
Monitoring Access Following Medicare Price Changes: Physician Perspective

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In this article, the author examines changes in Medicare beneficiaries' access to services following the Omnibus Budget Reconciliation Act of 1987 "overpriced" procedure price reductions from the physician perspective. Three measures of physician availability remained essentially constant: number of physicians treating beneficiaries or performing overpriced procedures; average Medicare caseload; and average share of a physician's Medicare practice comprised of those who are poor and not white. Physician practice characteristics were examined and provided evidence of continuing participation in Medicare: Average Medicare revenue increased 10 percent, and average volume of all services increased. However, physicians with the largest fee reductions or who were the most financially dependent on the procedures did not change overpriced procedure volume.

INTRODUCTION

On December 19, 1989, Congress enacted Public Law 101-239, which mandated that the Health Care Financing Administration (HCFA) change the basis of payment for physician services from reasonable charges to a fee schedule using a resource-based relative value scale. With

implementation of the Medicare fee schedule on January 1, 1992, the levels and relative prices for most Medicare services were altered. Simulations released by HCFA with the final rule for the 1992 Medicare fee schedule suggest that national average payment changes per service will range from +10 percent to -15 percent during the first year of implementation of the fee schedule and will vary by physician specialty and geographic locality. Given this widespread variation, the effect of physician payment reform on physicians and beneficiaries may be difficult to predict.

If physicians and beneficiaries respond to changes in relative prices, then access problems may be either created or alleviated. For example, physicians might respond to changes in relative prices by changing the number and types of Medicare beneficiaries they treat or by changing the supply or mix of services they provide. Physicians whose payments fall may increase the number of Medicare beneficiaries they treat or increase the number of services they provide to Medicare beneficiaries. Alternatively, some of these same physicians might respond by not treating any Medicare beneficiaries or by reducing the number of beneficiaries they treat or the number of Medicare services they provide.

Beneficiaries may respond to the fee schedule by changing their demand for or use of Medicare services. Surgical proce-

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dures with prices that are likely to fall under the fee schedule may become more affordable to beneficiaries, especially for those who do not have supplemental insurance. Conversely, office visits may become relatively more expensive as prices rise for these services. Simulations of changes in out-of-pocket liabilities performed by Mitchell and Menke (1990) using the proposed rules for the Medicare fee schedule suggest that Medicare beneficiaries who are not white or persons living in rural areas would face large increases in their out-of-pocket spending for Medicare services. The increase in out-of-pocket liabilities results from the combination of increases in payments under the fee schedule for office visits and the mix of services that these two subpopulations primarily use.

Because physician payment reform legislation represented a major change in the payment for physician services, there was concern within Congress over how physicians would respond to the relative price changes as well as over how Medicare beneficiaries would fare under the new legislation. Thus, Congress mandated that the Secretary of Health and Human Services report annually on issues related to access to physician services for Medicare beneficiaries. The Physician Payment Review Commission (PPRC) was directed to review and comment on the Secretary's report.

Given that the PPRC (1991) viewed monitoring changes in access and utilization as an important activity during the implementation of the Medicare fee schedule, it convened an expert advisory panel on access to assist in the development of a monitoring strategy. The framework developed by the advisory panel focuses on

monitoring trends in utilization of selected Medicare services for vulnerable subpopulations and across selected geographic areas. Vulnerable subpopulations include those beneficiaries with limited financial means or complex medical problems, as well as the very old and the disabled. Geographic areas of interest include health professional shortage areas, rural areas, inner cities, and areas that will experience large fee declines for selected services.

The advisory panel further recommended a number of approaches for measuring changes in access to care: (1) monitoring the use of primary care and preventive services; (2) monitoring changes in frequency of sentinel events that indicate poor care or delay in seeking care; (3) analyzing changes in practice patterns by studying episodes of care; and (4) analyzing changes in mortality rates. In addition, the advisory panel recommended monitoring changes in physician availability and the number of Medicare beneficiaries physicians treat.

To date two reports have been issued by each authority with the first set of reports outlining the strategies that will be used to monitor changes in access and the second set of reports providing baseline data (Physician Payment Review Commission, 1991, 1992; U.S. Department of Health and Human Services, 1991, 1992). Both strategies rely heavily on monitoring changes in utilization rates of vulnerable subpopulations defined in either geographic or demographic terms. In this article, I provide an illustrative example of one strategy for monitoring changes in access to physician services for Medicare beneficiaries from the physician practice

perspective using Medicare claims data.¹ Reductions in Medicare prevailing charges for 12 "overpriced" surgical procedures more than 2 years before the Medicare fee schedule was put into effect provide a natural experiment to study changes in beneficiary access to Medicare services and provide the basis of this article.

On April 1, 1988, Congress reduced the Medicare prevailing charge for 12 overpriced procedures: hip replacement, knee arthroplasty, knee arthroscopy, bronchoscopy, pacemaker insertion, coronary artery bypass graft (CABG), gastrointestinal (GI) endoscopy, transurethral resection of the prostate (TURP), suprapubic prostatectomy, dilation and curettage (D & C), carpal tunnel release, and cataract extraction. Prevailing charges were reduced by 2 percent and subject to further reductions on a sliding scale of 3/13 of a percentage point for each percent that the 1987 prevailing charge exceeded 85 percent of the weighted national average of all prevailing charges for each procedure, up to a maximum of 150 percent of the national average prevailing charge. The reductions varied across physicians and Medicare pricing localities, yielding nominal changes in the prevailing charges ranging from 0 to 17.5 percent.

Within the context of Medicare's customary, prevailing, and reasonable (CPR) payment methodology, a physician's payment may not be affected by a change in the prevailing-charge level. Under the 1965 Medicare law, payment for a physician's service is the lowest of three charges: the actual charge, the physician's customary charge, or the prevailing

charge.² If a physician's actual or customary charge for a service is less than his or her prevailing charge, then a reduction in the prevailing charge would be of no consequence financially to the physician in 1988. Furthermore, physicians who changed participation status, specialty designation, or Medicare pricing area could have received a prevailing-charge increase for these 12 procedures between 1987 and 1988.

CONCEPTUAL FRAMEWORK

The conceptual framework for this article builds on one originally developed by Aday and Anderson (1975) but incorporates aspects of conceptual frameworks used by other health services researchers (Physician Payment Review Commission, 1991; U.S. Department of Health and Human Services, 1992; Aday and Anderson, 1981; Aday, Fleming, and Anderson, 1984; Sloan and Bentkover, 1979). Most definitions of access may be categorized under the terms of potential and realized entry into the health care system. Dimensions of potential access typically are considered the structural aspects of the health care system and include both characteristics of the population at risk as well as the health delivery system. With respect to the Medicare population and this study, potential access measures may be defined in terms of the availability of physicians to treat Medicare beneficiaries or to

²Under CPR, the actual charge is the amount the physician has billed Medicare for his or her services. A physician's customary charge is a service-specific charge that is defined as the median charge submitted by the physician during the calendar year preceding the current year. Prevailing charges are service-specific charges developed for like physicians within economically distinct areas called pricing localities. Carriers set the prevailing charge for each service at a level equal to the lowest charge that is above the 75th percentile of all customary charges that have been submitted by like physicians within each pricing locality in the year prior to the current year.

¹Parts of this article appeared in U.S. Department of Health and Human Services (1992).

perform certain treatments such as CABG or hip replacements. Other measures of potential access may include the size of Medicare caseloads and the proportion of a physician's practice comprised of vulnerable subpopulations such as the poor, those other than white, and the disabled.

Realized access is often defined in terms of the population's utilization rates. Ideally, these rates should be determined in relation to the medical needs of the population, thereby allowing changes in utilization rates to reflect changes in health status and not structural or economic changes (Aday and Anderson, 1975). From the physician practice perspective, the number of types of services provided to Medicare beneficiaries as well as the level of financial participation in Medicare may be viewed as realized access measures.

To monitor changes in potential and realized access from the physician practice perspective, the availability of physicians who treat Medicare beneficiaries and three characteristics of physicians' Medicare practices were analyzed: the number and types of beneficiaries physicians treat; physicians' level of financial participation in Medicare; and the volume and intensity of services provided by physicians. Analyses of physician availability and the number and types of beneficiaries physicians treat were designed to answer two potential access questions:

- Did the number of physicians treating Medicare beneficiaries or performing the overpriced procedures change following the price reductions?
- Did the quantity and types of beneficiaries physicians treated vary with the degree of price change or by level of finan-

cial dependence on the overpriced procedures?

