19 selected percentile points.⁹ It suggests that, to the extent that physicians added patients during the first and second years of physician payment reform, the gains affected physicians throughout the caseload distribution. Figure 2 also highlights the strong variation in physicians'

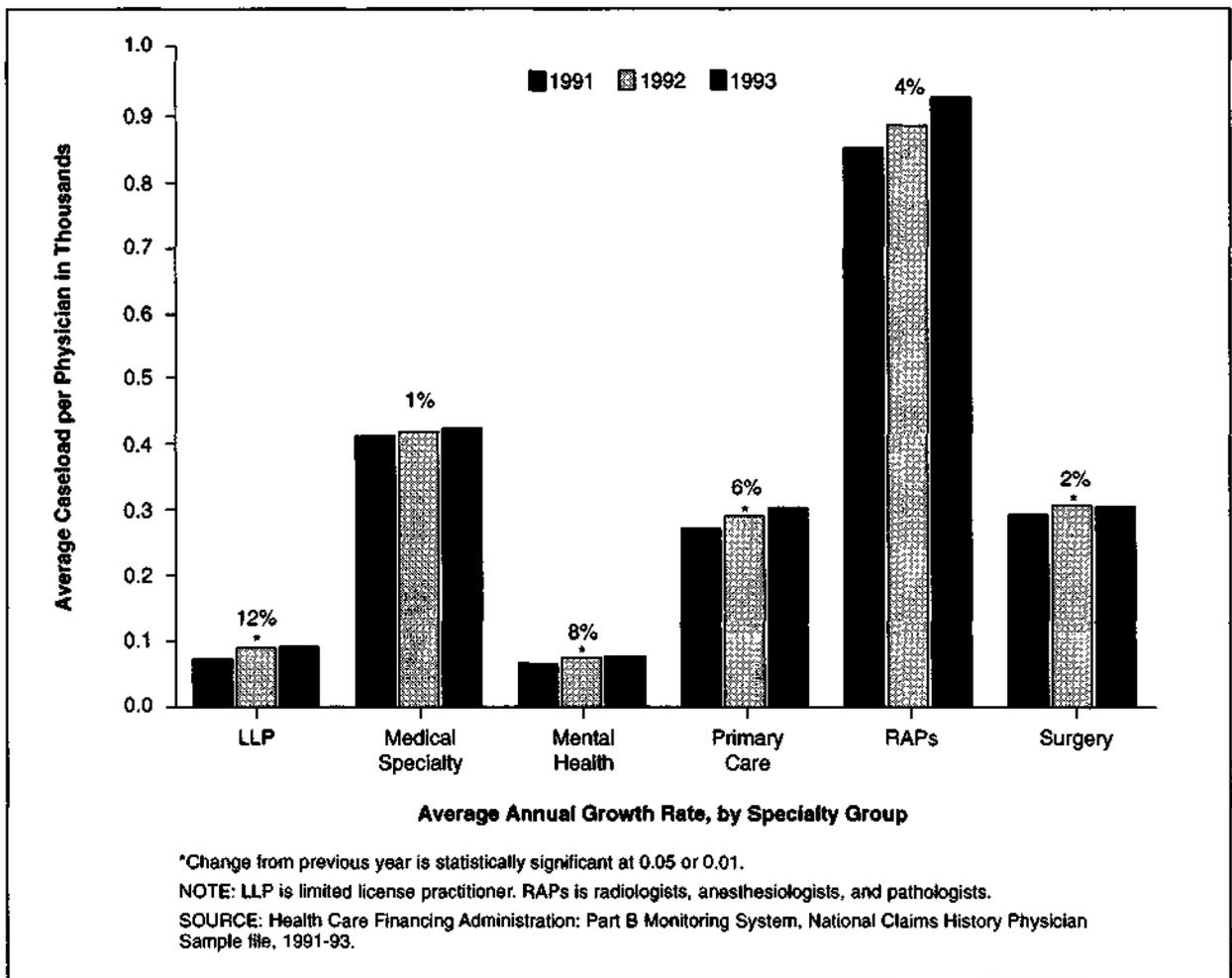
total Medicare activity, as measured by caseload. Each year, physicians in the bottom quarter of the sample had about 40 patients each or less, whereas physicians in the top quarter had about 400 or more. Physicians with the most Medicare activity have caseloads ranging into the thousands, although the highest percentile points are not shown in the figure.

Caseload by Specialty

Specialty groups were unevenly affected by the Medicare fee schedule (MFS), with highly specialized physicians experiencing more price cuts among the services they perform. Such physicians, potentially

⁹The sample sizes for the data in Figure 2 were 6,464 and 6,737 physicians for 1992 and 1993, respectively.

Figure 3
1991-93 Average Caseload, by Specialty and Annual Average Growth Rate



most affected by Medicare revenue reductions, are a particular focus of concern about decrements in access. Based on weighted data from 15 States, average caseloads for the six major specialty classes tended to increase each year during the 3-year period 1991-93, except possibly for surgeons (Figure 3).

Growth seemed to slow in several of the specialty groups during 1992-93, at least for the limited number of areas contributing data. In fact, consistent with the State-specific means, all of the statistically reliable changes in specialty caseloads occurred during 1991-92. The groups with significant changes in 1991-92 were limit-

ed-license practitioners (23 percent), mental health specialists (14 percent), primary-care practitioners (7 percent), and surgeons (5 percent). Average annual growth was as low as 1 percent and 2 percent for medical subspecialties and surgical specialties, respectively, and as high as 8 percent and 12 percent for mental health specialists and limited-license practitioners, respectively, the two groups with relatively small bases. Primary-care practitioners, who traditionally serve as point of entry into the health care system, added an average of 19 more patients in 1992, and their 3-year growth in caseload averaged 6 percent per year.

