Articles on Other Topics

The Effect of Managed Care on the Incomes of Primary Care and Specialty Physicians

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Objective. To determine the effects of managed care growth on the incomes of primary care and specialist physicians.

Data Sources. Data on physician income and managed care penetration from the American Medical Association, Socioeconomic Monitoring System (SMS) Surveys for 1985 and 1993. We use secondary data from the Area Resource File and U.S. Census publications to construct geographical socioeconomic control variables, and we examine data from the National Residency Matching Program.

Study Design. Two-stage least squares regressions are estimated to determine the effect of local managed care penetration on specialty-specific physician incomes, while controlling for factors associated with local variation in supply and demand and accounting for the potential endogeneity of managed care penetration.

Data Collection. The SMS survey is an annual telephone survey conducted by the American Medical Association of approximately one percent of nonfederal, post-residency U.S. physicians. Response rates average 60–70 percent, and analysis is weighted to account for nonresponse bias.

Principal Findings. The incomes of primary care physicians rose most rapidly in states with higher managed care growth, while the income growth of hospital-based specialists was negatively associated with managed care growth. Incomes of medical subspecialists were not significantly affected by managed care growth over this period. These findings are consistent with trends in postgraduate training choices of new physicians.

Conclusions. Evidence is consistent with a relative increase in the demand for primary care physicians and a decline in the demand for some specialists under managed care. Market adjustments have important implications for health policy and physician workforce planning.

Key Words. Physician income, managed care, primary care physicians, specialists, physician workforce

Recent healthcare reform efforts have focused attention on the perceived proliferation and excessive use of medical specialists relative to primary care physicians. Concerns about specialists have resulted in proposals to regulate medical education programs and impose caps on the number of entrants into specialty training programs (see Council on Graduate Medical Education [COGME] 1994). This article provides evidence that, independent of regulatory initiatives, market forces are leading to adjustments in the market for physicians.

Since the mid-1980s, healthcare markets have been transformed by the growth of managed care. Managed care payers seek to contain costs by imposing controls on the settings where patients obtain services and on the particular services they receive. Of key importance is the fact that managed care plans frequently limit a patient's access to specialty care and simultaneously negotiate reduced payments to providers for services.

We use physician survey data for 1985 and 1993 to examine the relationship between physician compensation and the growth of managed care at the state level. Two-stage least squares is employed to account for the endogeneity of managed care growth. We find that managed care growth is associated with a decrease in the earnings of specialists relative to primary care physicians, which is consistent with a reduction in market-level demand for specialty services. These findings suggest that managed care is changing the relative demands for primary care and specialist physicians, and challenge the need for additional regulatory strategies to redress perceived imbalances in the physician workforce.

THE PHYSICIAN MARKET AND THE ECONOMICS OF SPECIALTY TRAINING

After completing medical school, physicians typically undertake three to six years of postgraduate training, such as internships, residencies, and fellowships. Fewer than 20 percent of recent medical graduates have completed

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primary care training programs, usually defined as programs in family practice, general internal medicine, and pediatrics (Starfield 1992), but over 80 percent of recent graduates complete specialty and subspecialty training programs. Nearly 70 percent of all U.S. physicians are currently specialists.

Many analysts have alleged that specialists drive up the costs of medical care, in part because they have more costly practice styles (Grumbach and Lee 1991; Schroeder and Sandy 1993; Wennberg et al. 1993). This does not, of course, automatically imply that there are inefficiencies in the market for specialist services. However, the market for physician services deviates from the textbook model of competition in a number of ways that may contribute to excessive utilization of specialty services.

On the supply side of the market, medical education receives large public subsidies. Medicare pays hospitals a bonus based on the number of residents in training. In recent years, the Medicare subsidy to residency training has totaled around $6 billion, or approximately $100,000 per resident. Since hospitals tend to rely more on specialists than generalists, this subsidy has favored the production of medical specialists. Since 1994, however, Medicare has frozen per capita payments for specialists, while allowing per capita payments for primary care physicians to rise with the inflation rate.

Specialty boards can restrict the number of hospital residency programs and potentially limit the production of specialists. However, specialty board controls on entry did not stem a shift of physicians into specialty areas during the 1980s.

The demand side of the market includes direct demand for physicians by patients (possibly mediated by managed care purchasers) and derived demand from hospitals and other providers that employ some physicians and grant privileges to others to perform services demanded by patients. Distortions on the demand side exist due to insurance and information problems. Under traditional indemnity health insurance, the responsibility for shopping for services was delegated to patients and their physicians who lacked incentives to limit expenditures. In addition, virtually all insurers traditionally covered the full cost of specialty care, whereas many did not cover primary care, further distorting the relative demands for each (Employee Benefit Research Institute [EBRI] 1995). Insurance-related distortions were compounded further by informational asymmetries. Patients often relied on their physicians for treatment recommendations. Under fee-for-service reimbursement, physicians had an incentive to "induce demand"; that is, recommend more complex treatments (Fuchs 1978; Hirth and Chernew 1994).