Analyses of the two remaining Medicare practice characteristics were designed to answer the following three realized access questions:

- Did physicians change their level of financial participation in Medicare?
- Did the volume of overpriced procedures provided by physicians vary with the degree of price changes?
- Did the volume or intensity of other Medicare services provided by physicians change when prices were altered?

DATA AND ANALYTICAL METHODS

To analyze changes in access, Medicare claims data for two comparable time periods before and after the enactment of the prevailing-charge reductions (April-December 1987 and April-December 1988) and for four States (Alabama, Arizona, Oklahoma, and Oregon) were studied. Combined, these four States contain approximately 6 percent of all Medicare beneficiaries and represent roughly 5 percent of total Medicare expenditures in 1987.

The study population contains 3,653 uniquely identified physicians who performed at least one of the overpriced procedures during either of the study periods and provided Medicare services in both years.³ For these selected physicians, all Medicare services performed during these two study periods are in the data

³H&K Research, under contract to HCFA, attached Unique Provider Identification Numbers (UPINs) to the individual claims. Because of the retrospective nature of the UPIN assignments, H&K Research was unable to uniquely identify group physicians with their claims for three States. Thus, only solo practitioners are contained in the data base for Arizona, Oklahoma, and Oregon. Solo and group physicians from Alabama are in the data base.

base. Two characteristics of the beneficiary, race and economic status, were appended to the claims data. These characteristics were chosen as one way of identifying groups of Medicare beneficiaries that might be most vulnerable to relative price changes.⁴

Given that the level and direction of the Omnibus Budget and Reconciliation Act of 1987 overpriced procedure price reductions varied across individual physicians, one could hypothesize that physicians who experienced large price reductions faced greater incentives to change their Medicare practices than those physicians who experienced only small price changes. To capture the variation in the price changes at the individual physician level, physicians were grouped into the following prevailing-charge-reduction classes:

- Increase or no change: Physicians whose prevailing charge was unaffected by the price cut or whose prevailing charge increased.
- Small decrease: Physicians whose prevailing charge was reduced by 5 percent or less.
- Medium decrease: Physicians whose prevailing charge was reduced by more than 5 percent but not by more than 10 percent.
- Large decrease: Physicians whose prevailing charge was reduced by more than 10 percent.

Physicians who performed multiple procedures were assigned to a prevailing-

charge-reduction class based on a weighted average change in prevailing charges for all overpriced procedures. For some physicians in the sample, the overpriced-procedure prevailing-charge reductions were of little consequence because prices were reduced for only 12 procedures. For those physicians who performed only a few of these procedures in 1987, the effect on their Medicare practice revenue would be minimal. In contrast, for those physicians who were highly dependent on one or more of the overpriced procedures in 1987, the effect on their Medicare practice revenue could be large.

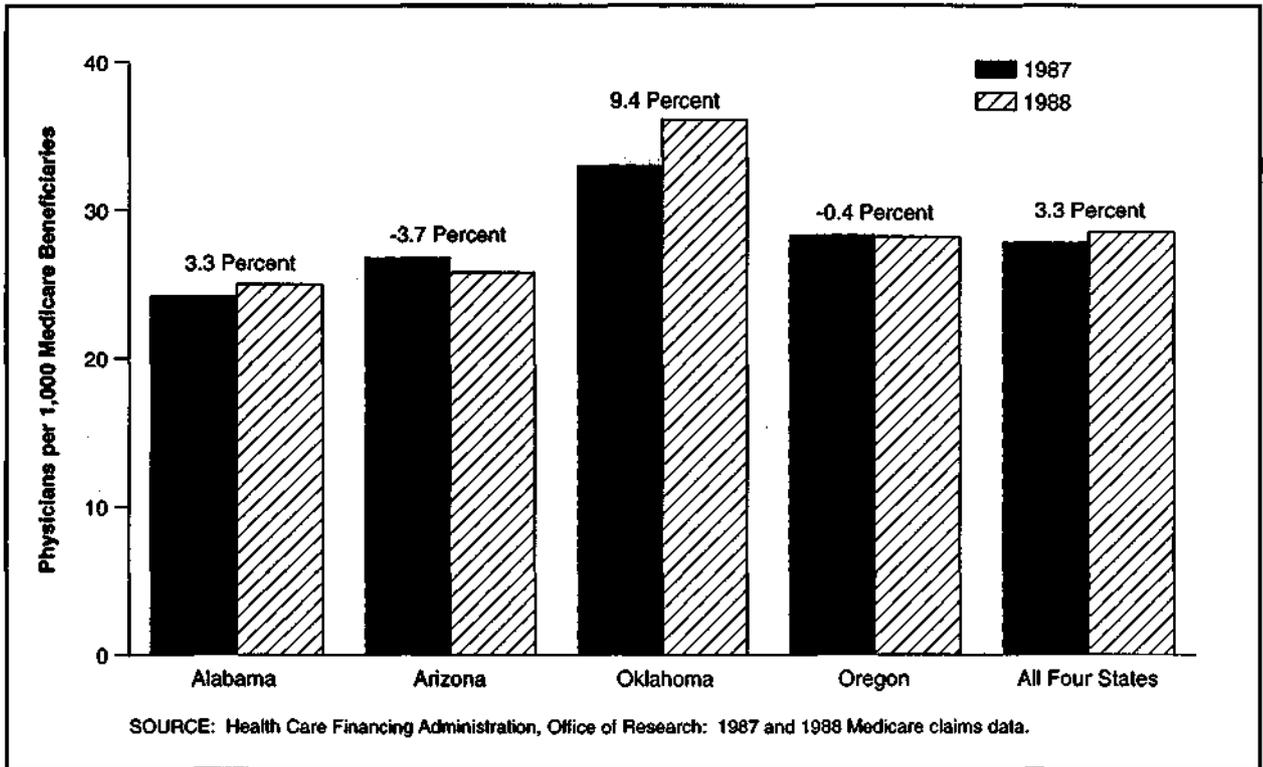
Holding all other factors constant, a price reduction for the highly dependent physicians could result in a substantial reduction in Medicare revenue and could provide incentives for physicians to alter their practice patterns. Thus, it may be instructive to analyze changes in Medicare practice characteristics by the physician's level of dependence on the overpriced procedures. Study physicians were assigned to one of four mutually exclusive "BITE" categories based on their 1987 level of financial dependence on all of the overpriced procedures. Dependence was calculated as the percent of the 1987 Medicare practice revenue derived from all of the overpriced procedures. The four categories of dependence are: (1) 10 percent or less; (2) more than 10 percent but not more than 25 percent; (3) more than 25 percent but not more than 50 percent; and (4) more than 50 percent.

Finally, to assess changes in the volume of services provided to Medicare beneficiaries, two types of quantity variables were created at the physician level: (1) an unadjusted count of the

⁴The source of the race variable was the Health Insurance Skeleton Eligibility Write-Off file, which contains selected entitlement and demographic data on all Medicare beneficiaries. Economic status was defined as poor or non-poor. The supplementary medical insurance (SMI) Premium Accounting and Enrollment System file was the source of the economic status variable whereby beneficiaries whose States were paying the SMI premium were considered poor.

Figure 1

Number and Percent Change in Number of Solo Physicians per 1,000 Medicare Beneficiaries for Physicians Providing Overpriced Procedures: Selected States, 1987 and 1988



overpriced procedures, which represents a simple summation of the quantity of each of the overpriced procedures that the physician provided to Medicare beneficiaries each year; and (2) a total relative value quantity measure that is designed to capture the total volume and intensity of services provided by a physician. The relative value units (RVUs) were created by dividing the four-State average allowed charge for each procedure code/modifier combination by the 1987 four-State average allowed charge for an intermediate office visit. Following the merger of the RVUs with the claims data, the RVUs were multiplied by the appropriate number of services (at the line-item level) and aggregated to the physician level.

