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The Effects of Medical Group Practice and Physician Payment Methods on Costs of Care

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Objective. To assess the effects of payment methods on the costs of care in medical group practices.

Data Sources. Eighty-six clinics providing services for a Blue Cross managed care program during 1995. The clinics were analyzed to determine the relationship between payment methods and cost of care. Cost and patient data were obtained from Blue Cross records, and medical group practice clinic data were obtained by a survey of those organizations.

Study Design. The effects of clinic and physician payment methods on per member per year (PMPY) adjusted patient costs are evaluated using a two-stage regression model. Patient costs are adjusted for differences in payment schedules; patient age, gender, and ACG; clinic organizational variables are included as explanatory variables.

Data Collection. Patient cost data were extracted from Blue Cross claims files, and patient and physician data from their enrollee and provider data banks. Medical group practice data were obtained by a mailed survey with telephone follow-up.

Principal Findings. Capitation payment is correlated with lower patient care costs. When combined with fee-for-service with withhold provisions, this effect is smaller indicating that these two clinic payment methods are not interchangeable. Clinics with more physician compensation based on measures of resource use or based on some share of the net revenue of the clinic have lower patient care costs than those with more compensation related to productivity or based on salary. Salary compensation is strongly associated with higher costs. The use of physician profiles and clinical guidelines is associated with lower costs, but referral management systems have no such effect. The lower cost clinics are the smaller, multispecialty clinics.

Conclusions. This study indicates that payment methods at both the medical group practice and physician levels influence the cost of care. However, the methods by which that influence is manifest is not clear. Although the organizational structure of clinics and their use of managed care programs appear to play a role, this influence is less than expected.

Key Words. Physician compensation, medical group practices, managed health care

BACKGROUND

The effects of alternative payment methods on physicians' practice styles and their use of resources are fundamental issues in most proposals for health care reform, as well as in the design of managed health care programs. Several studies have shown that physicians who practice in HMOs use fewer resources than those in fee-for-service programs, but it is not clear if this relates to the way physicians are compensated (Dowd, Johnson, and Madson 1986; Arnould, Debrock, and Pollard 1984; Miller and Luft 1994). In some staff model HMOs, physicians are compensated by a fixed salary, but in others some form of fee-for-service is used (Hillman, Pauly, and Kerstein 1989; Gold, Nelson, Lake, et al. 1995). The issue is further complicated in network HMOs and their managed care offspring, since those organizations often pay medical group practices (or networks of practices) some form of capitation payment per enrollee but the practices compensate their physicians on a different basis (Hillman, Welch, and Pauly 1992; Goldfield, Berman, Collins, et al. 1992; Kralewski, Wingert, Knutson, et al. 1996). Moreover, outside of staff model HMOs, a medical group practice seldom provides services exclusively for one HMO or managed care plan, and therefore the practice may have a mixture of revenue streams ranging from capitation payment to fee-for-service billed charges. In these practices, it is doubly difficult to untangle the separate effects of practice payment and physician compensation on resource use (Gold, Nelson, Lake, et al. 1995; Kralewski, Wingert, Knutson, et al. 1996). One of the first studies that successfully untangled these payment methods was recently conducted by Conrad, Maynard, Cheadle, et al. (1998) in the state of Washington. Although that study was a major contribution to a better understanding of the effects of physician compensation within medical group practices on the utilization and costs of health services, the lack of variance in health plan payment to the clinics limited the analysis.

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The fact that some form of medical group practice is central to the HMO and managed health care concept also raises issues regarding the separate effects of organizational controls at the practice level versus practice payment on the savings achieved by HMOs. For example, the reduced use of hospital inpatient days by HMOs may reflect overall HMO or group practice organizational policy rather than a physician's response to his or her compensation method.

Although considerable evidence supports the contention that payment methods have a significant influence on physician practice styles, the studies providing that evidence often are unable to identify the separate effects of payment and other organizational, physician, and patient attributes. Hellinger (1996) summarizes this best in his extensive review of the physician compensation literature. He concludes that:

> each of these studies is subject to potential biases. . . . To accurately measure the impact of financial incentives confronting physicians on utilization, future studies must include more information about enrollee, physician, health plan, and market characteristics that affect utilization.

This article addresses these issues by assessing the independent effect of physician compensation methods in medical group practice clinics on the per member per year (PMPY) costs of services for enrollees in a managed care health plan sponsored by Blue Cross Blue Shield of Minnesota (Blue Plus). Our study focused on medical group practice clinics with three or more full-time physicians and a primary care component. About half of these clinics are members of larger group practice systems and about half are multispecialty clinics. Both the degree of financial risk sharing for patient care at the clinic level and the methods by which the physicians in those practices are compensated are included in the analysis. The dependent variable is PMPY costs for Blue Plus members continuously enrolled during 1995. We hypothesize that the cost of medical care for these patients is influenced by the methods employed to pay the medical group practices that they selected to manage their care and the method of physician payment within those practices.