MANAGED CARE AND PHYSICIAN DEMAND

Managed care plans, including HMOs, PPOs, and point-of-service (POS) plans, have introduced significant changes to the demand side of the market. Managed care includes a variety of cost-containment strategies used by employers and insurers, such as utilization review (UR), selective contracting, and financial incentives. Through UR, insurers monitor patterns of treatment. Through selective contracting, insurers and employers negotiate discounted prices with a limited panel of healthcare providers. Providers are chosen on the basis of their prices, quality history, treatment styles; their willingness to abide by UR; and their willingness to accept financial risk (e.g., capitation). Managed care plans may attempt to control access to specialists through restrictions on referrals and the use of primary care physicians as gatekeepers.

Insurers use a variety of financial incentives to influence patient and provider behavior. Low copayments encourage patients to use panel providers. Physicians frequently have a portion of their income tied to plan costs or profitability, through the use of withholds and bonus systems. Capitation shifts the responsibility for treatment costs to providers: those who have above average utilization of costly services may have lower than average earnings.

The combined thrust of these strategies is (1) to shift purchasing responsibility from individual patients and their physicians to payers, who have strong incentives to hold down costs and who may be able to realize economies of scale in gathering and evaluating information about price and quality; (2) to build features into health insurance that limit access to care and the utilization of services; and (3) to cut the prices paid to providers. These strategies may alter both the overall demand for physicians and the relative demands for primary care physicians and specialists. Those physicians who depend on hospital-based revenue may be especially affected, as managed care strategies target expensive inpatient care.

The conventional wisdom is that managed care has lowered healthcare cost, or at least its rate of growth. Many studies of the effects of managed care on costs, however, are inconclusive because they fail to control for patient sorting into plans (Miller and Luft 1994). Several recent studies that do control for sorting suggest that managed care plans provide permanent reductions in level of expenditures; however, they may fail to restrain future growth (Baker 1996; Cutler and Sheiner 1997; Hill and Wolfe 1997). Research on the effects of managed care penetration on the demand for physicians has been largely inconclusive (Baker 1994; Wong 1993). Finally, most research to date has

focused on HMOs. These results cannot be generalized to other models of managed care such as PPOs and POSs, which, in fact, make up the majority of the managed care market.

In this article we focus on the relationship between a broadly defined measure of managed care penetration at the state level between 1985 and 1993 and growth in physician income. In long-run equilibrium, physician incomes will tend to equilibrate across markets as physicians migrate away from less attractive markets. However, if physicians do not respond rapidly to differential income opportunities, then changes in demand will be reflected by changes in income, at least in the short run.[1]

Physician supply may be slow to respond to income differentials for several reasons. First are the substantial constraints on physician mobility: it is extremely costly for a physician to give up an established practice and referral patterns. Indeed, only about 5 percent of physicians relocate their practices in a given year (Marder 1990). Some of this 5 percent—those who stay within the same market—would not affect our state-level analysis. Others in this 5 percent relocate for non-economic reasons. Second, if it is expected that managed care will ultimately spread to most markets, physicians may not relocate in response to short-run growth in managed care in their own state. Thus, it is not likely that the relocation of established physicians results in the equilibration of income over the time period that we study. Over time, changes in demand may affect not only physician incomes, but also their career choices. McKay (1990) and others have found that residents' choice of specialty is sensitive to expected income. To the extent that managed care increases the relative rewards to primary care, this income expectation can have important implications for the future supply of physicians and thus can influence the need for federal regulation of the physician workforce.

The next section discusses methods and data. We examine determinants of physician income across states and across time to take advantage of the fact that states not only differ in levels of managed care penetration, but in managed care growth rates as well. Managed care penetration is likely endogenous with respect to physician and market characteristics: we employ two-stage least squares to account for this fact. Data from the American Medical Association's (AMA) Socioeconomic Monitoring System (SMS) survey are used to measure income of primary care and specialty physicians. Data from the SMS on physician contracts with various forms of managed care are used to construct state-level measures of managed care penetration. The subsequent section presents our empirical model, followed by the section reporting our results. We find that incomes of primary care physicians rose

more rapidly in states with higher managed care penetration, while incomes of hospital-based specialists rose less rapidly in high managed care states. We close with a brief discussion of the policy implications of these findings.