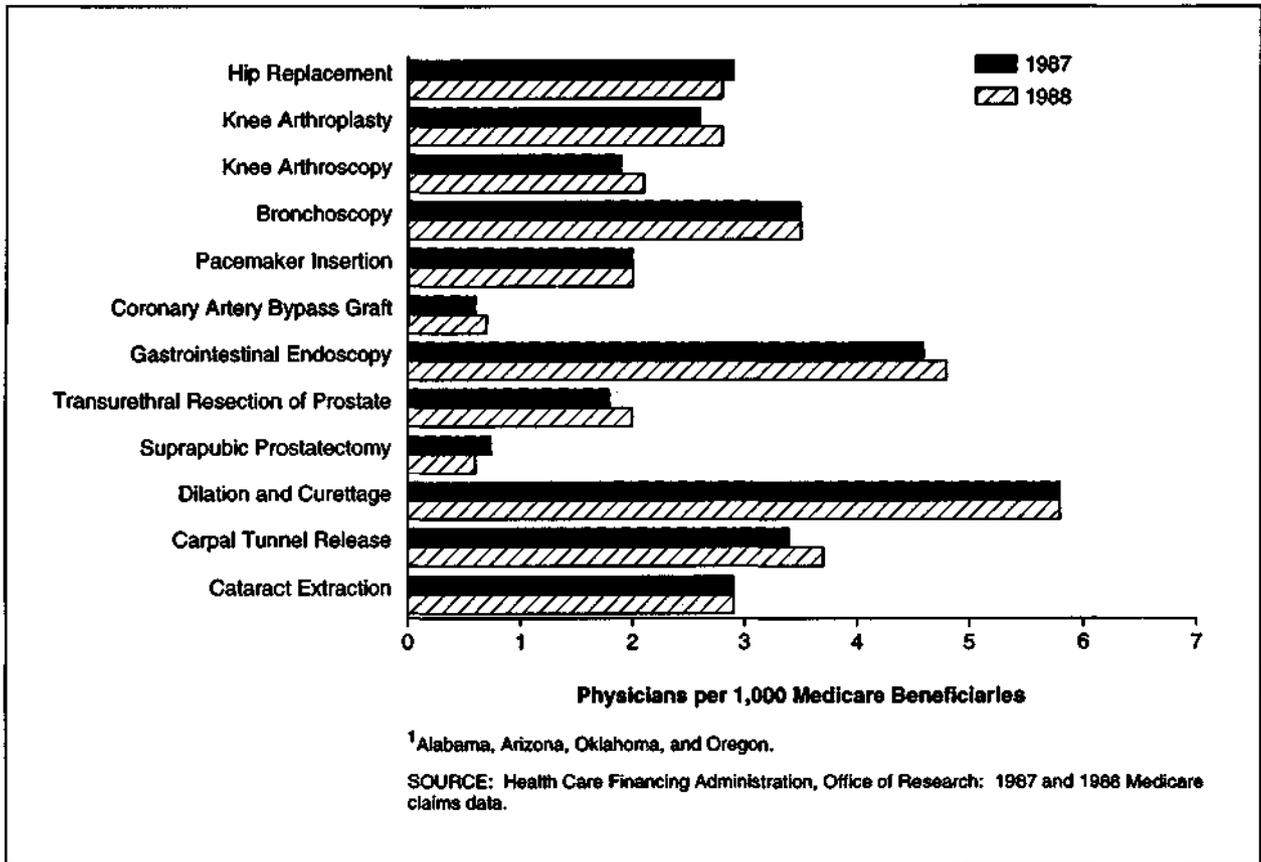
STATISTICAL METHODS

Comparisons of the physician practice were made between the two time periods, with each physician acting as his or her own control. Two-tailed paired *t*-tests were used to determine statistical significance of changes in the physician's practice between 1987 and 1988. (For small samples or for data that do not follow the normal distribution, Wilcoxon signed-rank tests were performed. However, only the paired *t*-test results are presented.⁵) Group means were compared using analysis of variance. Deviations from the mean values are expressed as standard errors. Changes were considered sta-

⁵The Wilcoxon signed-rank test results were consistent with the paired *t*-test results.

Figure 2

Number of Physicians per 1,000 Medicare Beneficiaries for Physicians Providing Overpriced Procedures: Selected States,¹ 1987 and 1988



tistically significant if the associated *p* value was 0.05 or less.

RESULTS: POTENTIAL ACCESS

Physician Availability

The first measure of potential access studied was whether physician availability changed coincident with price reductions for the 12 overpriced procedures. Figures 1 and 2 address the following access questions: (1) Did the number of physicians providing services to Medicare beneficiaries change between 1987 and 1988; and (2) Did the number of physicians performing overpriced proce-

dures change coincident with the fee reduction.⁶

Figure 1 displays the number of solo physicians per 1,000 Medicare beneficiaries for physicians who provided at least one overpriced procedure in either year. In 1987, the rate varied across the four States, ranging from 26.3 solo practitioners per 1,000 beneficiaries in Alabama to 34.4 in Oklahoma. Between 1987 and 1988, the rate of solo practice physicians billing Medicare per 1,000 beneficiaries increased 3.3 percent from 27.6 physicians

⁶Figure 1 is restricted to solo practitioners. Thus, changes in physician availability may reflect a shift from solo practice settings to group practice settings. The remaining analyses contain group practitioners from Alabama and only solo practitioners from the other three States.

per 1,000 beneficiaries to 28.5 physicians per 1,000 beneficiaries for the four States. Alabama and Oklahoma showed increases in the rates of physicians performing overpriced procedures, 3.3 percent and 9.4 percent, respectively; Oregon declined 0.4 percent and Arizona declined 3.7 percent.

Figure 2 reveals that there is wide variation in the rate of study physicians performing particular procedures, but that the rate of these physicians performing most of the overpriced procedures did not decline following the fee reductions. For example, there were approximately 6 physicians per 1,000 beneficiaries for physicians who performed D & Cs, but less than 1 physician per 1,000 beneficiaries for physicians who performed a CABG.⁷ For all but 2 of the 12 overpriced procedures, the rate of physicians performing the service remained the same or increased between 1987 and 1988, with increases ranging from 4.3 percent to 17.6 percent.

Suprapubic prostatectomy was the only procedure for which there were substantially fewer physicians in 1988 than in 1987 performing the service. Although the 19-percent decline appears dramatic, this reduction is consistent with clinical changes in the treatment of benign prostatic hypertrophy (BPH), the most common indication for a prostatectomy. Physicians are opting for the less invasive endoscopic techniques to treat BPH and reserving the suprapubic approach for patients with very large prostates (Boutwell and Stason, 1992).

⁷The low number of physicians performing CABGs is likely a function of the sample. Most of the physicians represented in the sample are solo practitioners, suggesting that most physicians who perform CABGs are members of group practices.