Sources of Data

Our sample of medical group practices was drawn from the primary care clinics that contracted with Blue Cross Blue Shield of Minnesota during 1995 to provide services under their "Blue Plus" managed care program. Blue Plus enrollees are required to select a clinic with a primary care component to manage their care. In this study, all health care costs were assessed to the

primary care clinic (PCC), even though some specialists' services may be provided by other clinics through referrals. Medical groups, including multisite group practices, were limited to those with at least 200 continuously enrolled Blue Plus members during the 1995 calendar year. A total of 174 medical group practices with 229,000 enrollees met these criteria. This included 58 independent clinics and 116 clinics that were part of group practice systems, that is, group practices with multiple clinic sites or multiple clinic sites owned by hospitals or health plans. Most of these clinics were located in Minnesota, but Wisconsin, Iowa, South Dakota, and North Dakota were also represented.

Clinic organizational data, including sources of revenue and method of physician compensation, were obtained from a survey mailed to the medical director and administrator of each clinic. We excluded two large multispecialty group practices and the University of Minnesota Family Practice Clinics from our study because those organizations bill at the corporate level and could not provide clinic-level cost data broken out for Blue Cross patients. We also excluded *clinic* sites with fewer than 50 Blue Cross patients during 1995 in order to accurately assess clinic-level costs. Consequently, 86 clinic sites that provided and managed care for 57,123 patients during 1995 were included in our analyses. To determine whether or not the deletion of clinics biased our population, we compared their size, proportion of physicians who were primary care, proportion of revenue from capitation, and physician payment method to those included in our study using *t*-test statistics. The only statistically significant difference was that those in our study included quality of care factors in their physicians' payment method slightly more often than the deleted clinics. We focused on group practice sites rather than on the corporate system because we found considerable organizational variance among sites within the same group practice system, even in terms of how the physicians were compensated. Tables 1 and 2 show the distribution of the variables obtained from these clinics and data about the patients enrolled in the clinics.

PMPY cost data were obtained from Blue Plus administrative claims data. Each medical group practice had a written contract with Blue Plus with a payment mechanism that placed them at some financial risk. All of these contracts required that claims data be submitted for payment. Consequently, PMPY costs for each patient could be calculated. For this study, costs equal Blue Plus payment plus subscriber liability for professional and facility services. Mental health/chemical dependency and pharmacy costs were not included. The group practice claims also contained sufficient diagnostic data to support morbidity adjustments using Ambulatory Care Groups

Table 1: Distribution of Clinic Variables ($N = 86$)

Variable	*Percentage or Mean* *	*Minimum*	*Maximum*
Females			
0–2	1.3	0	9.1
3–14	10.2	0	38.8
15–44	26.1	2.5	49.5
45–64	15.7	0	41.0
Males			
0–2	01.7	0	10.8
3–14	10.7	0	40.2
15–44	20.3	1.1	31.8
45–64	14.0	0	37.5
Proportion of Clinic Revenue Received From			
Capitation for physician and hospital services	11.0	0	65.0
Capitation for physician services with some hospital risk	.4	0	35.0
Capitation for physician services only	1.8	0	40.0
Capitation for primary care physician services only	5.0	0	45.0
Fee-for-service with withhold provision	21.6	0	70.0
Discounted or negotiated fee-for-service	12.4	0	98.0
Fee-for-service based on fee schedule	27.0	0	98.0
Proportion of Primary Care Physician Payment Based On			
Salary	48.1	0	100.0
Physician productivity	40.4	0	100.0
Physician quality of service	1.2	0	20.0
Physician utilization of resources	0.4	0	6.0
Some share of clinic's net revenue	15.4	0	100.0
Proportion of Physicians in the Group Practice Who Are Primary Care	87.3	6.0	100.0
Proportion of Physicians in the Group Practice Who Are Women	22.1	0	100.0
Mean Years Experience of Physicians in the Group Practice	18.1	5.7	30.5
Size of the Group Practice (full-time physicians)	11.2	3	79.0
Extent of Gatekeeper System	2.3	1	3.0
Extent of Clinical Information System	2.0	0	6.0
For-Profit Status of the Group Practice	53.5	NA†	NA
Member of a Group Practice System that Includes an Owned Hospital	33.7	NA	NA
Member of a Group Practice System	29.1	NA	NA
Independent Group Practice	37.2	NA	NA
Number of Clinical Guidelines Used	1.6	0	5.0
Number of Physician Profiles in Use	4.9	0	12.0

*Percent, unless otherwise noted.

†Not Applicable.

Table 2: Distribution of Patient Variables (Total $N = 57,123$)

Variable	N;	*Percentage*
Females		
0–2	732	1.0
3–14	5,731	10.0
15–44	15,135	26.5
45–64	9,006	15.8
Males		
0–2	874	1.5
3–14	5,957	10.4
15–44	11,577	20.3
45–64	8,115	14.2
Traditional HMO coverage	8,530	14.9
Point-of-service coverage with copay and/or deductible provision	5,652	9.9
Point-of-service coverage	42,941	75.2
Have drug coverage	50,268	88.0

(ACGs) (Weiner et al. 1991), in addition to controlling for age and gender. Consequently, we were able to control for biased patient selection using these measures. Finally, the type of insurance coverage for each enrollee was obtained from the Blue Plus health plan, and the cost data were adjusted to correct for any differences in fee schedules.