METHODS AND DATA

Methods

We compare changes in median physician incomes at the state level between 1985 and 1993 with changes in state-level managed care penetration, controlling for changes in demographic variables that may independently affect physician incomes. There is sufficient variation among states to uncover important relationships in physician markets. We recognize, however, that use of state data can mask interstate variation. Finer levels of analysis would be useful but are beyond the scope of the present study. Our empirical analysis of the impact of managed care on physician incomes is specified in terms of changes, rather than levels. By differencing, we eliminate potential biases due to any fixed idiosyncratic state-level factors that could affect levels of physician income or managed care penetration. We examine incomes rather than effective hourly wages, because changes in demand associated with managed care may affect hours as well as fees.

We use two-stage least squares (2SLS) to isolate the exogenous effects of managed care penetration on incomes. As noted by McLaughlin (1988) and Baker (1994), decisions by managed care organizations to enter specific markets may be endogenous to the costs of care and the characteristics of provider markets. For example, managed care plans may enter those markets in which healthcare costs—including physician compensation—are expected to rise. To implement 2SLS and avoid potential endogeneity bias we require variables that explain changes in managed care penetration but are otherwise independent of changes in physician income. Candidates for identifying the first stage of the 2SLS model include hospital structure, consumer mobility, and employer characteristics.

Data

We use data from the American Medical Association's Socioeconomic Monitoring System (SMS) to evaluate managed care penetration and physician incomes. The SMS surveys patient care physicians regarding activities, practice setting and organization, managed care involvement, and income. The survey, which is conducted annually, covers approximately one percent of

the population of active, nonfederal, post-residency, patient care physicians, and obtains responses from approximately 4,000 physicians annually. The response rate is approximately 60 percent and data are weighted for nonresponse bias.

We employ data from the 1985, 1986, 1993, and 1994 SMS surveys. Different physicians are surveyed in each year, with limited overlap.[2] Sample size is sufficient to permit state-level analysis of physicians in major specialty groupings. To the extent that respondents are representative of their state's overall physician populations, we effectively have state-level "panels." Our primary objective is to examine longitudinal differences in managed care penetration and physician income at the state level.

Studies of managed care must come to terms with how to measure it. Managed care includes many organization forms (HMOs, PPOs, etc.) and cost-containment strategies; however, the majority of prior research on managed care plans has looked only at HMOs. A major reason for the emphasis on HMOs is that they have been subject to extensive regulation by state insurance commissions, whereas PPOs have not. As a result, extensive data are available from state regulators for enrollments in HMOs, but not for PPOs enrollment. Although a focus on one particular form of managed care such as the HMO is useful, it may provide an incomplete picture of the impact of managed care.

We examine all organizations that employ selective contracting, either solely or in combination with other cost-containment mechanisms. Thus, we aggregate data about HMOs, PPOs, and hybrid forms. There are number of reasons for expecting that HMOs and PPOs may have similar effects on the physician marketplace. The most important is that through the common practice of selective contracting, both forms play providers off against each other to obtain discounted prices. Moreover, HMOs and PPOs often use similar forms of payment, particularly since the dominant forms of HMOs generally reimburse on a fee-for-service basis (Simon and Emmons 1997). This reflects the frequently blurred distinctions between HMOs and PPOs. For example, hybrid POS plans combine aspects of both types of plans (see Arnould, Rich, and White 1993). While there are differences between plans—for instance, whether they promote the use of primary care, how they pay physicians, and the extent to which they employ utilization management techniques—these differences are not readily matched into classifications such as HMO and PPO. These facts argue for using a broad measure of managed care. (Later, we compare our findings with those using a more restrictive measure of penetration.)

We compute our measure of managed care penetration from the SMS.[3] Specifically, we measure penetration in a state as the percentage of physician revenue that is derived from employment by, or contracts with, HMOs, IPAs, and PPOs.[4] Because the SMS questions respondents about practice earnings from the previous year, but queries them on current year managed care contracts, we use the 1986 SMS to obtain 1985 incomes, and the 1985 SMS to obtain 1985 penetration rates. Likewise, we use the 1994 SMS to obtain 1993 incomes, and the 1993 SMS to obtain 1993 penetration rates. Use of different SMS samples to compute income and penetration avoids spurious correlation and biases that may be introduced if penetration and income are measured for the same group of physicians.[5] To reduce possible bias further, as well as to improve the precision with which we measure penetration, we use changes in managed care penetration rates computed over all physicians to predict changes in income within each specialty group.[6]

The effects of managed care on physician income may vary by specialty, so we construct three specialty categories: (1) primary care, defined as general/family practice, general internal medicine, and pediatrics; (2) subspecialists defined as physicians practicing in either a surgical or an internal medicine subspecialty (e.g., orthopaedic surgeons, cardiologists); and (3) "RAPs" (radiologists, anesthesiologists, and pathologists), hospital-based specialists whose services are demanded only upon referral. We chose these categories to maximize variation in the effect of managed care on different "types" of physicians, while generating enough observations to support state-level aggregation. In 1993, 33 percent of all physicians were classified as primary care, 22 percent were subspecialists, and 19 percent were RAPs.