Table 3
Mean Caseload per Physician, Change and Percent Change in Mean, and Median,
by Specialty Group: 1992-93

Specialty ¹	1992 Mean Caseload ²	1993 Mean Caseload ²	1992-93 Change in Mean	1992-93 Percent Change in Mean	1993 Median Caseload ³	1992-93 Percent Change in Median
Primary Care	263	275	**12	5	198	6
Family Practice	277	291	**14	5	219	3
General Practice	266	275	8	3	188	4
Psychiatry	66	68	2	2	29	7
Medical Specialties	350	364	**14	4	299	2
Cardiology	501	524	*23	5	477	2
Internal Medicine	333	350	**17	5	291	6
RAP⁴	766	806	*40	5	341	13
Anesthesiology	230	237	7	3	192	5
Radiology	1385	1455	70	5	1210	17
Surgery	298	304	6	2	170	3
General Surgery	229	235	6	3	207	4
Obstetrics/Gynecology	70	76	**6	8	51	13
Ophthalmology	764	747	-17	-2	593	-3
Orthopedic Surgery	247	250	3	1	227	-1
Otolaryngology	318	315	-2	-1	259	-10
Podiatry Surgery	394	403	9	2	294	-11
Urology	472	487	15	3	477	7
LLP⁵	86	86	0	0	40	1
Chiropractic	43	43	0	1	29	0
Optometry	155	154	-1	-1	86	5

* Statistically significant at 0.05 level.

** Statistically significant at 0.01 level.

¹Data from the 6 broad specialty groups may include physicians in detailed specialties not shown.

²Means weighted based on estimated Medicare physician populations of the 36 States.

³Median based on a self-weighting 2-percent sample from the 36 States.

⁴RAP is radiology, anesthesiology, and pathology. Subtotal for radiology, anesthesiology, and pathology.

⁵LLP is limited license practitioner. Oral surgeons and podiatrists are also LLPs but included with surgeons for this analysis.

Between 1992 and 1993, data from the broader sample of States indicated that primary-care physicians, medical subspecialists, and radiologists/anesthesiologists/pathologists displayed above-average growth in caseload (Table 3). Their gains were in the range of 4 percent to 5 percent. Statistical evidence is weaker to support the measured gain for surgeons—about 2 percent, or 6 patients per physician ($p < 0.06$). The two remaining groups, psychiatrists and limited-license practitioners, appear to have had stable caseloads.

Among 16 detailed specialties, cardiologists, internists, and family practitioners experienced 5-percent caseload increases between the first and second years of physician payment reform. Obstetrician-gynecologists saw 6 more patients, on aver-

age, which amounted to an 8-percent gain because of their low general levels (76 patients each in 1993). The medians in Table 3 were computed from a 2-percent self-weighting sample from all the study States. Though not formally tested, most medians seem to indicate stable or growing caseloads. Exceptions were confined to several surgeon groups, with otolaryngology and podiatry showing declines on the order of 10 percent.

To judge whether the slower 1992-93 caseload growth in Figure 3 might be extrapolated to the broader experience of the 36-area subset, Table 4 compares specialty results from the 15-State sample and the 36-State sample. The major differences in the broader sample are a 3-times larger change estimate for the medical specialties

Table 4

Comparison of Caseload Change Estimates for 15- and 36-State Samples, by Specialty Group: 1992-93

Specialty ¹	1992-93 Change in Mean ²		1992-93 Percent Change in Mean	
	36 States	15 States	36 States	15 States
	Primary Care	**12	13	5
Psychiatry	2	2	2	2
Medical Specialties	**14	5	4	1
RAPS ³	*40	42	5	5
Surgery	6	-2	2	-1
LLP ⁴	0	2	0	2

*Statistically significant at .05 level.

**Statistically significant at .01 level.

¹Data from the 6 broad specialty groups may include physicians in detailed specialties not shown.

²Means weighted based on estimated Medicare physician populations of the States.

³RAP is radiology, anesthesiology, and pathology. Subtotal for radiology, anesthesiology, and pathology.

⁴LLP is limited license practitioners. Oral surgeons and podiatrists are also LLPs but included with surgeons for this analysis.

SOURCE: Health Care Financing Administration: Part B Monitoring System, National Claims History Physician Sample file, 1992-93.

and a switch to a positive-change estimate for surgeons, from -2 to 6 patients. For primary care, psychiatry, radiologists/anesthesiologists/pathologists, and limited-license practitioners, the caseload change estimates were very similar. Thus, the sample comparisons imply a need for some caution in generalizing the 3-year trends for surgeons and medical subspecialists. They require similar conservatism in generalizing the 3-year trends beyond the 15 States in Figure 1.

Caseload by Race of the Patient

An important issue in access monitoring is whether disadvantaged groups are more vulnerable to potentially deleterious effects of reform than are others. Those with the fewest resources and poorest health, for example, are least likely to overcome possible reform-related disruptions in health services supply. Accordingly, we examined caseload by race of the patient. Race is used as a proxy, although an imperfect one, for disadvantaged status, and it is one of the few proxy variables that is readily available in Medicare claims data.