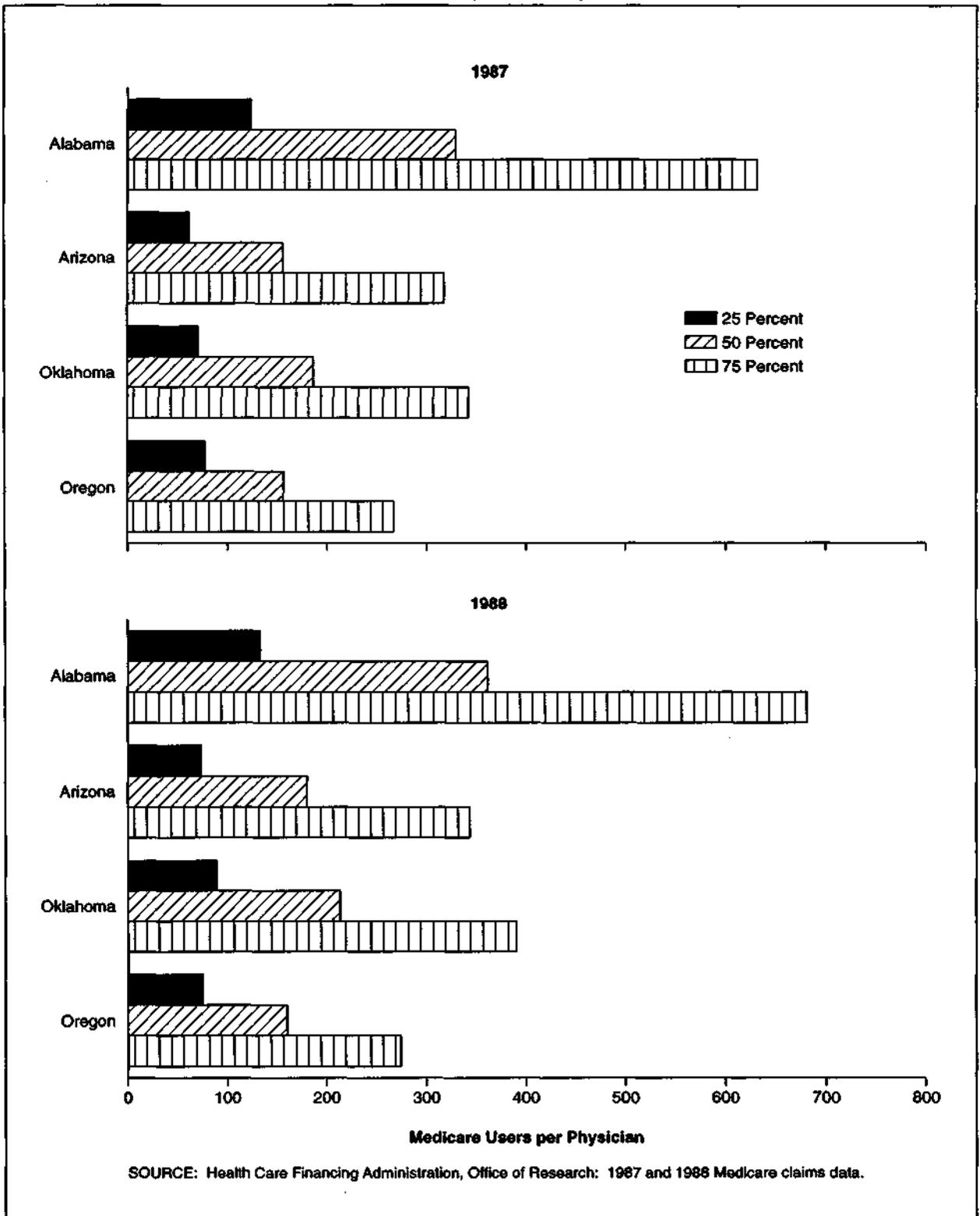
Medicare Caseload

The number and types of Medicare beneficiaries that physicians are treating may be a more valuable indicator of potential access than simply a count of the number of physicians who provided a service during a particular time period. In areas in which physicians have moderately sized caseloads, beneficiaries probably have considerable choice in the selection of a physician and may not face any particular barrier to receiving care following a price reduction. Conversely, in areas in which physicians have very small Medicare caseloads, beneficiaries may have limited choice among physicians and may face a significant barrier to receiving care following a price reduction. Physicians with small Medicare caseloads are likely to have strong demand for their services from privately insured patients. Following a Medicare fee reduction, these physicians have less financial incentive to treat Medicare patients and may choose to not treat any Medicare patients as the disparity between the private insurance fee and the Medicare price increases. Physicians with moderately sized Medicare practices are likely to have fewer privately insured patients and may not be able to change the composition of their medical practice without considerable difficulty.

Figures 3, 4, and 5 provide estimates of physicians' Medicare caseloads by State, size of price change, and by level of dependence on the overpriced procedures. Figure 3 displays the distribution of the number of Medicare patients served per physician by State and year. Caseloads are presented for physicians at the 25th, 50th, and 75th percentiles. Beneficiaries could be counted more than once if they received care from multiple physicians.

Figure 3

Distribution of Medicare Caseloads Across Physicians, by State: Selected States, 1987 and 1988



SOURCE: Health Care Financing Administration, Office of Research: 1987 and 1988 Medicare claims data.

In 1987, the average caseload was 319 ± 6 beneficiaries per study physician for the four States combined. For each of the four States, there is roughly a twofold difference in the number of beneficiaries per physician practice across each of the three percentiles, suggesting wide variation in Medicare practice size. In addition, Alabama's physicians displayed markedly larger Medicare caseloads than the other three States in both years, reflecting the presence of group practice physicians in this State's sample of physicians.

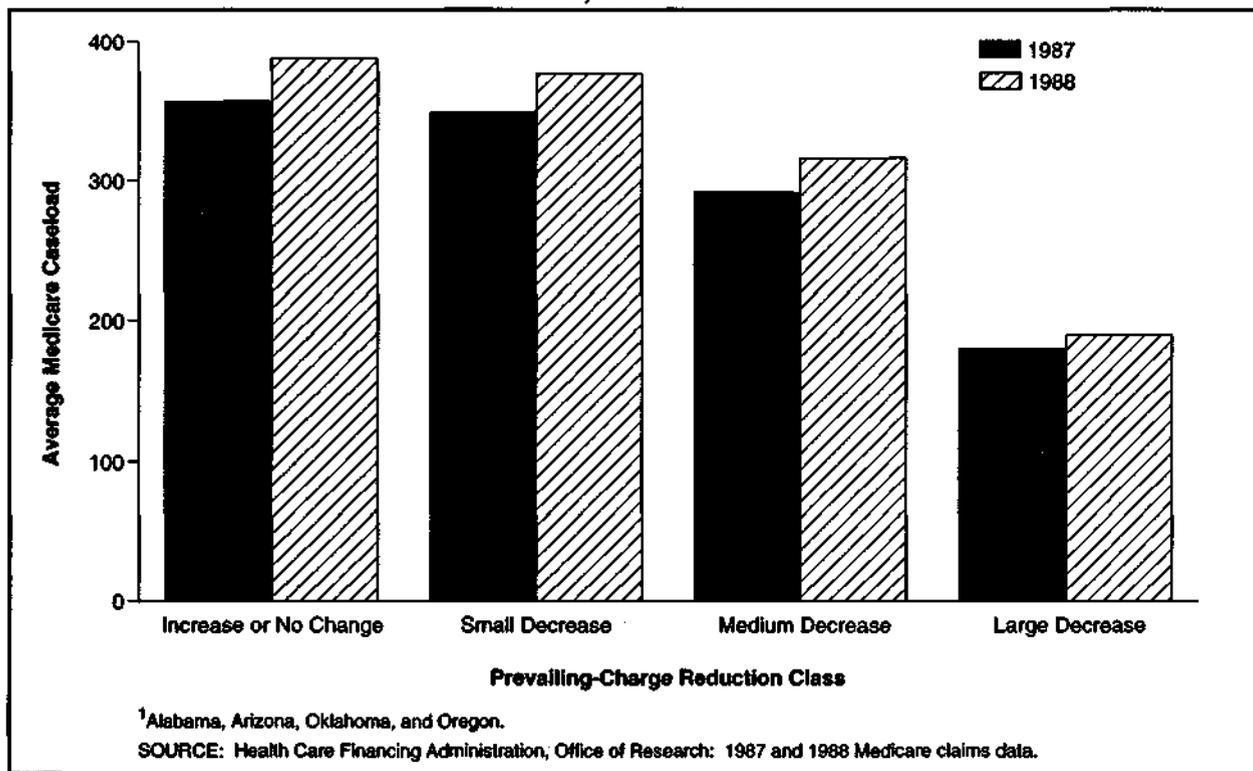
In 1988, the average caseload increased to 345 ± 6 beneficiaries per physician ($p < 0.0001$). Of particular note is the consistent pattern of increasing Medicare caseloads across the study physicians at each percentile in 1988 relative to 1987.

This finding suggests that not only did the average caseload increase in 1988, but there were increases in Medicare caseloads across the entire distribution of physicians. Paired *t*-tests of the differences in Medicare caseloads between 1987 and 1988 by State revealed statistically significant increases in all four States ($p < 0.0001$).

Figure 4 displays the average Medicare caseloads for 1987 and 1988 by prevailing-charge-reduction class. Of particular interest is the negative correlation between the size of the prevailing charge reduction and average Medicare caseload. Study physicians who faced no prevailing-charge change or experienced a small reduction had the largest average Medicare caseloads in 1987, 357 ± 14 and 350 ± 10

Figure 4

Average Physician Medicare Caseload, by Prevailing-Charge Reduction Class and Year: Selected States¹, 1987 and 1988