The groupings are not collectively exhaustive: general surgeons, obstetricians/gynecologists, emergency medicine physicians, psychiatrists, and "other" specialties are omitted (approximately 25 percent of all physicians). The impact of managed care on these excluded groups is more difficult to characterize than for subspecialist, primary care, and RAP physicians. For example, general surgeons and obstetricians/gynecologists frequently deliver a mix of primary and specialty care. Analysis of the intermediate "specialties" would be interesting. Unfortunately, none of these specialties constitutes more than 6 percent of the physician population, yielding too few observations at the state level for meaningful analysis. Aggregating these specialties would produce groups with too much intragroup heterogeneity.

We calculate income levels for each of the three specialty groups, by state and over time. Income is defined as inflation-adjusted net practice income, after expenses but before taxes. After partitioning data by specialty, sample

sizes are quite small in some states, making data sensitive to outliers. We deal with this problem in several ways. First, we combine North and South Dakota, Vermont and New Hampshire, and Wyoming and Idaho, into three state pairs. Second, we drop states that had fewer than five observations. We end up examining 47 observations (or states and state pairs) for primary care, 45 "states" for subspecialty care, and 43 "states" for RAPs. Third, we use weighted least squares to account for sampling error, in states with relatively few responses, and for the fact that the precision of our estimates increases with the number of physicians in each state and specialty group. We use median rather than mean income to further mitigate the impact of outliers.[7]

EMPIRICAL MODEL

We estimate a multi-equation model in which changes in market level penetration of managed care and physician incomes are jointly determined. Let

$$\begin{aligned} \textit{Change in managed care penetration}_m &= \beta' X_m + \delta' Z_m + \Sigma_s Y_s \\ \textit{Change in median physician income}_{m,s} & \\ &+ \nu_{s,m} \end{aligned} \tag{1}$$

$$\begin{aligned} \textit{Change in median physician income}_{m,PC} &= \alpha_{PC} \\ \textit{Change in managed care penetration}_m &+ \theta_{PC} X_m \\ &+ \mu_{PC,m} \end{aligned} \tag{2a}$$

$$\begin{aligned} \textit{Change in median physician income}_{m,Surg} &= \alpha_{Surg} \\ \textit{Change in managed care penetration}_m &+ \theta_{Surg} X_m \\ &+ \mu_{Surg,m} \end{aligned} \tag{2b}$$

$$\begin{aligned} \textit{Change in median physician income}_{m,RAP} &= \alpha_{RAP} \\ \textit{Change in managed care penetration}_m &+ \theta_{RAP} X_m \\ &+ \mu_{RAP,m} \end{aligned} \tag{2c}$$

where the change in median physician income in market m by specialty s and the percentage point change in market-level managed care penetration in market m are computed for the period between 1985 and 1993. X_m is a vector of variables measuring changes in economic and demographic variables that

affect the supply or demand for physician services, or both, and therefore may affect both incomes and managed care penetration. Z_m is a vector of market variables that affect managed care but do not affect incomes.

We use 2SLS to obtain consistent parameter estimates for the equation system. Several specification tests were run to test the appropriateness of 2SLS. Hausman tests reject exogeneity of the change in market-level managed care penetration at $p = .03$. Chow tests reject homogeneity of α and θ across Equations (2a)–(2c) at $p < .01$. A Breuch-Pagan test rejects the hypothesis that the errors in Equations (2a)–(2c) are correlated, implying that it is not necessary to estimate three-stage least squares.

Determinants of Physician Income

There has been considerable research into the socio-demographic and economic factors that affect geographic and specialty-specific variation in physician income (Headon 1991; Marder 1990; Willke and Cotter 1989). Variables that reflect market demand and supply conditions must be included in our estimates of (2a)–(2c) to control for other factors affecting physician income levels. We examined a comprehensive array of variables that had demonstrated explanatory power in other published studies. Sample size considerations required that we include in our final specifications only those variables that have strong theoretical or empirical importance. Consistent with estimating changes in physician income on the left-hand side, we measure changes in our right-hand side predictors (between 1985 and 1993) as well.

