Do Integrated Medical Groups Provide Higher-Quality Medical Care than Individual Practice Associations?

Ateev Mehrotra, MD, MPH; Arnold M. Epstein, MD, MA; and Meredith B. Rosenthal, PhD

Background: The association between the organizational structure of physician groups and health care quality has never been evaluated empirically.

Objective: To examine whether integrated medical groups (IMGs) provide higher-quality primary care than individual practice associations (IPAs).

Design: Cross-sectional study.

Setting: PacifiCare, a large health maintenance organization.

Participants: Approximately 1.7 million enrollees of PacifiCare cared for by 119 California physician groups between July 1999 and June 2000.

Measurements: The percentage of eligible PacifiCare enrollees who received mammography, Papanicolaou smear screening, chlamydia screening, diabetic eye examination, an asthma controller medication, or a β-blocker after acute myocardial infarction.

Results: Physician groups identified as IMGs, compared with those identified as IPAs, had higher rates of mammography (relative risk, 1.15 [95% CI, 1.01 to 1.33]), Papanicolaou smear screening (relative risk, 2.29 [CI, 1.53 to 3.42]), chlamydia screening (relative risk, 2.17 [CI, 1.04 to 4.55]), and diabetic eye screening (relative risk, 1.55 [CI, 1.28 to 1.88]). Leaders of IMGs were more likely to report using EMRs (37% vs. 2%; $P < 0.001$) and quality improvement strategies, but these characteristics explained little of the quality differences between IMGs and IPAs.

Limitations: Organizational characteristics, including group type, were reported by physician group leaders and not directly assessed. Patient characteristics that could have accounted for some of the observed differences also were not assessed.

Conclusions: Patients cared for in IMGs generally received higher-quality primary care than those cared for in IPAs. Having an EMR and implementation of quality improvement strategies did not explain the differences in quality. These findings suggest that physician group type influences health care quality.

Ann Intern Med. 2006;145:826-833. www.annals.org
For author affiliations, see end of text.

Despite the considerable investments made in measuring and monitoring quality of care at the health plan level, many have argued that physician groups are a more appropriate locus of quality measurement (1, 2). Because physician groups are composed of the actual providers of care, they are better situated to improve the quality of care for their patients. Little is known, however, about the physician group characteristics that are associated with high-quality care.

One important characteristic of physician groups is their organizational structure. Integrated medical groups (IMGs) anchor 1 end of the spectrum of organizational structure. Such groups are centralized organizations in which physicians are employees or participants in a partnership arrangement. In general, physicians belong to only 1 IMG and practice together in facilities owned and managed by the group. At the other end of the organizational spectrum are independent practice associations (IPAs), which are decentralized groups (sometimes called "virtual" groups). Physicians typically have nonexclusive contractual relationships with IPAs and generally manage their own offices independently. In the middle of the spectrum are what we term "hybrids," physician groups that are composed of a core medical group with an associated IPA.

Although to our knowledge there has been no previous research on the quality differences between types of physician groups, there has been research comparing types of health plans. In general, staff-model health maintenance organizations have higher quality scores than do other types of health plans (3, 4). Because staff-model health maintenance organizations are similar to IMGs in that they use a closed panel of employed physicians, it is possible that IMGs might also provide higher-quality care.

Other physician group characteristics that can influence quality are use of quality improvement strategies and electronic medical record (EMR) decision support. These strategies can improve quality of care (5, 6), and several important studies have compared the use of these strategies in IPAs and IMGs. These studies have found that IMGs are more likely to use an EMR (7) and quality improvement strategies related to preventive care (8), although they do not consistently use more quality improvement strategies related to chronic disease management (7, 9–11).

In this study, we examined the quality of primary care provided by different types of physician groups in California. We hypothesized that IMGs would have higher quality scores than would IPAs. We also examined whether having an EMR and implementation of specific quality

See also:

Print
Editors' Notes 827
Editorial comment. 860

Web-Only
Conversion of tables into slides

Context

The quality of health care may differ by the way physician practice groups are organized. Physician practices that are members of integrated medical groups (IMGs) may have resources to improve quality that independent physician practices do not.

Contribution

The authors used data from a quality report card of a California health maintenance organization to compare the quality of care delivered by IMGs or individual practice associations. They found that IMGs tended to do better on standard measures of quality, such as Papanicolaou smears and diabetic eye screening.

Cautions

Group type and other organizational characteristics important in the analysis were reported by physician group leaders and were not directly assessed. Differences in patients also were not assessed.