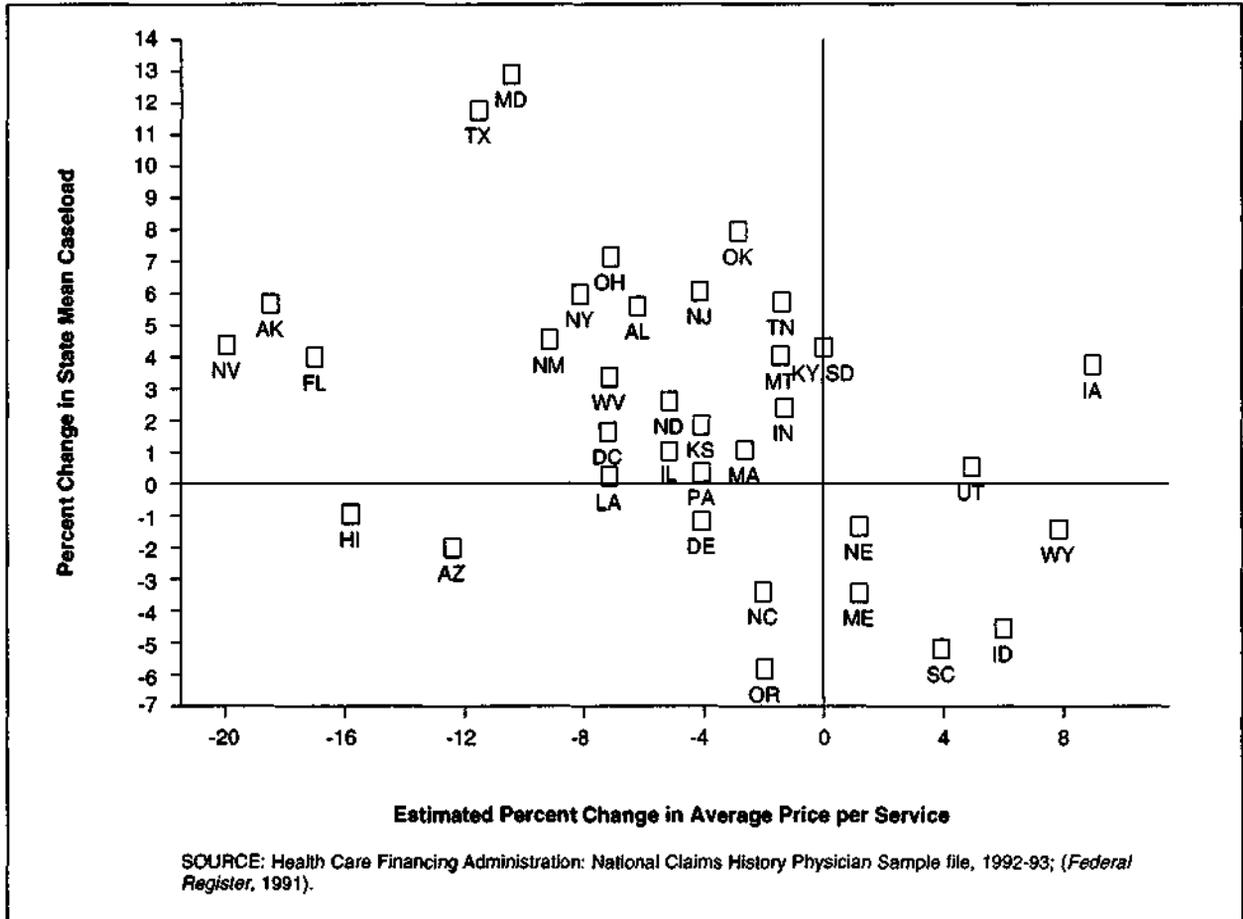
Between 1992 and 1993, caseloads among physicians' white patients grew 3 percent, as did the all-patient caseload

reported earlier. For black patients, average physicians' caseload grew about 5 percent; for patients of other races, 17 percent; and for patients of unknown race, 14 percent. The large percentage growth for patients in the "other" and "unknown" race groups reflects the very small bases for these groups: an average per physician of 8 and 4 patients, respectively, in 1992.

State-level estimates for 1992 and 1993 suggest that a few States were largely responsible for white and black beneficiaries' overall gains in caseload: Maryland, New York and Texas for white beneficiaries; Florida, Maryland, Texas, and Nevada for black beneficiaries. Whereas two States, Oregon and South Carolina, registered a decline for white patients, no States showed losses for black patients. Most States' data revealed comparatively large gains in caseload for patients in the "other" and "unknown" racial categories.

We compared the actual caseload growth with the growth that would be predicted from enrollment changes. This was done to provide some perspective on the race differences in caseload growth. Direct comparisons among the race-specific growth rates have limited meaning. But if caseload growth lags behind enroll-

Figure 4
Percent Change in 1992-93 Caseload Versus Estimated 1991-96 Percent Change
in Average Price per Service



ment growth, particularly for vulnerable groups, then stability of access may be in question. The non-HMO enrollments grew approximately 1 percent for white beneficiaries, 2 percent for black beneficiaries; 15 percent for beneficiaries in the "other" category, and 4 percent for beneficiaries of unknown race. For three groups, the comparison between enrollment and caseload growth provided modest evidence that caseload growth outpaced enrollment growth ($p < 0.05$, 0.06 , and 0.07 for white, black, and "other," respectively). For patients of "unknown" race, the evidence was stronger ($p < 0.0001$). An 18-State analysis covering 1991-92 found similar results.

Caseload Change in Relation to Price Change

Given the essentially descriptive nature of the physician-based analyses, the physician-based monitoring effort necessarily emphasizes scrutiny of trends for signs of access dislocation. Factors influencing physician services delivery are complex, and the data demanded for a controlled study to pinpoint effects of the reforms are costly to assemble. Nevertheless, to introduce a fee-change proxy that would allow cautious inference about the role of the new payment policy in explaining the trends, we charted the relationship between the caseload changes and HCFA's price-change estimates. As shown in Figure 4,

there is an inverse relationship between the 1992-93 percent change in mean caseload by State and the forecasted average price change during the period 1991-96. The estimates of total price change cover the entire 5-year phase-in of the MFS; they range from -20 percent to 9 percent in the study States. The observed inverse relationship was quantified in a three-variable regression. This regression, which controlled for an autonomous time trend and changes in non-HMO Medicare enrollment, suggested that a -0.24-percent change in caseload would accompany each 1.0-percent increase in price ($p < 0.02$, regression F -statistic = 3.88, R -square = 0.19). Although the regression coefficients for time trend and enrollment change were not statistically significant, the size and signs of these coefficients suggested that caseload change might rise in relation to enrollment increases and because of other, unmeasured factors.¹⁰

Performance Rates for Detailed Procedure Groups

To study service-mix responses for services most affected by price decreases under MFS, we examined change in physicians' participation in all 44 BETOS categories of surgical and diagnostic procedures. A 1991-92 comparison, based on paired sample data from 18 States, suggested general stability in procedure performance between the last pre-reform year, 1991, and the first year under the new policy, 1992 (Meadow, 1994). That is, the number of physicians performing at least one instance of the procedure was statistically the same in most categories (data not shown). We observed declines exceeding 7 percent in the number of physicians performing procedures in three categories: hip fracture repairs, ambulatory inguinal

hernia repairs, and miscellaneous minor procedures not priced under the MFS.¹¹ Performers of cataract operations, musculoskeletal ambulatory procedures, and laparoscopic cholecystectomy increased.