We estimate three reduced-form income equations—one for each specialty group. Each equation contains two endogenous variables: the change in median physician income for the specialty group between 1985 and 1993, and the percentage point change in the share of physician revenues derived from managed care during this period. The change in the share of physician revenues derived from managed care is computed across all physicians in the state, not just those in the specialty group under consideration. Independent variables in the income equations (2a)–(2c) are the changes in the state's median per capita income, age distribution (change in the percentages of the population over 65 and under 5), and educational attainment (change in the percentage of the population who are high school graduates). We also control for changes in the percentage of the population living in urbanized areas and in the percentage of the population without health insurance.[8] The rationales for including these variables are as follows. Physician services are a normal good and insurance coverage is generally found to stimulate demand. Age affects the demand for services—with demand being particularly high

among the old and the young. Education levels have been shown to correlate with the health status of the population, and educational attainment has been shown as a proxy for access to medical care. The change in the percentage of the population in urban areas may capture a number of effects, such as preferences in physician location or higher input prices.

Physician earnings (and managed care penetration) may also be affected by state regulation. We include dummy variables to indicate the passage of "any willing provider" laws (AWP). These laws affect the ability of HMOs and PPOs to practice selective contracting (Simon 1997). Specialist groups, whose services are more severely rationed under managed care, have been proponents of AWP legislation, although several state medical societies with broad constituencies have also endorsed AWP legislation. If AWP laws reduce the effectiveness of selective contracting, we would expect to find a smaller managed care effect in states with AWP laws. State AWP laws differ in whether they cover all types of managed care plans. Hence, separate variables are used to indicate which states enacted laws that apply to both HMOs and PPOs versus states with legislation that applied only to PPOs and network forms of managed care. As of 1993, 13 states had some form of AWP legislation.[9] Means and variances of all variables are reported in Table 1.

Determinants of Managed Care Growth

There is a much smaller literature on the factors that contribute to the entry and growth of managed care plans. Scale economies may limit the entry of managed care plans in sparsely populated geographic areas (Newhouse et al. 1982; Kronick et al. 1993; Given 1996). However, there is considerable variation in the degree of managed care penetration across urban areas with

Table 1: Descriptive Statistics for Key Variables

Variable	*Mean*	*s.d.*	*Minimum*	*Maximum*
Change in managed care penetration	15.2%	6.8	−0.6	31.4
Change in median physician income	26750	39165	−1223	140938
Change in percent population over 65	2.62	1.93	−0.25	8.2
Change in percent population under 5	−0.33	0.96	−3.18	2.23
Change in per capita income	462.7	669.7	−1175	1926
Change in percent population, high school graduates	8.4	2.6	2.7	15.2
Change in percent population, urban	2.6	1.8	−0.1	3.9
In-migration (per 10,000)	158.6	130.3	22.0	622.0
Hospital Herfindahl (1980)	39.2	17.5	9.1	79.7
Percent workers in big firms (1989)	18.2	5.4	2.4	31.8
Percent workers in small firms (1989)	28.2	4.7	19.5	46.6

seemingly similar populations. It has been suggested that entry by managed care organizations depends critically on the demands of employers. In general, larger firms have been more likely to offer managed care to their employees than small firms. The percentage of employees in big firms measures the percentage of a state's workers employed in 1989 by firms with more than 500 workers. The percentage of employees in small firms measures the percentage employed in firms with fewer than 20 workers. The selective contracting performed by managed care plans may attract those consumers who are not already attached to particular providers. We include the percentage of a state's population that moved to that state within the previous five years as a measure of in-migration.

Dranove, Simon, and White (1998) suggest that managed care organizations that employ selective contracting will be more successful where there are several hospitals that managed care purchasers may play off against each other to obtain discounts. To capture this effect and measure concentration in the hospital markets in states, we compute a state-level Herfindahl index for 1980.[10] This measure is equal to a weighted average of the Herfindahl in each separate market area in the state where the markets are metropolitan areas and the weights are local populations. Thus, this measure captures (the inverse of) the amount of hospital choice faced by an average consumer in the state.[11]

Diffusion of managed care in a marketplace may depend on the preconditions for supply and demand, as well as on changes that occur over time. We examine alternative specifications of the managed care penetration equation, including both the initial levels and the changes in the exogenous variables. To conserve degrees of freedom, we use a parsimonious specification in our first-stage regression.

Employer size, hospital concentration, and migration are all arguably exogenous to the system of Equations (1)–(2). An F-test rejects the hypothesis that the coefficients on the percentage of workers in big firms, small firms, hospital concentration, and in-migration in the first-stage regression are jointly equal to zero at conventional significance levels ($p = .01$).