SPECIFICATION OF VARIABLES

Explanatory Variables

Payment methods are specified at both the medical group practice clinic site level and at the physician level within those clinics. At the group practice clinic level, payment methods are stated as the proportion of total revenue obtained from the following sources during 1995:

1. Full-risk capitation for all doctor and hospital services
2. Capitation for doctors' services with some risk sharing for hospital costs
3. Full capitation for all physician services only
4. Full capitation for primary care physician services only
5. Fee-for-service with withhold provision or target rates with settlement at the end of the year or adjustment during the next year

6. Discounted fee-for-service negotiated specifically with the clinic
7. Fee-for-service based on a general fee schedule not specific to the clinic
8. Billed charges (fee-for-service)

Within the medical group practice clinic, the method of primary care physician (PCP) compensation is specified as the proportion of payment during 1995 that was based on the following:

1. Guaranteed or base salary
2. Individual physician productivity (e.g., cash collection, billings, visits, relative value units, etc.)
3. Individual physician quality of care (e.g., patient satisfaction, chart review, evaluations by supervisor, etc.)
4. Assessment of individual physician management of utilization (e.g., rate of referrals, laboratory, x-ray utilization, etc.)
5. The financial performance of the group of which the individual physician is a member (e.g., share of group net revenue)

All of the physician payment variables are included in our analysis. However, because of the small proportion of clinic revenue derived from some of the capitation payment methods, all forms of this payment were collapsed into one capitation variable. This enabled us to evaluate the overall effects of health plan financial risk-sharing payment methods to clinics and the influence of physician compensation method within those clinics on physician-directed use of resources.

Building on Hellinger's (1996) review of the physician compensation literature, we hypothesize that (a) patients enrolled in medical group practices that have a higher proportion of revenue obtained from payment sources with greater financial risk sharing for patient care will have lower costs because those physicians will improve their incomes by controlling costs, and (b) patients enrolled in medical group practices that base a greater proportion of their physicians' compensation on individual productivity will have higher costs because those physicians have fewer personal economic incentives to control resource use.

Dependent Variable

The dependent variable in this analysis is per member per year (PMPY) costs to provide services for individual Blue Plus enrollees adjusted for differences

in payment schedules. Patient age, gender, and ACG are included as explanatory variables in the regression analysis. Blue Plus captures all claims costs for services including point of service charges. We controlled for an enrollee's age and gender through seven categories, males age 0–2, 3–14, 15–44, and 45–64; females 0–2, 15–44, and 45–64 (females 3–14 was the omitted category). In developing our model, we tested three different approaches to case-mix control with ACGs. These were a morbidity index score, the use of a separate dummy variable for each of five morbidity groups, and the use of a separate dummy variable for 51 of the 52 ACGs. We chose the latter approach because it had the best explanatory power in our model.

Our previous research has shown that hospital charges for similar services in the Twin Cities often have a great deal of variance (Kralewski, Wingert, and Dowd 1996). Consequently, these costs were standardized by calculating the mean population costs for an inpatient hospital day and for a hospital outpatient visit and then substituting those mean costs for hospital inpatient day and outpatient visit charges. Also, some small variance existed in the fee schedules negotiated between Blue Plus and the group practices. To adjust for these differences, we created a PMPY adjustment based on the average level of payment for 35 separate high-volume relative value units (RVUs) and used that product to correct for payment differences. Since these differences were small, this correction did not change the cost data. Finally, to adjust for the fact that about 12 percent of the patients in our study did not have prescription drug coverage, which authorizes the pharmacist to bill Blue Plus directly, we deleted drug charges from our cost data. As noted previously, mental health and chemical dependency costs were also excluded from this analysis because those data were not available.

Control Variables

Several control variables are included in our analysis. Studies have shown that resource use in medical group practices is influenced by the size of the medical group (Epstein, Begg, and McNeil 1983; Wingert 1995; Piette and Moos 1996; Rich, Kralewski, Feldman, et al. 1998); the use of administrative demand and referral management programs such as gatekeepers (Starfield, Powe, Weiner, et al. 1994; Forrest and Starfield 1996); clinical guidelines (Aucott, Pelecanos, Dombrowski, et al. 1996; Lobach and Hammond 1997); physician profiling (Powe, Weiner, Starfield, et al. 1996; Balas, Boren, Brown, et al. 1996; Rich, Kralewski, Feldman, et al. 1998); and clinical information systems (Hlatky et al. 1993; Connelly, Sieloff, and Willard 1995). We hypothesize that larger clinics will be more costly, but that all of these other clinic structural variables are expected to reduce costs.