Between the first and second years of payment reform, based on paired sample data from 36 areas, 9 procedure categories experienced statistically significant declines in performers at the 1-percent significance level, against a background of negative-change estimates for the majority of categories¹²(Figure 5). The figure shows the 16 categories with declines of at least 5 percent. The nine categories were colectomy (-9 percent), cholecystectomy (-7 percent), other major procedures (-2 percent), thromboendarterectomy (-10 percent), pacemaker insertion (-8 percent), hip fracture repair (-7 percent), inguinal hernia repair (-6 percent), upper gastrointestinal endoscopy (-5 percent), and sigmoidoscopy (-6 percent). In addition, four categories—transurethral resection of the prostate (TURP), major breast procedures, coronary artery bypass grafts (CABG), and miscellaneous minor procedures priced under MFS¹³—exhibited declines significant at the 2-percent level. The only categories exhibiting a statistically significant increase in performers were lithotripsy and minor procedures not priced under MFS. Examination of performance rates for all the physicians in the study again suggested a generally small, broad-based decline in performance rates, with most of the statistical test results similar to the paired-data results (Meadow, 1995). We also checked to see if the declines were attributable to

¹⁰Results were similar using the individual physician data in the regression, except that the enrollment change effect was stronger ($p < 0.10$), whereas the coefficient of determination decreased markedly.

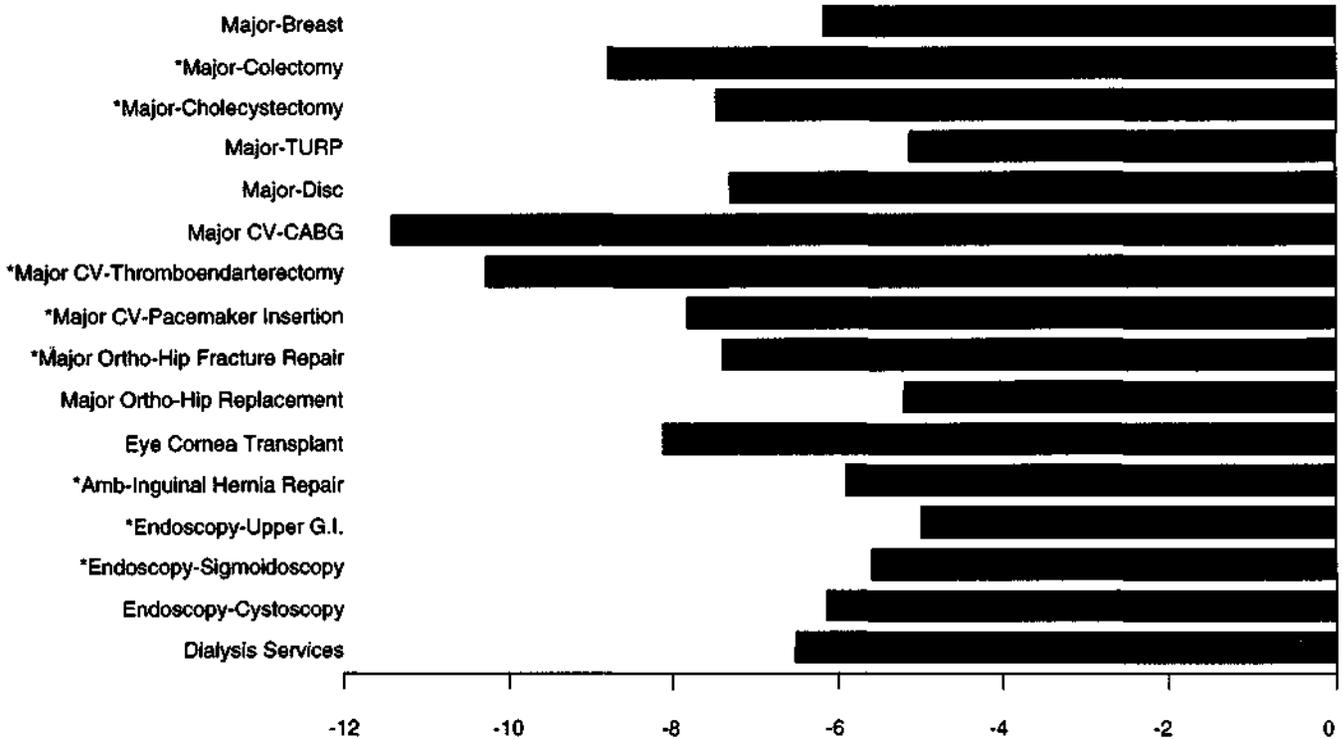
¹¹This category includes a limited number of procedures mostly concerning the nose, mouth, ear, and immunizations injections.

¹²Thirty-four of the 44 categories exhibited declines in the estimates.

¹³This is a diverse category of hundreds of procedures from the respiratory, digestive, cardiovascular, urinary, eye, and other sections of the HCPCS. Various biopsies also comprise this category.

Figure 5

Change in Performance Rate for Selected Berenson/Eggers Type-of-Service Procedure Groups¹: 1992-93



¹Test of 1992-93 difference in proportion of physicians performing the procedure is significant at 0.01.

²Figure depicts percent change for all procedure groups with 1992-93 declines of 5 percent or more.

NOTES: TURP is transurethral resection of the prostate. CV is cardiovascular. CABG is coronary artery bypass graft. G.I. is gastrointestinal.