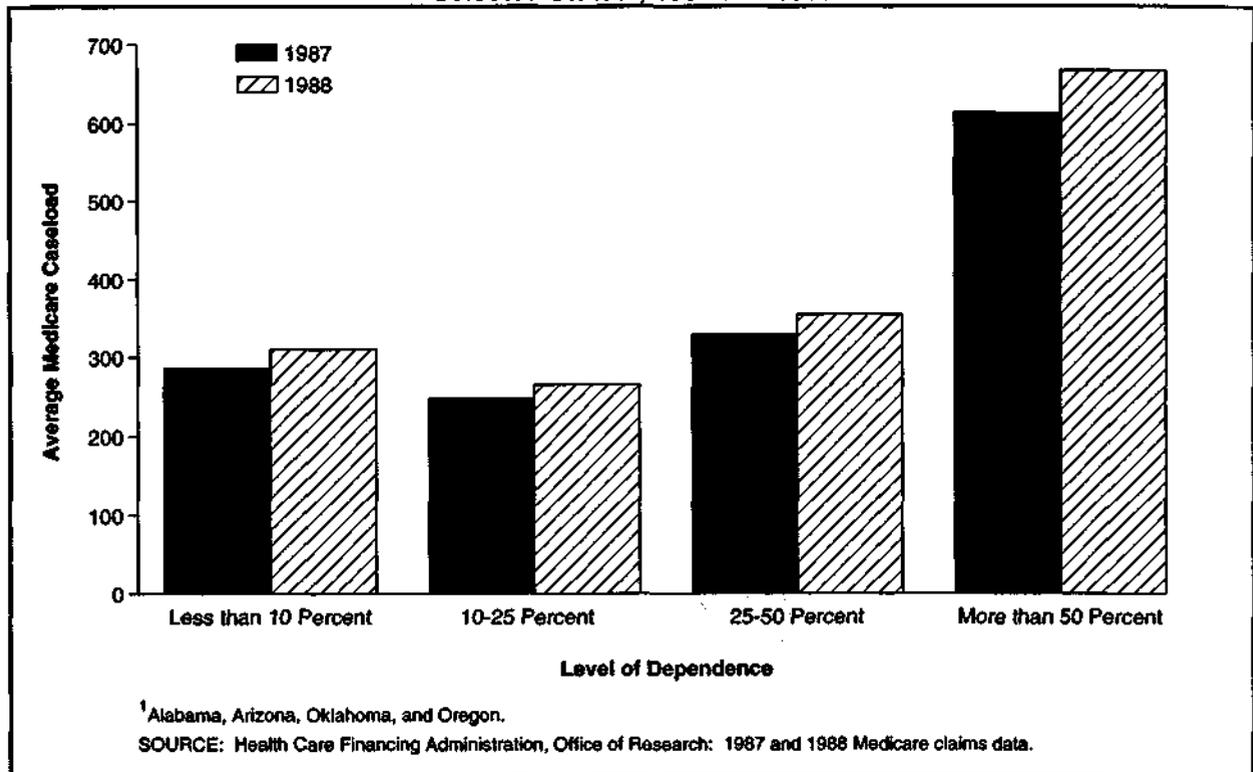
beneficiaries, respectively. Study physicians who experienced medium-sized reductions had an average caseload of 290 ± 10 beneficiaries in 1987, and study physicians who experienced large reductions had the smallest 1987 average Medicare caseload of only 180 ± 12 beneficiaries.

The correlation between prevailing-charge reduction and average Medicare caseload can be attributed to a combination of factors. Physicians who had the largest prevailing-charge reductions would have been physicians with the highest prevailing charges. Therefore, the small caseloads of these physicians may reflect price sensitivity on the part of Medicare beneficiaries. Alternatively, these physicians may be in higher priced urban areas and may face greater compe-

titition from other physicians for Medicare beneficiaries. Finally, physicians with higher prevailing charges may choose to supply services to fewer Medicare beneficiaries yet achieve the same level of Medicare revenue as physicians whose prevailing charges are lower.

In 1988, the physicians within each of the four prevailing-charge-reduction classes experienced statistically significant increases in their average Medicare caseload: Increase or no change, 31 ± 4 , ($p < 0.0001$); small reduction, 28 ± 2 , ($p < 0.0001$); medium reduction, 25 ± 3 , ($p < 0.0001$); and large reduction, 10 ± 3 , ($p < 0.0001$). An analysis of variance revealed statistically significant differences in the average Medicare caseload increases across the four prevailing-charge-reduc-

Figure 5
Average Medicare Caseload, by Level of Dependence on Overpriced Procedures:
Selected States¹, 1987 and 1988



tion classes ($p < 0.001$). Pairwise analysis among the classes reveals the average caseload increase for the large-reduction class is consistently different from the increases for the other three classes. This suggests that the study physicians who faced the largest price reductions not only had the smallest Medicare caseloads but experienced the smallest caseload increase between the 2 years relative to all other physicians.

The results of the analysis of changes in average Medicare caseload by level of dependency on the overpriced procedures are displayed in Figure 5. Physicians who were most dependent on the overpriced procedures for Medicare revenue in 1987 had the largest average Medicare caseload, 613 ± 26 beneficiaries. In contrast, the less dependent physicians had Medicare caseloads roughly one-half the average caseload size of the most dependent physicians. All physicians, regardless of level of dependency on the overpriced procedures, experienced statistically significant increases in their average caseloads in 1988. However, physicians in the more-than-50-percent dependency class experienced a larger increase in average caseload size than each of the 3 other classes, 54 ± 5.4 beneficiaries ($p < 0.0001$).

Types of Medicare Patients

The advisory panel on access convened by the PPRC developed a framework that focused on vulnerable Medicare subpopulations, in particular, those beneficiaries with limited financial means. Furthermore, the advisory panel recommended monitoring changes in physician availability for these vulnerable subpopulations. Two characteristics of the benefi-

ciary, race and economic status, were appended to the claims data as one way of identifying groups of Medicare beneficiaries that might be most vulnerable if physicians altered their Medicare practice characteristics in response to price changes.

For each study physician's Medicare practice, the proportion of beneficiaries who were not white or who were poor was calculated. There were no statistically significant changes between 1987 and 1988 in the proportion of the average caseload that was not white or that was poor across all prevailing-charge-reduction classes, although there were modest declines in the proportion of beneficiaries classified as poor across the four groups.

With only two exceptions noted, there were no statistically significant changes in patient mix across the BITE classes. First, the proportion of Medicare patients who were not white increased from 7.5 percent in 1987 to 7.9 percent in 1988 ($p < 0.05$) for physicians who were most dependent on the overpriced procedures. Second, the proportion of poor Medicare patients fell for physicians who were least dependent on the overpriced procedures, from 12.1 percent to 11.8 percent ($p < 0.05$). Further examination shows that, despite this decline in share of Medicare caseload that was poor, in 1988 the average physician in the lowest dependency BITE class saw two more Medicare poor persons than in 1987. However, the average size of these physicians' Medicare practices grew faster than did the numbers of poor Medicare patients seen, 24 ± 2 beneficiaries in 1988. The declining caseload share that was poor may also reflect the decline in 1988 in the percentage of persons eligible for Medicare

who were classified as poor in these four States from 9.6 percent to 9.3 percent.

RESULTS: REALIZED ACCESS

Level of Financial Participation in Medicare

Analyses of two Medicare practice characteristics, level of financial participation in Medicare and the volume and intensity of services provided to Medicare beneficiaries, are designed to identify changes in realized access. Measures of total Medicare revenue provide an indication of the study physicians' total financial participation in Medicare. For purposes of this study, Medicare revenue is represented by total allowed charges and is calculated by multiplying the quantity of each service provided by the Medicare-allowed charge. No adjustments were made for balance billing or for bad debt from non collection of the coinsurance or deductible. All dollars are expressed in nominal terms but have been adjusted by the Practice Expense Component of the Geographic Practice Cost Index⁸ to allow cross-sectional comparisons.

In 1987, the average Medicare revenue for study physicians in all four States combined was nearly \$78,000. Cross-sectionally, Alabama exhibits the highest average revenue figure (\$88,500), followed by Arizona (\$76,663), Oklahoma (\$72,670), and Oregon (\$59,802). All four States exhibit similar revenue distributions, with many physicians having modest levels of Medicare revenue and a few physicians having extremely high levels of Medicare revenue. In 1988, average Medicare revenue

increased 10 percent to roughly \$86,000 across the four States. Paired *t*-tests of revenue change at the State level reveal that study physicians in all four States experienced statistically significant increases in their 1988 revenue: Alabama, \$9,482 ± 821 (*p* < 0.0001); Arizona, \$9,079 ± 1,156 (*p* < 0.0001); Oklahoma, \$9,287 ± 1,225 (*p* < 0.001); and Oregon, \$2,137 ± 835 (*p* < 0.01).

Stratifying physicians by direction and level of prevailing-charge reduction yields interesting results. Physicians who received the largest price reduction experienced the smallest increase in Medicare revenue in 1988, \$2,039 ± 999 (*p* < 0.05). In contrast, physicians whose prices were not reduced experienced the largest increase in Medicare revenue in 1988, \$14,402 ± 1,458 (*p* < 0.0001). Physicians who had small- or medium-sized prevailing-charge reductions experienced similar but somewhat more moderate growth in their Medicare revenue in 1988, \$7,928 ± 745 (*p* < 0.0001) and \$6,253 ± 1,008 (*p* < 0.0001), respectively.

The 1988 increase in Medicare revenue reflects the net effect of a variety of factors: a decrease in the overpriced procedures' prevailing charges; an increase in primary care services' prevailing charges by 3.6 percent; an increase in all other services' prevailing charges by 1 percent; a change in the number of Medicare beneficiaries treated by a physician; and a change in the quantity of services provided as well as other factors. However, it would appear that not only were the study physicians generally able to recover any losses in their Medicare revenues from the overpriced procedure price reductions, but the average study physician increased his or her financial participation in Medicare.

⁸The Practice Expense Component of the Geographic Practice Cost Index published in the Final Rule for the Medicare fee schedule (*Federal Register*, 1991) was used to adjust Medicare revenue.