Also, four types of Blue Plus health insurance coverage are offered to enrollees. (1) Traditional HMO (HMO): enrollees in this product select a primary care clinic and the physicians in that clinic manage all of their care including referrals. Enrollees are fully covered for all services except prescription drugs (which is a separate insurance product) but must pay all of the costs of services obtained outside the clinic by self-rreferrals. (2) Point of Service (POS): members in the point of service insurance plan select a primary care clinic for their services but may self-refer to providers within a *plan network* if they (the patients) are willing to pay about 20 percent of those costs. They can also self-refer to *any provider* if they pay 50 percent of those costs. All referrals to any provider authorized by the primary care clinic are fully covered. (3) Point of Service "CMM" (POSCMM): This plan is the same as number 2 except that it includes copayment and/or deductible provisions in all three benefit tiers. (4) The fourth insurance variable is prescription drug coverage: about 88 percent of the enrollees have prescription drug coverage. We hypothesize that enrollees in the traditional HMO health insurance product will have lower costs because physicians have more economic incentives to conserve resources for that population and have more control over their care, and that enrollees with drug coverage will have higher costs because of the biased selection into those programs (Manning, Leibowitz, Goldger, et al. 1984).

We included the following variables related to the above attributes in our analysis:

1. *Medical group practice size.* Number of full-time physicians.
2. *Referral management.* Specified in terms of which of the following best describes the management of covered referrals to specialists outside the group for most of the clinic's patients (1 to 3 scale):
   - Patients are free to make appointments to see any specialist outside the clinic without a referral.
   - Referrals to some specialists outside the clinic are made and managed by the patient's primary care physician, but patients are free to make appointments to see some specialists without a referral.
   - All referrals to specialists outside the clinic are made and managed by the patient's primary care physician.
3. *Clinical guideline use.* Number of well-established clinical guidelines in use in the group practice to assist in the management of primary care patients (up to five)

4. *Physician profiling.* Number of individual physician practice pattern profiles in use from a list of 12 clinical areas such as hospital use, laboratory tests, and so on.
5. *Extent of clinical information systems.* Number of computer-based clinical information systems in place out of a possible eight systems commonly used by medical group practices
6. Type of insurance coverage. HMO, POS, POSCMM, Drug Coverage

Studies have also shown that physician characteristics are important factors in resource use (Greenfield, Nelson, Zubkoff, et al. 1992; Lurie, Margolis, McGovern, et al. 1997). However, since the 1995 Blue Plus data do not identify the specific physician providing a service, we were only able to include physician characteristics through the following proxy measures:

1. Proportion of physicians in each group practice who are primary care (family practitioners, general internists, or general pediatricians)
2. Mean years experience of the physicians in each group practice as measured by years since graduation from medical school
3. Proportion of the physicians in each group practice who are women

Two additional control variables are included in our analysis: whether or not the medical group practice is a for-profit organization and whether or not it is a member of a group practice system. Although little empirical evidence is available to indicate that these attributes influence physician practice styles, the belief is widespread that they are important factors affecting costs ("Hospital and Health Plan Conversions" 1997; Shortell, Gillies, and Anderson 1994; Walston, Kimberly, and Burns 1996; Brown 1996). Consequently, we include them in our analysis.

These variables are summarized in Table 3. An initial exploratory analysis of our data using ordinary least squares (OLS) regression found capitation payment to the group practices to be associated with increased costs. However, because we are using cross-sectional data, we are unable to determine the degree to which clinic payment methods are influenced by clinic costs of care. For example, health plans may favor capitation payment to clinics that are high cost in order to minimize the plan's financial risk. If so, regression estimates of the effect of practice payment on costs are biased. A Hausman test confirmed this endogeneity problem (Hausman 1978). Consequently, we created a corrected clinic payment variable using five clinic organizational characteristics that would be expected to influence the clinic's

Table 3: Variable Specification

PMPYCH	=	log of per member per year charges for Blue Plus patients adjusted for ACG, hospital charges, and fee schedule differences (excludes those who used no services)
PTAGE	=	patient age in years
PTGEN	=	patient gender 1 if female, 0 otherwise
HMO	=	1 if traditional HMO product, 0 if not
POS*	=	1 if point-of-service coverage, 0 if not
POSCMM	=	1 if point-of-service with copay and/or deductible, 0 if not
DRUGCOV	=	1 if have drug coverage, 0 if not
GRPSIZE	=	number of full-time physicians
GATEKEEP	=	3 if all referrals are controlled, 2 if some referrals are controlled, and 1 if no control
GUIDELN	=	number of guidelines in use
PHYPRO	=	Number of different physician profiles in use from a list of 12 clinical areas
CLININFO	=	number of computer-based clinical information systems in use from a list of eight common systems
PRIMCARE	=	proportion of physicians in each medical group practice who are primary care
PHYEXP	=	mean experience of physicians in each medical group practice (years since graduation)
PROPFEM	=	proportion of physicians in each group practice who are female
FPROF	=	1 if group practice is for-profit, 0 otherwise
GPSYS	=	1 if group practice is a member of a group practice system, 0 otherwise
GPSYSHOSP	=	1 if group practice is a member of a group practice system that includes an owned hospital, 0 otherwise
SALARY	=	proportion of physician compensation based on fixed salary
PHYPROD	=	proportion of physician compensation based on his or her productivity
PHYQUAL	=	proportion of physician compensation based on his or her quality of care
PHYUT	=	proportion of physician compensation based on his or her management of resources
GRPFIN*	=	proportion of physician compensation based on the financial performance of the group practice (some share of net revenue)
FCAP	=	proportion of group practice revenue obtained from capitation for all physician and hospital services
MODCAP	=	proportion of group practice revenue obtained from capitation for doctor's services with some risk sharing for hospital costs
CAPPHY	=	proportion of full capitation for all physician services only
CAPPHYP	=	proportion of full capitation for primary care physician services only
FFSH	=	proportion of fee-for-service with withhold provision or target rates with settlement at the end of the year or adjustment during the next year
FFSD	=	proportion of discounted or negotiated fee-for-service negotiated specifically with your clinic
FFSSCH	=	proportion of fee-for-services based on a general fee schedule not specific to your clinic
BILLCHG*	=	proportion of billed charges (fee-for-service)