SOURCE: Health Care Financing Administration: Part B Monitoring System, National Claims History Physician Sample file, 1992-93.

fewer physicians serving as surgery assistant, but found this to be a relatively minor factor.¹⁴

To check for a pattern of change in the performance rates in relation to price changes under the MFS, we classified all

paired-sample physicians into four "fee-impact areas," according to the average Statewide price change HCFA forecasted for 1991-96: (1) increase (4 percent to 9 percent); (2) no change (3 percent to -3 percent); (3) moderate decrease (-4 percent to -9 percent); and (4) large decrease (-10 percent to -20 percent). For each class of physicians, we computed the average percent change in surgery participants across all 44 procedure groups. This average varied significantly ($p < 0.05$) and systematically¹⁵ across categories of price change. The "increase" category had the largest average decrease (-4.57 percent),

¹⁴We analyzed performance rates for surgeons serving as primary performer (as opposed to assistant). Medicare pays assistants at surgery 16 percent of the allowed charge. We hypothesized that given procedure-price reductions, this fraction may now be low enough to deter participation as assistant in some cases. The results for primary performers, based on paired data, showed few departures from the initial analysis. For colectomy, the percent decline among primary performers appeared considerably smaller (-5 percent for all performers versus -9 percent for primary performers). For hernia repair, the percent decline halved. Other departures were small. The statistical test results were weaker in this analysis, in part, because of smaller sample sizes. Nevertheless, the results suggested that assistants at surgery were not primarily responsible for the lower performance rates observed between 1992 and 1993 (Meadow, 1995).

¹⁵The probability for the analysis-of-variance test of difference in means between the two price-decrease groups and the remaining two groups was < 0.03 .

Table 5

Mean Assignment Rate per Physician, Change and Percent Change in Mean, and Median, for 35 States and the District of Columbia: 1992-93

State	1992 Mean Assignment Rate	1993 Mean Assignment Rate	Change in Mean Assignment Rate	1992-93 Percent Change in Mean	1993 Median Assignment Rate	1992-93 Percent Change in Median
Total	0.82	0.86	**0.05	6		
Alabama	0.92	0.94	**0.02	3	1.00	0
Alaska	0.84	0.88	**0.04	4	1.00	0
Arizona	0.78	0.85	**0.06	8	1.00	0
Delaware	0.86	0.89	**0.04	4	1.00	0
District of Columbia	0.83	0.86	*0.03	3	1.00	0
Florida	0.83	0.89	**0.06	7	1.00	0
Hawaii	0.92	0.94	**0.02	3	1.00	0
Idaho	0.49	0.58	**0.09	19	0.58	67
Illinois	0.78	0.83	**0.06	7	1.00	0
Indiana	0.79	0.84	**0.06	8	1.00	0
Iowa	0.72	0.82	**0.10	14	1.00	0
Kansas	0.86	0.89	**0.03	4	1.00	0
Kentucky	0.83	0.88	**0.06	7	1.00	0
Louisiana	0.81	0.87	**0.05	6	1.00	0
Maine	0.92	0.95	**0.02	3	1.00	0
Maryland	0.90	0.91	0.01	1	1.00	0
Massachusetts	0.97	0.97	0.00	0	1.00	0
Montana	0.57	0.69	**0.12	21	1.00	105
Nebraska	0.74	0.82	**0.08	11	1.00	0
Nevada	0.91	0.91	0.00	0	1.00	0
New Jersey	0.73	0.76	**0.04	5	1.00	0
New Mexico	0.78	0.82	**0.04	6	1.00	0
New York	0.76	0.80	**0.03	4	1.00	0
North Carolina	0.81	0.86	**0.06	7	1.00	0
North Dakota	0.66	0.68	0.02	3	1.00	0
Ohio	0.87	0.94	**0.07	8	1.00	0
Oklahoma	0.71	0.79	**0.08	12	1.00	0
Oregon	0.69	0.77	**0.08	11	1.00	0
Pennsylvania	0.93	0.96	**0.03	3	1.00	0
South Carolina	0.81	0.84	**0.04	4	1.00	0
South Dakota	0.40	0.48	**0.08	20	0.30	14
Tennessee	0.84	0.89	**0.04	5	1.00	0
Texas	0.76	0.82	**0.06	7	1.00	0
Utah	0.84	0.89	**0.05	6	1.00	0
West Virginia	0.94	0.94	**0.00	0	1.00	0
Wyoming	0.61	0.69	**0.08	13	1.00	2

*Statistically significant at 0.05 level.

**Statistically significant at 0.01 level.

SOURCE: Health Care Financing Administration: Part B Monitoring System, National Claims History Physician Sample file, 1992-93.

followed by the "no-change" category (-3.21 percent), the "moderate decrease" group (-2.26 percent) and the "large decrease" group (0.19 percent). Thus the declines found in the performance rates display the same negative relationship to price changes observed in the caseload analysis.

Assignment Rate per Physician

When the physician accepts assignment of the Medicare-allowed charge, the

patient's costs are more predictable and often lower than under non-assignment. This facilitates access by mitigating financial barriers to care. Early findings of the physician-based monitoring effort demonstrated widespread gains in assignment rates between 1991 and 1992 (Meadow, 1994). These gains tended to hold across States, specialties, and race of the patient. Between the first and second years of physician payment reform, the growth in assignment rates continued. The overall

mean assignment rate in the study areas increased by 5 percentage points, on average, reaching 86 percent in 1993.¹⁶

The mean assignment rate varies somewhat by State, but in 31 States and the District of Columbia it rose reliably in 1992-93 (Table 5). Of the 5 States (Maryland, Massachusetts, Nevada, North Dakota, and West Virginia) with little change in the mean assignment rate, 4 had relatively high assignment averages—more than 90 percent. (In Massachusetts and Nevada, assignment is mandatory.) Such stability may signal that assignment rates in those four States may be nearing their practical maximums.

The distribution of physicians' assignment rates is indicative of beneficiaries' ability to readily access physician services under favorable financial terms. In 1992, in 13 States and the District of Columbia, at least 70 percent of the physicians in each area took assignment on all of their Medicare services. By 1993, 13 additional States joined this group, so that in 27 of the 36 areas in the study, beneficiaries faced physician providers who, more likely than not, would accept assignment on all their services.

DISCUSSION

A key question about physicians' reaction to payment reform is whether physicians will "drop out" of the Medicare fee-for-service market. This is difficult to document in the short term with administrative data, because some physicians bill Medicare sporadically, and, because as noted earlier, the MPIES Registry cannot always readily and accurately update changes in a physician's Medicare status. But it is likely that any retreat from Medicare would occur over a period of

time, as a physician stops accepting new Medicare patients while continuing to see established patients until they leave the physician's care. A gradual retreat would probably reveal itself in negative changes in the caseload measures used in this study, but instead we found stable or growing Medicare practice sizes.