RESULTS

Table 2 presents the 2SLS estimates of the impact of managed care growth on changes in physician incomes. The first column reports the results for primary care physicians. An increase in managed care penetration is associated with an increase in the incomes of primary care physicians. Results are statistically and

Table 2: Impact of Managed Care on Physician Income (Dependent Variable: Change in Median Physician Income, 1985–1993)

	Estimated Coefficients (t-statistics)		
Variable	*Primary Care*	*Subspecialists*	*RAPs*
Intercept	9564.7 (1.83)	236.3 (0.028)	19551.2 (2.541)
Change managed care penetration	2263.5 (2.053)	530.4 (0.49)	−1992.7 (2.42)
Change per capita income	−0.979 (0.169)	24.12 (2.55)	8.53 (0.67)
Change percent high school graduates	1454.2 (0.888)	1344.0 (0.970)	−713.1 (0.25)
Change percent population over 65	4841.3 (2.174)	3528.7 (1.699)	−10479.2 (2.51)
Change percent population under 5	−1499.5 (2.069)	−16845.1 (0.976)	−4429.1 (0.47)
Change percent population urban	1375.9 (2.34)	4511.6 (2.01)	1003.6 (1.98)
Change percent population uninsured	−53.5 (0.35)	−58.57 (0.16)	−2021.2 (0.55)
AWP Law—PPOs only	5685.2 (1.996)	28437.7 (1.788)	−3267.9 (2.026)
AWP Law—HMOs/PPOs	−18042.5 (1.640)	−3054.0 (1.442)	3989.6 (1.946)
N	47	45	43
Adjusted R^2	0.281	0.072	0.377

economically significant. The coefficient on the predicted change in managed care penetration suggests that each increase in managed care penetration of one percentage point resulted in a cumulative $2,263 gain in real income over the period 1985 through 1993. On average, managed care penetration rose by 15.2 percent over the eight-year period we studied, which would translate to real gains of more than $34,000 for primary care physicians relative to those markets with no managed care growth. This represents an increase in income of more than 6 percent for primary care physicians, who earned $69,000 on average in 1985.

In contrast, the real incomes of RAP physicians fell significantly as a function of managed care growth. The significant, negative coefficient on the RAP earnings equation (column 3) suggests that a one percent increase in managed care penetration resulted in a cumulative loss of $1,993 in real earnings. In the average market with 15.2 percent growth in managed care, this amounts to a (cumulative) loss of over $30,000 relative to the markets with stable managed care penetration.

Results for RAPs and primary care physicians are consistent with expectations. Real income changes for medical and surgical subspecialists, however, do not appear to be significantly related to managed care penetration. Several factors may be at work. First, studies have documented that managed care is most effective in reducing utilization of inpatient hospital

services (Congressional Budget Office [CBO] 1994, 1995; Goldman 1995). Cost savings have not been widely documented for outpatient services. RAP physicians are largely hospital based, and reductions in the demand for hospital services would be expected to disproportionately affect their earnings. Second, RAP services are generally consumed only upon referral from another physician. RAPs rarely have established patients of their own and hence would have less opportunity to "induce" demand or engage in strategic behavior that would permit them to offset the price reductions that occur under managed care with increases in the volume of services that they provide. Similarly, utilization review has focused on tracking diagnostic tests and hospitalizations.

The estimated coefficients on the control variables are of mixed interest and significance. Increases in the elderly populations are associated with higher incomes for all physician groups. Increased wealth in a population is associated with increased income for specialists. Surprisingly, changes in insurance status do not enter significantly in the equations. Increased urbanization is associated with higher income for all physicians. AWP laws appear to have mixed effects.

Table 3 presents the estimates of the first-stage managed care penetration regression. The percentage of workers employed by small firms is negatively associated with managed care growth. Interestingly, contrary to our expectation, there is also a negative association between managed care growth and the percentage of workers employed by big firms. Apparently, firms of intermediate size were most likely to facilitate growth in managed care over this time period. The coefficient on in-migration has the expected sign, but is marginally insignificant. States with higher levels of concentration in hospital markets (i.e., fewer hospital choices) have significantly lower penetration. With respect to the socioeconomic variables, increases in the percent urban and the population under age 5 are associated with higher managed care growth, as also is higher income. A rise in the percentage of the population over 65 is linked to reductions in managed care growth.