*Omitted variable in equation.

ability to handle financial risk. These included group practice or hospital system membership, years of experience with risk-sharing payment contracts, years of experience of physicians, the number of specialties represented in the clinic, and urban versus rural location. Clinic size was not included in this model because we found that system membership offset the expected disadvantages of small clinics. Clinics that are members of a clinic system and clinics with more specialists are expected to be better positioned to manage risk payment methods advantageously because of their internal capacity to spread risk among more patients and because they can control a broader range of providers. Similarly, clinics with more experience with financial risk-sharing contracts are expected to be in a better position to manage risk, but those with more experienced and presumably more established physicians, and clinics located in rural areas where there is often little competition, are expected to favor and be able to negotiate contracts that minimize risk. We used these variables to calculate a corrected capitation payment for each clinic. The results are shown in Table 4.

One additional correction was made to our data. Since we are observing multiple patients at each clinic, the possibility exists that the patients enrolled in a given clinic may share some unobserved characteristics that would bias regression estimates. To resolve this problem, we included a Huber (1964) correction in our analysis to adjust the standard errors.

The estimated equation and the expected signs for the coefficients for our analysis are as follows (patient age, gender, and ACG omitted):

$$\begin{aligned}\text{PMPYCH} = {} & \beta_0 + \beta_1\text{GRPSIZE} \pm \beta_2\text{GPSYS} \pm \text{GPSYSHOSP} - \\ & \beta_2\text{GATEKEEP} - \beta_3\text{GUIDELN} - \beta_4\text{PHYPRO} - \beta_5\text{CLININFO} \pm \\ & \beta_6\text{PRIMCARE} \pm \beta_7\text{PHYEXP} + \beta_8\text{PROPFEM} + \beta_{11}\text{SALARY} - \\ & \beta_{12}\text{PHYPROD} - \beta_{13}\text{PHYQUAL} - \beta_{14}\text{PHYUT} - \beta_{15}\text{CAP} - \\ & \beta_{22}\text{HMO} + \beta_{23}\text{POSCMM} + \beta_{24}\text{DRUGCOV}.\end{aligned}$$

Because we have taken the log of the dependent variable, the coefficients on continuous explanatory variables, such as the physician's experience, can be interpreted as the percentage change in the dependent variable as the explanatory variable changes one unit. For discrete (dummy) variables, the coefficient can be interpreted as the percentage change in the dependent variable as the explanatory variable changes from a zero to a one, after transforming the coefficient as follows:

$$\textit{Percentage change} = [\exp(B - .5\ \textit{variance}\ B)] - 1 \qquad \text{(Kennedy 1981)}$$

Table 4: Regression Estimates Creating a Corrected Capitation Clinic Payment Variable ($N = 86$ clinics; 57,123 patients)

Model	*B*	*Std. Error*	*T*	p-*Value*
Constant	5.890	11.917	.494	.622
Clinic part of any system	13.376	4.702	2.845	.006
Number of different specialities at clinic	−.479	.213	−2.249	.027
Mean number of years MD experience	−.445	.625	−.712	.479
Years experience with capitation or other financial risk payment	1.148	.482	2.384	.020
Clinic is in urban zip code	10.804	4.544	2.378	.020

Dependent variable: sum of all forms of capitation clinic payment
Adjusted $R^2 = .28$

FINDINGS

The first notable finding from these analyses is that considerable variance exists across the medical group practices in terms of the mean per member per year costs of care, even when patient age, gender, and ACG, and differences in clinic payment schedules are accounted for. These adjusted costs range from less than $1,000 to over $3,000 PMPY. The group practices in the most expensive quartile were over twice as high as the mean for all the groups. Even within the more tightly clustered midrange clinics, there is a $400 PMPY difference in costs (Figure 1). Although nearly 90 percent of the revenue in these group practices is derived from managed care programs that use some type of financial risk-sharing payment system and employ at least some additional resource management programs such as physician practice profiles, or clinical guidelines, there is wide variance in practice styles as measured by resource use.