Volume of Overpriced Procedures

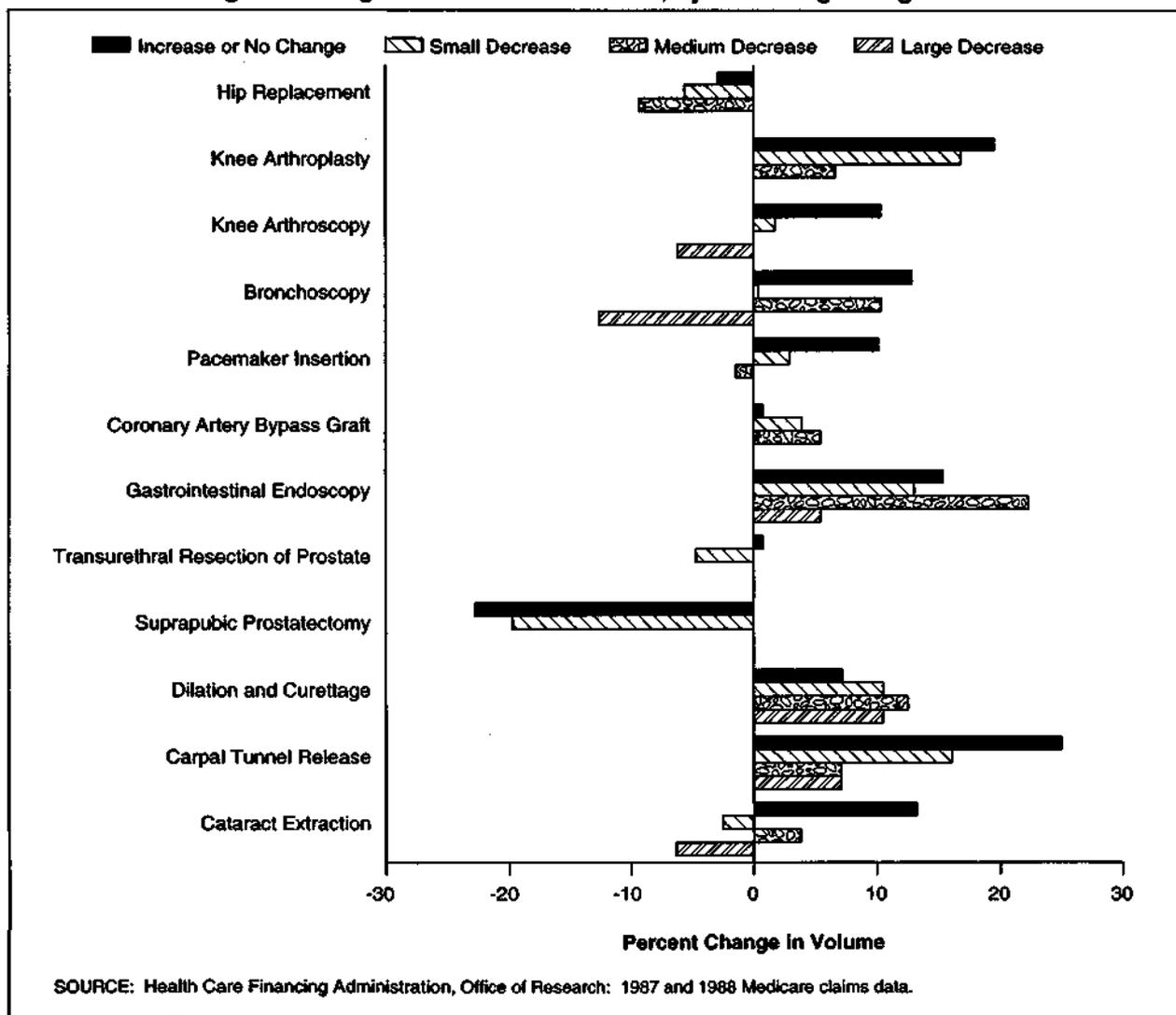
A more direct inquiry regarding realized access deals with the volume and intensity of services provided before and after a price change. Did the volume of overpriced procedures provided change, or did the volume or intensity of other services provided to Medicare beneficiaries change? Two volume measures were analyzed to answer this question: the change in the number of overpriced pro-

cedures; and the change in total number of RVUs provided by the individual physician to Medicare beneficiaries.

Analyzing the change in quantity of overpriced procedures across all physicians reveals that for only five of the overpriced procedures there were small but statistically significant changes in the volume of services provided: knee arthroplasty, 0.5 ± 0.2 ; GI endoscopy, 5.0 ± 0.8 ; suprapubic prostatectomy, -0.4 ± 0.2 ; D &

Figure 6

Percent Change in Average Volume of Procedures, by Prevailing-Charge Reduction Class



C, 0.2 ± 0.1 ; and carpal tunnel release, 0.3 ± 0.1 . Of these five procedures, the change in volume was positive for four of the five procedures and negative for only one procedure, suprapubic prostatectomy. As already mentioned, this reduction is consistent with changes in the treatment of BPH.

Stratifying physicians by the level of prevailing-charge reduction reveals considerable variation in the direction and magnitude of volume changes. Figure 6 displays the percent change between 1987 and 1988 in average number of overpriced procedures by prevailing-charge-reduction class. From the data displayed, several patterns do appear: First, physicians whose prices were not reduced were most likely to have the largest increase in volume of overpriced procedures in 1988; second, for three procedures, the price-reduction size is inversely related to the size of the volume increase; and finally, for five procedures, physicians in the larger prevailing-charge-reduction classes reduced the volume of overpriced procedures in contrast with those physicians who received no price reduction or small reductions and increased volume of services.

Paired *t*-test analyses of changes in volume at the physician level are displayed in Table 1. Overall, there appears to be limited volume response to the price changes. Physicians who experienced either medium or large prevailing-charge reductions do not exhibit statistically significant changes in the volume of most of the overpriced procedures they were providing to Medicare beneficiaries. The only group of physicians exhibiting a change are those physicians who performed GI endoscopy. However, the increase in volume consistently across three of the four

prevailing-charge-reduction classes would suggest that volume changes for this procedure appear to be a function of the underlying rate of technology diffusion.

Physicians who received small price reductions and performed either knee arthroplasties or carpal tunnel releases responded to the price reduction by increasing the volume of overpriced procedures they provided to Medicare beneficiaries. Physicians whose prices were not reduced responded in one-third of the procedure groups by increasing the volume of overpriced procedures they provided Medicare beneficiaries.

Changes in Total RVUs

The second set of analyses assesses changes in total RVUs provided by individual physicians to Medicare beneficiaries. Unlike the earlier analysis, however, the volume response to the overpriced procedure price cuts is disaggregated into two quantity measures: Q_{op} , total RVUs for the respective overpriced procedure, and Q_{oth} , total RVUs for all remaining Medicare services. An increase in RVUs may be interpreted as an increase in volume and/or intensity of services.

Table 2 presents the results from the analysis of change in RVUs by size of prevailing-charge reduction. Changes in the overpriced procedure RVUs, Q_{op} , followed a pattern similar to that observed with the pure quantity measures, namely that there was limited volume response to the price changes, suggesting limited change between 1987 and 1988 in the intensity of services within each of the procedure classes. In other words, it appears that physicians did not substitute five-vessel CABGs for one-vessel CABGs

following the price reductions. Results from the analysis of Q_{oth} reveal that total RVUs for all other Medicare services increased following the overpriced procedure price changes; however, those physicians who received the largest price reductions were the least likely to experi-

ence an increase in Q_{oth} . This finding would suggest that these physicians may have attempted to recover their "losses" from the non-Medicare market.