The population segments at greatest risk of contracting their Medicare practices are surgical specialists and physicians working in areas experiencing the largest Medicare fee reductions. Data from a broad set of States suggests that surgeons as a group had stable average caseloads during the first and second years of physician-payment reform. The best available data from the pre-reform period came from a subset of 15 States, and indicated a small increase in surgeons' average caseload during the first transition year. This does not rule out decreases for some detailed surgical specialties that we were not able to analyze statistically. As the physician-based data accumulate and improve, we expect that future monitoring studies will be better able to pinpoint specialties or other subgroups where supply behavior is changing.

The pattern of caseload changes suggested that physicians added caseload inversely in relation to Statewide average fee changes. This finding, though merely preliminary given the gross fee-change measure and the paucity of variables controlled in the analysis, is consistent with the theory that physicians will adjust to adverse price movements by working harder in the short term. But usually this behavioral-offset hypothesis posits that physicians can most easily adjust primarily by working more intensively on their existing patients. A trend to adding patients might be more readily explainable as an effect of patients' response to price changes, especially considering that assignment is continuing to grow. Such a

¹⁶The assignment-rate average is lower than statistics reported in HCFA's Reports to Congress on assignment, participation, and balance billing. The main reason is that those reports use weighted rather than unweighted averages.

conclusion would be premature, however, because analyses of the role of patient demand were not part of the studies.

The analysis of performance rates suggested that participation in procedures also changed inversely with fee movements. But the context of this pattern was a small but generalized decline in the number of physicians performing numerous surgical procedures between 1992 and 1993. In most cases, some (but not all) of the decline could be explained by fewer physicians serving as assistant surgeon. The range of additional factors explaining these changes is likely to be broad, encompassing changes in specific health conditions, clinical and technological developments, price, and other market variables. Some examples illustrate the forces at work. In the case of TURP, data since the 1980s show a marked decline in the number of surgeries (Holtgrewe, 1994) and in age-adjusted Medicare surgery rates (Lu-Yao et al., 1994). Alternative therapies and changes in patient and physician preferences appear to be responsible. Thromboendarterectomy is another instance in which clinical practice may have been in flux (Fisher et al., 1989). For cholecystectomy, substitution of an ambulatory procedure, laparoscopic cholecystectomy, became widespread in the early 1990s (Fendrick et al., 1994).

Private and public utilization control mechanisms are potentially a factor—as in the observed decline in sigmoidoscopy performers. In 1992, Medicare established a program of Part B Focused Medical Review (FMR), under which carriers analyze claims patterns and other data for evidence of excessive services. In 1993, the program led to special medical review activities for sigmoidoscopy at six carriers, of which five were included in this study (i.e., carriers covering Indiana, Louisiana, Massachusetts, Texas, and Utah). Thus,

the decline in physicians performing sigmoidoscopies in the Part B sample appears attributable, at least in part, to the new medical review initiative. FMR is a potential contributor to declines in other procedure categories, as are controls and incentives in private plans. The latter may conceivably exert a spillover effect on the practices of Medicare physicians.

Taken together with surgeons' case-loads, which were fairly stable over time, the 1993 decline in performance rates could mean that, although surgeons generally continued to see Medicare patients about as much as they had in 1992, the decision to perform a procedure in some cases may have changed. If the decision was economically motivated, it might have been to not recommend surgery or to refer the patient elsewhere for surgery. But such an outcome—which remains to be substantiated with further studies—does not appear related to price disincentives of physician-payment reform.

In raising the possibility of referral effects, the performance-rate results highlight an important benefit of the physician-based access studies: They can provide a counterpoint to beneficiary-based analyses and thus lead to alternative hypotheses for investigation. A shift to more referrals is not suggested by data showing continued, if slowing, growth in population-based use rates for some of the procedures (Eggers, 1995), but it is a question brought to the fore by the addition of surgery performance data. There are additional benefits of conducting these studies. Monitoring average physician-allowed charges provides information on second-order effects of physician-payment reform—effects with the potential to become a leading indicator of access changes if they denote adverse shifts in physicians' economic status (Meadow, 1995). The study of contrasting subpopulations of physicians, such as specialists ver-

sus primary-care doctors, and high-assignment versus low-assignment providers, provides important perspective on the potential variation in access responses. In so doing, the physician-based studies can help point the way to policy refinements that may better foster intended outcomes.

In common with beneficiary-based measures, the physician-based access indicators are limited in the extent to which they proxy the underlying construct of interest (McCall, 1993). In measuring changes in the indicators, we assume that the baseline status represents some equilibrium access level, against which changes are to be interpreted as favorable or not favorable for access. In fact, the character of the baseline levels of access is unclear, and may represent excessive or deficient or appropriate access. Another limitation to interpretation concerns the weak controls available to the studies, noted earlier. A better reflection of physician decisionmaking with respect to access would result if additional explanatory variables, such as patient demand, technology, clinical advances, and market conditions, were incorporated into the analyses. These factors are not measurable in claims and require added resources to assemble. Finally, pending further advances in UPIN reporting, the studies' results have limits on their generalizability. Analyses to date have been generalizable to subnational sets of States. A full national analysis will be possible when all States' carriers reach a uniformly high level of UPIN reporting on physician claims.

TECHNICAL NOTE

Operations and Data of the MPIES

Under COBRA 1985 (beginning in 1989) Medicare's Part B carriers enumerated Medicare physicians and forwarded personal and professional data to a national

clearinghouse—the MPIES Registry. During the startup phase, carriers often did not verify data from billing physicians to meet MPIES Registry specifications. Instead, they conveyed available data elements maintained in their own provider files. This had implications for the completeness and accuracy of the descriptive information, as described below. The MPIES Registry then assigned a UPIN to each enumerated individual. The procedure was aided by a subcontract to the American Medical Association to confirm the individual physician's identity.