Clinic Payment

By estimating the cost equation using the corrected capitation clinic payment variable, we found that capitation has a negative effect on costs when compared to all other forms of clinic payment ($\beta = -.004$, $p = .000$; Table 5). It is important to note again that our cost data relate to Blue Plus patients only whereas the group practice payment data reflect total practice revenue from

Figure 1: Distribution of Adjusted PMPY Costs by Clinic Controlling for Patient Age, Gender, and ACG ($N = 86$)

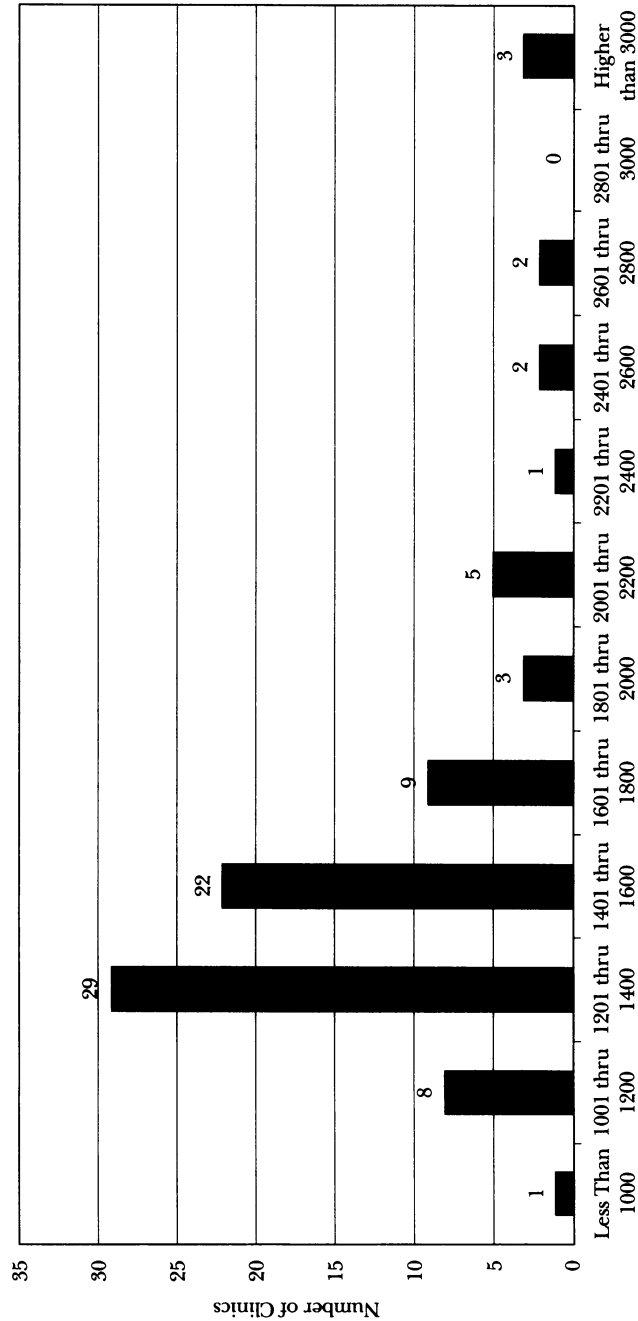

Table 5: Two-stage Regression Analysis of Group Practice Explanatory Variables Including an Estimated Aggregate Clinic Capitation Payment Variable on PMPY Adjusted Costs ($N = 86$ clinics; 57,123 patients)

Explanatory Variable	*B*	p-*Value*
Proportion of clinic revenue received from		
Capitation payment (corrected)	−.004	.000
All other payment methods	(omitted variable)	
Proportion of physician payment in clinic based on		
Salary	.003	.000
Individual physician productivity	.001	.011
Individual physician quality of care	−.003	.179
Individual physician management of resources	−.032	.000
Some share of clinic revenue	(omitted variable)	
Proportion of clinic physicians who are primary care	.285	.000
Proportion of clinic physicians who are women	.212	.000
Mean years experience of clinic physicians	−.016	.000
Number of full-time physicians in the clinic (size)	.001	.133
Is a for-profit clinic	−.055	.000
Is a member of a group practice system	.146	.000
Is a member of a group practice system that includes a hospital	.087	.000
More restrictive gatekeeper system	−.012	.155
More extensive computer-based clinical information system	.003	.565
More use of clinical guidelines	−.015	.000
More use of physician profiles	−.004	.004
Patient has HMO coverage	−.036	.016
Patient has point of service coverage with copay and deductible	−.039	.030
Patient has prescription drug coverage	−.032	.048
Patient has point of service coverage	(omitted variable)	

Note: Patient ACG, age, and gender variables are not included in this table. Those data are available from the authors on request.

all sources. We assume that the group practice physicians treat all patients alike regardless of their health plan.

Since some managed care plan administrators contend that fee-for-service with withhold payment is simply another form of capitation, we created a second corrected clinic payment variable that combined all forms of clinic capitation payment plus fee-for-service with withhold payment using the same procedure described earlier. We then reanalyzed the data using this combined payment variable against all other forms of clinic payment. This expected clinic payment variable has a smaller but still negative effect on costs ($\beta = -.003$, $p = .000$ data not shown) indicating that fee-for-service with withhold payment to clinics is not as effective as capitation payment in reducing costs.