Table 3 displays the average change in RVUs by level of dependence on all overpriced procedures. As was observed with

Table 1

Average Change in Volume of Overpriced Procedures and Paired t-Test Results, by Level of Prevailing Charge Reduction

Procedure	Level of Reduction			
	Increase or No Change	Small	Medium	Large
Hip Replacement	-0.1070	-0.2227	-0.4329	--
t-statistic	-0.2858	-0.9132	-1.2854	--
p-value	0.7761	0.3621	0.2005	--
Knee Arthroplasty	0.5610	0.7020	0.3077	--
t-statistic	1.1873	2.7946	0.9717	--
p-value	0.2421	0.0057	0.3325	--
Knee Arthroscopy	0.2653	0.0374	--	-0.1676
t-statistic	0.8764	0.1636	--	-0.8251
p-value	0.3852	0.8703	--	0.4104
Bronchoscopy	0.5163	0.0607	1.0833	-0.8776
t-statistic	1.5544	0.1424	1.3413	-1.9162
p-value	0.1222	0.8969	0.1835	0.0613
Pacemaker Insertion	-0.4302	0.2090	-0.0851	-0.2500
t-statistic	-1.0492	0.5655	-0.1364	-0.1674
p-value	0.2970	0.5725	0.8921	0.8777
CABG	0.1304	1.4655	1.5455	--
t-statistic	0.1095	1.0882	0.6478	--
p-value	0.9138	0.2811	0.5241	--
GI Endoscopy	6.6527	3.5982	6.0083	0.6667
t-statistic	3.3359	4.4408	4.2643	0.4162
p-value	0.0010	0.0001	0.0001	0.6853
Transurethral Resection of Prostate	0.1830	-1.3383	--	2.5000
t-statistic	0.2234	-1.5853	--	0.7143
p-value	0.8235	0.1153	--	0.6051
Suprapubic Prostatectomy	-0.3333	-0.2857	--	--
t-statistic	-2.0999	-0.7870	--	--
p-value	0.0390	0.4352	--	--
D & C	0.1145	0.1341	0.2022	0.1767
t-statistic	0.6094	1.1191	1.4475	1.4723
p-value	0.5433	0.2641	0.1486	0.1419
Carpal Tunnel Release	0.5526	0.3617	0.1596	0.1739
t-statistic	1.9282	2.2396	0.6489	0.8351
p-value	0.0563	0.0261	0.5180	0.4048
Cataract Extraction	14.2581	-2.6968	2.6571	-1.8148
t-statistic	2.0507	-1.0252	1.4301	-0.7370
p-value	0.0446	0.3066	0.1549	0.4677

NOTES: CABG is coronary artery bypass graft. D & C is dilation and curettage. GI is gastrointestinal. Small reduction = 1-5 percent; medium reduction = 5.1-10 percent; large reduction = more than 10 percent.

SOURCE: Health Care Financing Administration, Office of Research: 1987 and 1988 Medicare claims data for Alabama, Arizona, Oklahoma, and Oregon.

the first quantity analysis, there is a pattern in which the change in volume was inversely related to the level of dependence on all overpriced procedures. Physicians who were most dependent on the

overpriced procedures were the least likely to increase volume of Q_{op} in 1988. Total RVUs for other services, Q_{oth} , increased most often for the least dependent physicians and least often for the

Table 2
Average Change in Overpriced and Non-Overpriced Procedure RVUs and Paired t-Test Results, by Prevailing Charge Reduction Level and Overpriced Procedures

Procedure	Level of Price Reduction							
	Increase or No Change		Small		Medium		Large	
	Q_{op}	Q_{oth}	Q_{op}	Q_{oth}	Q_{op}	Q_{oth}	Q_{op}	Q_{oth}
Hip Replacement	-9	219	-19	290	-40	185	11	-605
t-statistic	-0.278	2.7210	-0.815	4.8090	-1.270	2.4941	0.1159	-0.912
p-value	0.7820	0.0079	0.4157	0.0001	0.2059	0.0136	0.9151	0.4292
Knee Arthroplasty	46	293	66	178	30	176	68	77
t-statistic	1.0619	2.7214	2.8560	3.3601	1.0498	2.5364	2.7200	3.3478
p-value	0.2946	0.0096	0.0048	0.0009	0.2952	0.0120	0.2243	0.1848
Knee Arthroscopy	-0	359	2	179	—	—	-10	276
t-statistic	-0.017	3.1178	0.1779	2.0647	—	—	-1.004	3.5906
p-value	0.9862	0.0031	0.8592	0.0414	—	—	0.3166	0.0004
Bronchoscopy	2	394	-1	239	9	176	-11	127
t-statistic	0.7272	4.0814	-0.156	3.9723	0.9613	1.0954	-2.154	0.7603
p-value	0.4682	0.0001	0.8762	0.0001	0.3392	0.2765	0.0363	0.4508
Pacemaker Insertion	-19	388	7	500	-2	742	-5	1012
t-statistic	-1.070	2.3901	0.4129	3.1351	-0.092	4.0126	-0.084	1.2718
p-value	0.2875	0.0191	0.6802	0.0020	0.9274	0.0002	0.9385	0.2931
CABG	-3	278	245	223	337	609	—	—
t-statistic	-0.015	1.5577	1.1984	1.1636	0.9405	2.4590	—	—
p-value	0.9878	0.1336	0.2357	0.2494	0.3576	0.0227	—	—
GI Endoscopy	71	303	38	238	66	406	13	26
t-statistic	3.1755	3.6530	4.3856	5.3923	4.3264	5.7870	0.8851	0.0661
p-value	0.0017	0.0003	0.0001	0.0001	0.0001	0.0001	0.3950	0.9485
Transurethral Resection of Prostate	8	417	-54	340	—	—	83	22
t-statistic	0.2286	6.0851	-1.578	4.7933	—	—	0.6680	0.0753
p-value	0.8195	0.0001	0.1169	0.0001	—	—	0.6251	0.9521
Suprapubic Prostatectomy	-15	349	-10	470	—	—	—	—
t-statistic	-2.320	2.2755	-0.647	3.8316	—	—	—	—
p-value	0.0230	0.0257	0.5208	0.0004	—	—	—	—
D & C	0	79	1	86	2	98	2	9
t-statistic	0.2399	1.5332	1.1263	2.9430	1.3123	5.0759	1.9094	0.6183
p-value	0.8107	0.1257	0.2611	0.0035	0.1902	0.0001	0.0571	0.5368
Carpal Tunnel Release	5	259	5	325	3	267	4	112
t-statistic	1.0745	2.7549	1.7876	6.0722	0.5534	2.8512	0.9984	1.3969
p-value	0.2849	0.0068	0.0751	0.0001	0.5813	0.0054	0.3204	0.1641
Cataract Extraction	995	436	-158	213	166	216	-46	379
t-statistic	2.8274	1.8577	-1.054	2.5730	1.4127	2.5500	-0.311	1.9964
p-value	0.0063	0.0680	0.2934	0.0109	0.1600	0.0119	0.7586	0.0565

NOTES: CABG is coronary artery bypass graft. D & C is dilation and curettage. GI is gastrointestinal. Small reduction = 1-5 percent; medium reduction = 5.1-10 percent; large reduction = more than 10 percent. Q_{op} is quantity of overpriced procedures. Q_{oth} is quantity of other Medicare services.

SOURCE: Health Care Financing Administration, Office of Research: 1987 and 1988 Medicare claims data for Alabama, Arizona, Oklahoma, and Oregon.

most dependent physicians, although the difference between the least and most dependent physicians appears small.

DISCUSSION

To provide a view of changes in potential and realized access from the physi-

Table 3
Average Change in Overpriced and Non-Overpriced Procedure RVUs and Paired t-Test Results, by Level of Dependence on All Overpriced Procedures