Using a Different Measure of Managed Care Penetration

As we have discussed, managed care represents a constellation of approaches to changing the demand for medical services and the prices paid for them. Our measure of managed care—the percentage of physician revenues that are earned from contracts with HMOs, POSs, IPAs, or PPOs—captures several major forms of managed care. Most research on managed care to

Table 3: First-Stage Regression Estimates (Dependent Variable: Change in Managed Care Penetration [Percent MD Revenues from Managed Care], 1985–1993, by State)

	Estimated Coefficient (t-statistics)
Variables	*Model 1: WLS*
Intercept	138.6 (6.18)
Change in per capita income	−0.00283 (2.15)
Change in percent population high school graduates	−0.346 (0.82)
Change in percent population over 65	−0.87 (2.78)
Change in percent population under 5	4.831 (4.08)
Change in percent population urban	4.22 (1.76)
Change in percent population uninsured	−0.104 (0.29)
In-migration	0.0027 (1.65)
Percent workers in big firms	−0.623 (4.38)
Percent workers in small firms	−0.261 (4.24)
AWP Law—PPOs only	−1.99 (1.92)
AWP Law—HMOs/PPOs	2.59 (1.35)
Hospital Herfindahl (1980)	−0.160 (1.99)
N	48
Adjusted R^2	0.600

date has restricted attention to HMO enrollments, based on surveys of HMOs by Group Health Association of America and InterStudy, or market surveys by Marion Merrell Dow, due to the fact that no other information is systematically available. This limited view of what constitutes managed care may bias analyses. If the greatest impact of managed care were to result from the use of selective contracting, then defining managed care in terms of HMO enrollment would miss a large segment of the market.

To see if a more limited measure of managed care penetration would generate similar results, we reestimated our models using the state-level HMO enrollment rates.[12] Results of the 2SLS estimation are presented in Table 4. The magnitudes of the estimated effects of managed care on the incomes of generalists and RAPs are generally smaller than we obtained using our broader measure of managed care. Again, there is no significant relationship between managed care/HMO penetration and the earnings of subspecialists. Standard errors are generally larger. This suggests that both measures likely capture related dimensions of managed care penetration. However, use of a broader, revenue-based measure of managed care generated results with greater economic and statistical significance in this study.

Table 4: Impact of HMO Penetration on Physician Income (Dependent Variable: Change in Median Physician Income, 1985–1993)

	Estimated Coefficients (t-statistics)		
Variable	*Primary Care*	*Subspecialists*	*RAPs*
Intercept	2318.23 (0.67)	13922.1 (0.24)	27524.8 (1.56)
Change in HMO market share	1119.11 (1.751)	750.7 (0.42)	−1054.3 (1.92)
Change in per capita income	−2.886 (1.451)	17.44 (1.83)	7.09 (1.99)
Change in percent high school graduates	−1385.90 (−1.31)	3727.2 (1.264)	2700.1 (1.18)
Change in percent population over 65	1367.1 (2.020)	972.2 (1.623)	−8237.4 (2.24)
Change in percent population under 5	−5746.95 (1.554)	2146.0 (0.208)	−12687.4 (1.03)
Change in percent population, urban	955.7 (2.089)	2903.6 (2.37)	2744.0 (2.19)
Change in percent uninsured	−78.6 (0.60)	−91.7 (0.25)	−1673.4 (0.06)
AWP Law—PPOs only	5123.2 (0.920)	17290.6 (1.158)	−3286.9 (2.25)
AWP Law—HMOs	−17764.1 (2.161)	−19649.7 (0.977)	2042.6 (2.101)
Adjusted R^2	0.129	0.010	0.195

DISCUSSION

Our findings suggest that increasing managed care penetration results in higher incomes for primary care physicians and lower incomes for RAP physicians, all else equal. As of 1993, managed care had not yet affected the incomes of surgical specialists in a significant way. Perhaps managed care was not effectively altering patterns of specialist usage, or reductions in usage were being offset by increases in specialists' prices (or vice versa).

These results have an important implication for public policy. The federal government has recently sought to impose limits on the number of medical school graduates who seek a residency in a specialty area. Since 1994, Medicare has ceased increasing payments to hospitals for training medical specialists in attempts to promote the increased training of primary care physicians. If our results are correct, then we would also expect medical school graduates to make adjustments themselves as they anticipate changes in earning opportunities.

Has there been a supply response in the market for graduate (residency) medical education? Residency positions are filled each year through the

National Residency Matching Program (NRMP). Each year, medical school seniors compete for limited openings in residency programs ranging from family practice to ophthalmology. Students list their top residency program choices and the programs indicate their choice of students. On a single day in the spring a computer matches students with programs.

We examine the positions filled by U.S. medical school graduates in the NRMP from 1991 through 1996.[13] Residents in family practice, pediatrics, and internal medicine may all become primary care practitioners. Because many internal medicine residents complete subsequent subspecialty training, we exclude them from our analysis and consider residencies only in family practice and pediatrics as indicators of trends in primary care. We also do not attempt to examine subsequent training in medical subspecialties (e.g., cardiology) because of changes over time in the way slots have been filled for these programs. Instead, we limit our analysis to match data for surgical specialists as an indicator of trends in subspecialty training. We examine match data for programs in diagnostic radiology, anesthesiology, and pathology as indicators of trends in training for RAP specialties.