Physician Compensation

The method of primary care physician compensation in the group practices has a mixed effect on costs. Data from the two-stage regression equation (Table 5) indicate that a higher proportion of compensation based on a fixed salary increases costs but that the inclusion of resource management factors in the compensation system reduces costs when compared to the omitted category (i.e., more of the compensation linked to some share of the clinic's net revenue). The proportion of a physician's compensation based on his or her productivity is also significantly associated with increased costs.

Many of these clinics are relatively small (eight to ten physicians) and tend to be owned by the physicians. Consequently, productivity-based compensation would be expected to be closely related to the omitted category, that is, to a share of the clinic's net revenue. Our findings cast doubt on this contention and indicate that these physician payment systems provide different motivations. Physician payment methods based on clinic net revenue appear to be an effective mechanism to focus attention on costs of patient care, at least in these relatively small clinics.

The finding that inclusion of resource management factors in physician payment reduces costs is surprising in that only 11 of the 86 clinics included these factors and in most cases they accounted for less than 10 percent of their physicians' compensation. It appears that relatively small incentives in these areas have a significant effect on resource use.

Insurance Coverage

Patients in either the traditional HMO insurance plan or the point of service plan with copayment and/or deductible provisions have lower costs than

those in the conventional point of service plan with no copay or deductible requirements (Table 5). This largely reflects the findings in previous studies that enrollees in more restrictive health insurance plans or in plans with more out-of-pocket expenditures use fewer resources (Manning, Leibowitz, Goldger, et al. 1984; Conrad, Maynard, Cheadle, et al. 1998). The finding that patients with drug coverage have lower costs (when drug costs are excluded) is difficult to interpret. One explanation is that physicians are more able to achieve cost-effective medical practice through substitution if drugs are covered by the insurance plan. An alternative interpretation might be that employers with low experience ratings are offering their employees additional health insurance benefits such as drug coverage and that the ACG adjustment in our analysis does not capture these differences.

Medical Group Practice Organizational Characteristics

The effects of resource control mechanisms in the group practices on costs are mixed. As shown in Table 5, the use of guidelines and physician profiles reduces costs ($\beta = -.015$, $p = .000$ and $\beta = -.004$, $p = .004$, respectively), but the use of more restrictive gatekeeper systems has no effect. Moreover, computer-based clinical information systems, a technology believed to be essential to the control of physician use of resources, does not appear to have an influence on costs.

Several other group practice attributes are related to costs. A higher proportion of primary care physicians ($\beta = .285$, $p = .000$) and more women physicians ($\beta = .212$, $p = .000$) in the group practice increases resource use, but clinics with more experienced physicians use fewer resources ($\beta = -.016$, $p = .000$). Higher costs by primary care physicians is an unexpected finding and is contrary to some previous research (Hargraves et al. 1996). The findings regarding the gender mix of the physicians may be related to the fact that women doctors have been found to be more attentive to preventive medicine and may use more resources in that area (Lurie, Margolis, McGovern, et al. 1997; Rich, Kralewski, Feldman, et al. 1998). The physician's experience factor may mean that physicians with more practice experience are better able to manage patient care resources or that they are willing to assume more adverse patient care risks (Wingert 1995). It may also indicate that older, more experienced physicians are less dependent on technology.

Contrary to some previous studies, the size of the clinic in this study does not have a statistically significant influence on the costs of care. However, these are relatively small clinics and the direction of the regression coefficient is positive, indicating that size may still be an important factor. This may

reflect the fact that medical group practices achieve maximum efficiency at a relatively small size (Pope and Burge 1996), or it could mean that smaller group practices and especially small multispecialty groups develop informal consultation patterns that reduce the costs of care to formal claims for payment. Membership in a group practice system also increases costs in these medical groups. While there is growing evidence that hospital-owned group practice systems are more costly, this is the first time that physician-owned group practice systems have also been found to be more expensive (Zismer, Mason, and Waslaski 1999).

Finally, the for-profit status of health care providers is receiving a great deal of national attention in that some policymakers believe that the for-profit health care sector is more expensive. Our data do not support that contention. In fact, for-profit medical group practices in this study show significantly lower per member per year resource use than their not-for-profit counterparts ($\beta = -.055$, $p = .000$).

DISCUSSION

This study demonstrates two important factors related to the effects of physician payment systems on the costs of health care. First, at the group practice payment level, capitation payment appears to have a negative effect on costs. Capitation payment was significantly related to lower clinic costs. However, this negative effect on costs decreased when fee-for-service with withhold payment methods was included in the definition of "capitation." This indicates that fee-for-service with withhold provisions may be less effective than capitation payment in creating more cost-conscious practice styles in medical group practices.