Procedure	Level of Dependence							
	0-10 percent		10.1-25 percent		25.1-50 percent		More than 50 percent	
	Q _{op}	Q _{oth}	Q _{op}	Q _{oth}	Q _{op}	Q _{oth}	Q _{op}	Q _{oth}
Hip Replacement	133	358	41	210	-139	157	-182	777
t-statistic	3.4828	2.8627	1.8614	3.8930	-4.940	2.3229	-1.667	3.0406
p-value	0.0009	0.4842	0.0643	0.0001	0.0001	0.0214	0.1085	0.0056
Knee Arthroplasty	133	486	63	164	15	10	31	417
t-statistic	5.5730	4.4331	3.3106	4.0067	0.5458	0.1413	0.2177	2.8204
p-value	0.0001	0.0001	0.0011	0.0001	0.5859	0.8878	0.8292	0.0087
Knee Arthroscopy	63	746	11	318	-33	29	-40	669
t-statistic	3.3111	3.9500	1.3126	5.0546	-3.088	0.3686	-1.289	2.3058
p-value	0.0021	0.0003	0.1916	0.0001	0.0024	0.7130	0.2121	0.0320
Bronchoscopy	1	197	-3	291	-23	1262	10	501
t-statistic	0.2002	4.5752	-0.348	2.6929	-1.883	3.0769	1.8158	0.9490
p-value	0.8414	0.0001	0.7283	0.0084	0.0823	0.0088	0.0791	0.3500
Pacemaker Insertion	27	597	-88	254	-15	792	-18	390
t-statistic	2.2413	4.2737	-3.168	1.6590	-0.379	2.8807	-0.425	1.0483
p-value	0.0261	0.0001	0.0025	0.1030	0.7105	0.0102	0.6731	0.3006
CABG	89	420	-364	-770	1285	-4	112	351
t-statistic	1.5263	2.2180	-1.659	-1.419	2.9822	-0.012	0.4766	1.8577
p-value	0.1374	0.0343	0.2389	0.2918	0.0154	0.9907	0.6354	0.0684
GI Endoscopy	23	187	94	391	127	510	-31	2
t-statistic	5.1537	4.4294	3.5900	4.1449	3.0124	4.9920	-0.917	0.0130
p-value	0.0001	0.0001	0.0004	0.0001	0.0034	0.0001	0.4296	0.9905
Transurethral Resection of Prostate	21	214	118	368	-75	412	-207	309
t-statistic	0.5370	1.3117	2.8043	3.0786	-2.323	7.3144	-2.120	3.4833
p-value	0.5975	0.2053	0.0063	0.0028	0.0214	0.0001	0.0523	0.0037
Suprapubic Prostatectomy	-63	511	-11	529	-5	425	-32	-661
t-statistic	-1.259	3.8371	-1.079	3.0738	-0.667	3.1737	-1.361	-0.778
p-value	0.2321	0.0024	0.2881	0.0041	0.5071	0.0022	0.2156	0.4623
D & C	6	73	-7	48	-8	76	-14	23
t-statistic	6.7150	4.3126	-4.739	3.4327	-2.760	2.4000	-2.414	1.8669
p-value	0.0001	0.0001	0.0001	0.0007	0.0074	0.0209	0.0344	0.0888
Carpal Tunnel Release	5	254	7	341	0	70	13	573
t-statistic	1.5080	4.2967	2.1164	5.2988	0.0053	0.8884	1.0735	2.0229
p-value	0.1328	0.0001	0.0356	0.0001	0.9958	0.3758	0.2980	0.0591
Cataract Extraction	36	392	-196	183	334	164	108	262
t-statistic	0.9552	1.7317	-1.124	1.2594	2.7055	1.8517	0.7832	3.5762
p-value	0.3440	0.0894	0.2872	0.2365	0.0086	0.1182	0.4342	0.0004

NOTES: RVUs is relative value units. CABG is coronary artery bypass graft. GI is gastrointestinal. D & C is dilation and curettage. Q_{op} is quantity of overpriced procedures. Q_{oth} is quantity of other Medicare services.

SOURCE: Health Care Financing Administration, Office of Research: 1987 and 1988 Medicare claims data for Alabama, Arizona, Oklahoma, and Oregon.

cian practice perspective, physician availability and Medicare practice characteristics were analyzed. Physician availability as measured by number of physicians treating Medicare beneficiaries or performing overpriced procedures did not change substantially between 1987 and 1988 despite price reductions for these surgical procedures.

The results from the analyses of changes in Medicare caseloads suggest that, regardless of practice size or level of price change, most of the study physicians experienced increases in their Medicare caseload. It appears, however, that the study physicians who faced the largest price reductions had the smallest Medicare caseloads in 1987 and experienced the smallest increase in their caseload in 1988. Physicians who were highly dependent on the overpriced procedures had the largest Medicare caseloads in 1987 and experienced the largest increase in their 1988 caseload. In general, the average share of a physician's Medicare practice for two vulnerable groups of Medicare beneficiaries, those who are not white and those who are poor, remained constant between the 2 years.

Three measures of realized access were studied to assess whether physicians changed their level of financial participation in Medicare or the volume and intensity of services provided to Medicare beneficiaries. The results from these analyses are more complex. There was strong evidence that the study physicians continued to provide services to Medicare beneficiaries and increased their financial participation in the Medicare program in 1988. Average Medicare revenue increased 10 percent over the 2 years despite price reductions for the 12 procedures and only modest increases in fees

for other services. Even study physicians whose Medicare practices were highly dependent on the overpriced procedures did not appear to be adversely affected by the price cuts. These physicians experienced a 4-percent increase in their 1988 Medicare revenue.

The results from analyses of changes in the volume and intensity of services are quite complex. There was evidence that the study physicians continued to provide overpriced procedures. For four of the overpriced procedures, there were statistically significant positive changes in the volume of services provided. Only one procedure, suprapubic prostatectomy, showed a reduction in volume, which is consistent with changes in the clinical indication for its usage. Stratifying physicians by level of prevailing-charge reduction revealed a pattern in which physicians whose prices were not reduced were most likely to have the largest increase in volume, and physicians whose prevailing-charge reductions were the largest did not change the volume of the overpriced procedures. In general, volume of all other services increased across all four prevailing charge classes.

Analyzing volume response by level of dependence on the overpriced procedures revealed a pattern in which the change in both volume measures was inversely related to the level of dependence on the overpriced procedures for roughly one-half of the procedures. Physicians who were least dependent on the overpriced procedures increased all volume in contrast with physicians who were highly dependent on the overpriced procedures. These physicians did not change or reduce volume.

These analyses of changes in access from the physician perspective were con-

fined to four States, 2 years, primarily solo practitioners, and changes in prices for only 12 surgical procedures. This limits the generalizability of the results. But these limited results suggest that physicians do not respond quickly to changes in prices nor do they appear to respond in a way that would create access problems for Medicare beneficiaries. Even those physicians who were highly dependent on the overpriced procedures increased their Medicare caseloads and level of financial participation in Medicare after the price reductions.

In contrast to this study, implementation of the Medicare fee schedule will result in significantly more price changes and will occur in all States. Although the fee schedule will be phased in over a 5-year period, one would expect physicians to face greater incentives to change their Medicare practices under the Medicare fee schedule than were experienced in this study. Furthermore, the prices that Medicare will pay for surgical services under the fee schedule will be closer to the prices that Medicaid has historically paid and further from the prices that private insurers continue to pay physicians. It is generally recognized that some Medicaid recipients have faced considerable access problems as a result of stringent fee limits, while Medicare beneficiaries have been relatively free of access problems resulting from payment levels. As Medicare fees for surgical services move in the direction of the Medicaid fees, the past access experience of Medicare beneficiaries may not predict the future well. Thus, monitoring changes in physician availability and physicians' Medicare practice characteristics will take on greater importance than in the past.

This is the first study to analyze practice characteristics of individual physicians who provide services to Medicare beneficiaries using claims data. Access to physician services was measured in terms of the numbers of physicians performing overpriced procedures, the size of their Medicare caseloads, and the quantity and types of services they provided to beneficiaries. But what do changes in these measures actually represent? Although there was considerable variation in physician availability across the four States and in Medicare caseloads across physicians, one cannot determine from these claims data whether underlying access problems existed prior to the price reductions. Thus, changes in these measures may not represent changes in access. This limitation would suggest that further research is needed to determine standards or norms that connote whether the current levels of physician availability are adequate and to establish which changes in physicians' Medicare practice characteristics are sentinel events for identifying either potential or realized access problems.

REFERENCES

- Aday, L., and Anderson, R.M.: *Development of Indices of Access to Medical Care*. University of Michigan. Ann Arbor, MI. Health Administration Press, 1975.
- Aday, L., and Anderson, R.M.: Equity of Access to Medical Care: A Conceptual and Empirical Overview. *Medical Care* 19(12):4-27. December 1981.
- Aday, L., Fleming, G.V., and Anderson, R.: *Access to Medical Care in the U.S.: Who Has It, Who Doesn't*. Chicago. Pluribus Press, Inc., and Center for Health Administration Studies, 1984.
- Boutwell, R.C., and Stason, W.B.: *Technology Case Studies: Final Report*. Under Contract to the Health Care Financing Administration, Contract No. 500-89-0050. Center for Health Economics Research, January 15, 1992.

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. Vol. 56, No. 227, 59502-59819. Office of the Federal Register, National Archives and Records Administration. Washington. U.S. Government Printing Office, November 25, 1991.

Mitchell, J., and Menke, T.: How the Physician Fee Schedule Affects Medicare Patients' Out-of-Pocket Spending. *Inquiry* 27(2):108-113. Summer 1990.

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

Physician Payment Review Commission: *Monitoring Access: The Commission's Report to Congress: Draft Report*. U.S. Congress. 1992.

Sloan, F.A., and Bentkover, J.D.: *Access to Ambulatory Care and the U.S. Economy*. Lexington, MA. Lexington Books, 1979.

U.S. Department of Health and Human Services: *Report to Congress: Monitoring Changes in Use of, Access to, and Appropriateness of Part B Medicare Services*. U.S. Department of Health and Human Services. Washington, DC. 1991.

U.S. Department of Health and Human Services: *Report to Congress: Monitoring Utilization of and Access to Services for Medicare Beneficiaries Under Physician Payment Reform*. U.S. Department of Health and Human Services. Washington, DC. 1992.

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