The MPIES Registry constructed a computerized data base containing the UPIN data to support its procedures for assigning one and only one UPIN to each practitioner. The data base forms a cumulative record of all physicians ever in the MPIES. To date, it has served several research purposes. It provided the initial sampling frame for the payment reform studies. The MPIES Registry also supplied physician-specific data unavailable on claims. For example, the MPIES Registry has filled in the physician's specialty when the claims reported a non-specific category, such as "multispecialty group practice."

A number of MPIES Registry data elements have been or could be linked to claims records. These include the business address, ZIP Code, business State, business city, State of licensure, date of birth, professional school, graduation year, credential (degree obtained), primary specialty code, and primary board certification indicator. As of April 1994, date of birth, professional school, and graduation year were each present for about 90 percent of the physicians (Adamache, Cyr, and Merrill, 1994). The State of licensure and specialty data elements were virtually complete. Thus, for most physicians, the MPIES Registry file can supply two basic demographic items, age and State, as well

as specialties and the estimated tenure in practice. It has been the source of variables to compare subgroups of physicians with respect to board-certification status, continuing practice in the State of undergraduate medical training, and foreign versus domestic medical education (Physician Payment Review Commission, 1994; 1995).

Several additional variables are in the process of being added to the MPIES file, including the practitioner's social security number, business tax identification number, and the full street address of the practice site. A supplementary file is under development that will identify group practice members and link them to their respective groups.

The accuracy of the MPIES Registry data has been investigated by indirect verification—primarily checks of face validity and of logical consistency among related or repeated data elements (Adamache, Cyr, and Merrill, 1994). (If a physician practices in more than one work setting, he or she has multiple records that repeat data fields.) An example of a logical consistency check for related data elements is a comparison of the physician's specialty with the type of medical degree. (Several categories of limited license practitioners are included on the file as "Medicare physicians." So, for example, a doctor of podiatry should report only one specialty, podiatry surgery.) The investigation, performed on the July 1993 data base, found that *prima facie* errors are rare. Using a criterion of consistency among repeated data elements that should not vary across practice settings, a potential for error was found in about 5 percent of the non-missing values for birth date, school, and graduation year. The criterion of consistency among related data elements yielded similar results. Findings of the investigation varied by carrier, suggesting that carrier selection

strategies could be used in some studies to limit the risk of using incorrect data.

UPINs in the National Claims History

Billing policies and procedures by which a UPIN is appended to a claim record result in a low but persistent amount of incomplete reporting. Physicians submit claims under carrier-assigned identifiers, not the UPIN, so the carriers map their local identifiers to the UPIN during automated claims processing. To enable mapping, many carriers had to assign individualized local identifiers as an alternative to the indeterminate group billing numbers.

Two files summarizing NCH data at the UPIN level are now maintained to monitor UPIN reporting, to help develop research files, and to provide easily accessible charge totals by UPIN, payment locality, and assignment status of the claim. The UPIN reporting rate is the proportion of physician-services claims or allowed charges accounted for by UPINs listed on the MPIES Registry. Annual statistics produced from the NCH summaries show that the rate on Part B claims has increased during the 1991-93 period. Although reporting levels vary by carrier, the national average reached at least 84 percent of physician services line items by 1993. These services accounted for about 96 percent of physician-allowed charges.

Some of the services reported without an identifier were delivered by new Medicare physicians pending assignment of the UPIN and, some others, by longstanding Medicare physicians who have not obtained a UPIN. In fact, even in 1992, UPINs were still being phased in by some carriers, so that counts from the MPIES Registry are unreliable for assessing change in the size of the Medicare physician population before and after physician payment reform. Still

other missing UPINs were due to physicians, particularly group practice members, for whom mapping the local identifier to the UPIN is not possible for one reason or another. Reporting levels could be higher if, as an enforcement tool, claims-processing routines suspended items with a blank UPIN. But suspension is considered an excessive burden on payment operations.

To ensure as much as possible that each physician's claims stream is complete, we have limited access analyses to States with high UPIN reporting rates. In 1991, UPIN reporting on claims was adequate for only 18 States. For 1992 and 1993, data from 35 States and the District of Columbia were judged usable.

We monitor UPIN reporting to guard against fluctuations that could confound the analyses. Between 1992 and 1993, for the 36 study areas, UPIN-bearing claims increased from 97.4 percent to 98.2 percent of physician allowed charges in the NCH. It is difficult to assess the significance of this finding for conducting temporal analyses because of technical problems in assembling the correct denominator. One possibility, of course, is that UPIN reporting in the study States improved marginally. It seems unlikely that this would invalidate the analyses, especially given our assumption that most of the reporting change stems from additional UPIN assignments as opposed to more complete reporting for physicians with previously assigned UPINs.

This assumption does not preclude some missing claims for physicians who are observed in the sample, but this is probably not serious for monitoring purposes. Carriers have been known to experience occasional periods of electronic systems failures that result in claims entering the NCH without a UPIN, but we have no information suggesting that large-scale processing failures were more prevalent in

one year than in another. Carrier error in claims processing is another possible reason for missing UPINs, but we assume this too is random. Also, physicians with multiple practice arrangements involving group practices may have claims processed without the UPIN if one or more of their groups has not converted to individual local identifiers. As noted earlier, this problem was largely solved by 1992-93, especially in the States selected for study. Conceivably, physicians in the process of joining a different practice could experience a break in the continuity of mapping, even though carriers change physician identifiers in their software (Health Economics Research, 1995). If this type of interruption is correlated with time or with other independent variables of interest, then physician statistics under study could be biased, but probably not severely.

Sample Design of the Part B Physician Sample

With some modifications, the plan for selecting a physician sample was modeled after the standard 5-percent beneficiary sample, which HCFA has long maintained for research and evaluation purposes. The beneficiary sample consists of all Medicare claims for randomly selected beneficiaries. Terminal digits of the beneficiary identifier serve as sample selection rules. The resulting series of annual files is used in both cross-sectional analyses and longitudinal studies of panels of beneficiaries. The claims data base is frequently supplemented by descriptive information from enrollment files, particularly eligibility, coverage, and basic demographics.