Between 1991 and 1996, the percentage of positions in family practice that were filled by U.S. medical graduates rose from 56 percent to 73 percent, and the number of slots filled increased by 64 percent. For pediatrics residencies, the fill rate rose from 65 percent to 77 percent, and the number of slots filled rose by 19 percent. Historically, hospitals claimed that residencies in primary care specialties suffered because of the large disparities in earnings between primary care and specialist physicians. The relative rise of primary care incomes due to the growth of managed care has apparently begun to have an effect on primary care residencies.

Consistent with our findings for subspecialist earnings, there was no appreciable change in the fill rate for surgery and surgical subspecialty residency slots between 1991 and 1996. However, fill rates for RAPs declined substantially. An analysis of the data indicates that almost all of the brunt has been felt in anesthesiology, where the fill rate plummeted from 73 percent in 1991 to under 18 percent in 1996, and the number of slots filled dropped by more than 80 percent (National Residency Matching Program 1996). Combined with the evidence on physician earnings, these findings suggest that the physician labor market is adjusting to economic signals without resorting to direct regulation of slots or prices. In fact, the change in residency match is somewhat surprising in light of the (proportionally) modest declines in RAP income documented in this article. Evidence suggests, however, that much of the reversal in physician earnings has come only in the past couple of

years (Simon and Born 1996). The message from the residency match, where future physicians are projecting lifetime earnings, is that documented trends are expected to continue.

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NOTES

1. Physicians may also respond to managed care by reallocating their time. Analysis of data from the SMS indicates that the percentage of time spent on primary care activities by specialists drops dramatically with involvement in managed care (e.g., for general surgeons it drops from 35 percent to 24 percent and for internal medicine subspecialists, it drops from 34 percent to 26 percent). In contrast, primary care physicians report about the same percentage of time spent on primary care activities whether or not they are involved in managed care.
2. Each year one-third of the sample from the previous survey is resampled and then dropped from subsequent surveys.
3. Our measure of penetration incorporates most organizations that selectively contract for services. As with other studies, our measure of managed care excludes organizations that rely solely on utilization review.
4. Under reasonable assumptions, physician revenues from managed care will correlate highly with patient enrollment in managed care. However, if high managed care penetration allows physicians to charge higher (or lower) prices for managed care, then physician revenues may increase at a faster (or slower) rate than managed care penetration. In our data, the correlation between physician managed care revenues and HMO penetration is .74.
5. The SMS physician survey includes a number of questions about physician involvement in managed care: (1) it identifies physicians employed by staff-model HMOs; and (2) for physicians who are at least part owners of their practices, the survey queries participation in managed care contracts—including those with HMOs, IPAs, and PPOs—and the share of practice revenues coming from these contracts. Physicians with no contracts are considered to derive zero revenue from managed care. Bias may be introduced if the survey systematically over- or undersamples individuals who simultaneously prefer managed care and earn either above- or below-average incomes. This would be a problem only if we used

the same sample to measure both penetration and income. But as we describe in Note 6, this is not what we do.

6. There is only a one-third resampling. Combined with the fact that no specialty category accounts for more than one-third of all the physicians, the overlap between the sample from which we measure penetration and the sample for which we measure income is never more than one-ninth of the physicians in the penetration sample.
7. Using the median income may understate the influence that managed care has on average physician income if the median physician in a state is not involved with managed care and managed care primarily affects average income through low payments to affiliated physicians, leaving incomes of non–managed care physicians unchanged. Our results are generally robust if mean income is used in lieu of median income.
8. We experimented with many other control variables. Our qualitative findings on the effect of managed care on physician incomes are unaffected. We report here only those control variables that have strong theoretical or empirical support.
9. Information on state regulation of managed care was obtained from "State Legislative Health Care and Insurance Issues," Office of Government Relations, Blue Cross Blue Shield Association, 1993.
10. The Herfindahl index is the sum of squared market shares. We use the 1980 Herfindahl to eliminate ambiguity concerning cause and effect.
11. We set the Herfindahl in non-metropolitan areas equal to one, reflecting the fact that residents of these areas typically face a limited choice of hospitals.
12. Table 4 presents empirical results based on enrollment survey data obtained by Group Health Association of America (GHAA) for 1993 and 1985. Similar results are obtained if we use InterStudy HMO data or market survey estimates from Marion Merrill Dow instead of the GHAA estimates.
13. U.S. graduates usually have first choice of positions, so their fill rates reflect demand for training in different specialties. International medical graduates may select positions on the basis of availability as well as area of training.

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