Second, at the physician compensation level within the clinics, more payment based on sharing the net revenue in the group practice appears to be the most effective way to motivate physicians to conserve resources. It is important to note again that many of these group practices are quite small (eight to ten physicians) and are owned by the physicians. Consequently, they have the attributes of a small family-owned business with everyone well aware of the economics and bottom-line performance of the practice. This payment method may not be as effective in reducing resource use in larger practices. In either event, it appears that even small amounts of physician compensation based on resource management factors further reduce the PMPY costs of care. These factors may be more related to the creation of a cost-conscious

culture in the practice rather than the economic "take home pay" incentive in the shared net revenue approach. If so, it appears that this strategy is quite effective in that even less than 10 percent of the physician's compensation has a significant impact on costs.

We caution that our estimated effect of primary care physician payment may incorporate the effect of the way other physicians in these clinics are paid. If, for example, specialists are paid the same way as primary care physicians, then the coefficient on primary care physicians will include some of the effect of specialists, as well.

Another caution is that the use of contemporaneous ACGs might "overfit" the relationships between patient morbidity and resource utilization. In other words, patients who use more health care resources could be classified into higher contemporaneous ACG categories. To deal with this possibility, on the suggestion of an anonymous referee, we estimated the model by including patient age and gender but excluding ACGs. The results from this estimation showed that capitation payment (compared with all other forms of clinic payment) had a negative and statistically significant effect on utilization ($\beta = -.005$, $p = .000$). Thus, we suggest that "overfitting" the cost equation is not a serious problem in this analysis.

Some of the most important findings in this study relate to the lack of influence of some of the group practice organizational variables on costs. The degree to which the clinic physicians manage referrals to specialists has no effect on the costs of care for Blue Plus patients. Either these gatekeeper systems are ineffective or there is little spillover effect from one health insurance plan to another within a clinic. Even though more extensive use of clinical guidelines and physician profiles appears to lower costs, the information systems capacity that would be expected to enhance those programs has no such effect, possibly because those systems are still not well developed even though they are reported to be in place.

The finding that a higher proportion of primary care physicians in the practice is associated with higher costs is unexpected. Since our data set does not identify the physician who actually provided each patient's care, we assume that more primary care physicians in the clinics translates into more of the care being provided by those physicians. However, this may not be true because clinics with a higher proportion of primary care physicians must refer more patients to other group practices for specialists' services and more of those patients might be retained by the specialists than would be the case if the specialists were in house. Moreover, in our data the primary care clinic is charged with specialists' services only if they are associated with a formal bill,

and specialists who are available on site may provide at least some informal consultation with no charge. If this is the case, the appropriate conclusion would be that primary care physicians are less cost-effective in managing care when there are fewer (or no) specialists in the clinic for consultation. To explore this further, we conducted an additional analysis that included a variable designating whether or not the group practice included any specialist physicians. Clinics with specialists were found to have significantly lower costs ($\beta = -.046$; $p = .008$) than clinics with only primary care physicians. Given these conditions, the most cost-effective group practices in this study may be the smaller multispecialty clinics that use guidelines and physician practice profiles and that base more of their physicians' compensation on some share of the net revenue. However, "tendency to use specialists at another clinic location" would be an omitted variable in our analysis that would be positively correlated with percent of primary care physicians at the clinic and positively correlated with resource use as well. This would make the estimated cost coefficient for percent primary care physicians in our study too positive, that is, biased upward.

Since most of these clinic sites are quite small, the share of net revenue payment method may not prove to be as effective in larger clinics where individual physician behavior is less visible to colleagues and where it is more difficult for a physician to link his or her use of resources to bottom-line financial performance. It should also be noted that the way we conceptualized medical group practices might have influenced these (and other) findings. In this study, we attempted to obtain very precise data about the organizational and economic conditions faced by physicians practicing at each group practice site. Consequently, we specified the group practice clinic as the unit of analysis. Some of these clinics are members of group practice systems and an alternative way to view these organizations would be to consider each of the systems as a medical group practice. This would improve the analysis of systemwide policies and structures but would ignore the wide variation of the conditions experienced by physicians at each group practice site within those systems. The influence of practice size is a good example of this issue. In a previous analysis that focused on corporate-level group practice data, we found that larger organizations have higher costs, whereas in this study no such effect was found. This could mean that group practice systems can achieve cost advantages if their clinic sites are kept relatively small and, as previously noted, are configured as multispecialty practices. It could also mean that the higher costs associated with multisite group practices may result from increased administrative costs rather than changes in clinical efficiency.

In conclusion, both clinic payment methods and physician payment methods within the clinic are shown to have an effect on patient care costs. Moreover, the structure of the clinic also influences costs: smaller multispecialty clinics that have more intense clinical guideline and physician profiling programs have lower costs. However, our study raises questions about the effects on costs of programs such as gatekeeper systems, and of information systems capacity: either we have used inappropriate measures of these programs or their alleged effects have been overestimated. Our findings that physician payment method influences costs differ from the findings recently reported by Conrad, Maynard, Cheadle, et al. (1998). These differences may result from the use of a corrected clinic payment variable in our analysis. Clearly, more research needs to be devoted to untangling the influence of these payment variables. In either event, our study does not suggest that medical group practices, as organizations, are greatly influencing physician practice styles even though they have both the financial incentives and the organizational capacity to do so.

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