As with the beneficiary sample, the terminal digits of the physician identifier are randomly assigned and therefore usable as selection rules. But with the physician population, a uniform national sampling frac-

tion is inappropriate for State-level studies. Therefore, the sample design consisted of independent random samples in each State, with State sampling fractions ranging between 2 percent and 44 percent. Each sample is designed to achieve a relative standard error of 7.5 percent for allowed charges. The State samples can be combined to produce a self-weighting national sample and other subnational samples, or they can be combined using weights derived from the sampling fractions (Beebe, 1995).

Coefficients of variation for power analysis were initially estimated from a special State study and, later, from one of the UPIN claims summaries. The appropriate sampling fraction follows straightforwardly from the population count, assuming the count is accurate. The most accurate counts of active Medicare physicians come from UPIN-based claims summaries. The summaries proved superior to the MPIES Registry as a sampling frame for the Part B Physician Sample. Comparisons of physician counts from claims summaries and from the MPIES Registry showed that the MPIES Registry overstated the size of the physician population actually submitting claims annually (Beebe, 1995). Given the sampling methodology, overestimated population counts lead to unexpectedly small samples. Over time, as the physician population grows while the sampling fractions remain unchanged, the annual samples of physicians will increase beyond the numbers needed to achieve the targeted relative precision.

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REFERENCES

- Adamache, K.W., Cyr, H.A., and Merrill, A.R.: *Unique Physician Identification Number (UPIN) Validation Studies: Carrier Analysis*. Prepared for the Health Care Financing Administration under Contract Number 500-92-0020/5. Waltham, MA. Health Economics Research, Inc., 1994.
- Aday, L., and Anderson, R.M.: *Development of Indices of Access to Medical Care*. University of Michigan. Ann Arbor, MI. Health Administration Press, 1975.
- American Medical Association: *Medicare RBRVS: The Physicians' Guide*. Chicago. 1994.
- Beebe, J.C.: *Part B Physician Sample Redesign*. Prepared for the Health Care Financing Administration under Contract Number HCFA-94-0824. Annapolis, MD. 1995.
- Eggers, P.: *Beneficiary Access and Utilization*. Appendix V in: *Report to Congress: Monitoring the Impact of Medicare Physician Payment Reform on Utilization and Access*, Washington, DC. Health Care Financing Administration, 1995.
- Federal Register*: Medicare Program; Fee Schedule for Physicians' Services, Fee Schedule Update for Calendar Year 1992, and Physician Performance Standard Rates of Increase for Federal Fiscal Year 1992; Final Rules and Notice 56(227):59502-59819. Office of the Federal Register, National Archives and Records Administration, Washington, DC. November 25, 1991.
- Fendrick, A.M., Escarce, J.J., McLane, C., et al.: Hospital Adoption of Laparoscopic Cholecystectomy. *Medical Care* 32(10): 1058-1063, October 1994.
- Fisher, E.S., Malenka, D.J., and Solomon, N.A., et al.: Risk of Carotid Endarterectomy in the Elderly. *American Journal of Public Health* 79:1617-1620, 1989.
- Gillis, K.D., Lee, D.W., and Willke, R.J.: Physician-Based Measures of Medicare Access. *Inquiry* 29:321-331, 1992.
- Gornick, M.: Physician Payment Reform Under Medicare: Monitoring Utilization and Access. *Health Care Financing Review* 14(3):77-96, 1993.
- Health Care Financing Administration: *1993 Annual Report to Congress: Changes in Physician Participation, Assignment, and Extra Billing in the Medicare Program During Calendar Year 1992*. Washington, DC. 1994.
- Health Economics Research, Inc.: *Technical Proposal, Understanding Properties of the UPIN for Claims-Based Research*. Prepared for the Health Care Financing Administration. Waltham, MA. 1995.

Holtgrewe, H.L.: Editorial Comments. *Adult Urology* 44(5):698-699, November 1994.

Kish, L.: *Survey Sampling*. New York. John Wiley & Sons, 1965.

Lee, D.W., and Gillis, K.D.: Physician Responses to Medicare Physician Payment Reform: Preliminary Results on Access to Care. *Inquiry* 30:1-12, Winter 1993.

Lu-Yao, G.L., Barry, M.J., Change, C.H., et al.: Transurethral Resection of the Prostate Among Medicare Beneficiaries in the United States: Time Trends and Outcomes. *Adult Urology* 44(5):692-698, November 1994.

Maddala, G.S.: *Econometrics*. New York. McGraw-Hill, 1977.

McCall, N.T.: Monitoring Access Following Medicare Price Changes: Physician Perspective. *Health Care Financing Review* 14(3):97-117, 1993.

Meadow, A.: Access to Care Before and After Fee Schedule Implementation: A Physician-Based Analysis. Appendix VIII in: *Report to Congress: Monitoring the Impact of Medicare Physician Payment Reform on Utilization and Access*. Washington, D.C. Health Care Financing Administration, 1994.

Meadow, A.: Access to Care in the Early Years of Fee Schedule Implementation: A Physician-Based Analysis. Appendix XI in: *Report to Congress: Monitoring the Impact of Medicare Physician Payment Reform on Utilization and Access*. Washington, DC. Health Care Financing Administration, 1995.

Perloff, J.D., Kletke, P.R., and Neckerman, K.M.: Physicians' Decisions to Limit Medicaid Participation: Determinants and Policy Implications. *Journal of Health Policy, Politics, and Law* 12(2):221-35, 1987.

Physician Payment Review Commission: *Monitoring Access: Report to Congress*. Number 91-5. Washington, DC. Physician Payment Review Commission, 1991.

Physician Payment Review Commission: *Monitoring Access of Medicare Beneficiaries*. Washington, DC. Physician Payment Review Commission, 1993.

Physician Payment Review Commission: *Monitoring Access of Medicare Beneficiaries*. Washington, D.C. Physician Payment Review Commission, 1994.

Physician Payment Review Commission: *Monitoring Access of Medicare Beneficiaries*. Washington, D.C. Physician Payment Review Commission, 1995.

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