Implications

Integrated medical groups seemed to do better on some measures of quality, suggesting that it is important to account for organizational setting in measures of and discussions about health care quality.

—The Editors

improvement strategies was associated with any observed differences in health care quality.

Methods

Study Sample

The study sample comprised all physician groups in California that contract with PacifiCare. At the time of the survey, PacifiCare was the third largest health plan in California and the fifth largest in the United States. The survey data used in this study reflect the structure and organization of care for all patients, not just for PacifiCare enrollees. The physician groups in the study cared for approximately 1.7 million PacifiCare enrollees (all of whom were capitated) and 5.7 million capitated patients in all.

Measuring Quality of Care

Data on the quality of care for each of the physician groups were obtained from PacifiCare, which has been profiling the performance of its California network since 1993 and releasing a biannual public report card on a subset of measures since 1998. PacifiCare evaluates performance on a battery of measures, including member satisfaction, quality of care, patient safety, and utilization.

In this study, we focused only on the quality measures in the PacifiCare report whose numerators and denominators were computed on the basis of criteria from the Health Plan Employer Data and Information Set (HEDIS) (12). The quality scores were generated by PacifiCare on the basis of submitted claims and were independently audited. The audit included an evaluation of the completeness and accuracy of the underlying data used to generate the measures and the methodology used to identify denominator claims and calculate rates. We examined 3 preventive care measures (percentage of eligible patients who had mammography, Papanicolaou smear screening, or chlamydia screening) and 3 chronic disease management measures (percentage of patients with diabetes receiving a diabetic retinal examination, percentage of patients with moderate to severe asthma receiving a controller medication, and percentage of patients receiving a β-blocker after acute myocardial infarction). For each group, data were available on the number of eligible patients and the number of patients who received a given HEDIS measure.

The quality-of-care data for this study reflected care delivered to PacifiCare enrollees (commercial and Medicare) between July 1999 and June 2000, with the exception of mammography, which reflects care delivered between July 1998 and June 2000, and Papanicolaou smear screening, which reflects care delivered between July 1997 and June 2000.

Survey of Physician Group Leaders

Between May 1999 and June 2000, trained research staff at Harvard University, Boston, Massachusetts, conducted a 45-minute structured telephone survey with the chief executive officer or medical director of each group. Respondents were instructed to use calendar year 1998 as the frame of reference when answering survey questions. The survey covered many topics; in this study, we focused on questions related to the groups' organizational characteristics and use of quality improvement strategies.

The quality data reflect care provided approximately 1 year after the period covered by the survey, thereby allowing any quality improvement strategies reported on the survey to have some impact while not allowing too much time for the structure of the group or use of quality improvement strategies to change substantially.

Organizational Characteristics

Each physician group leader was asked about the group's organizational structure, whether the group's physicians were paid a quality bonus, and whether the group's physicians used an EMR. Physician group leaders in the survey identified whether their group was an IMG, an IPA, or a hybrid. Hybrid groups, called "wrap-arounds" in other studies (13, 14), were a combination of IMGs and IPAs in which a core IMG also had nonexclusive contracts with nonemployed physicians in the manner of an IPA. Because hybrids are a mixture of IPAs and IMGs, we expected their quality scores to lie between those for IPAs and IMGs. We defined a quality bonus as when an individual physician's

compensation is contingent on performance on quality-of-care measures. An EMR was defined as a computerized database containing a medical record for each patient. To test the sensitivity of this definition, we also conducted analyses with the definition of EMR restricted to systems that included a medication list or used computerized disease management guidelines. The results were qualitatively similar.

Another organizational characteristic we examined was patient volume. Several studies have described the volume–outcome relationship in surgery and for HIV infection and AIDS care (15–18). We hypothesized that this could also be true in outpatient primary care and determined the volume of patients eligible for the 6 quality measures in each group. To calculate patient volume, the number of PacifiCare patients who were eligible for a quality measure was divided by the reported share of the group's revenue from PacifiCare. For example, if a physician group had 100 patients with diabetes who were eligible for diabetic eye screening and PacifiCare composed 10% of their business, then we estimated that the physician group cares for 1000 patients with diabetes who are eligible for diabetic eye screening. Our measure of volume of care assumes that if 10% of the group's revenue comes from PacifiCare, then 10% of the patients with diabetes in this group have PacifiCare insurance. To test the sensitivity of our measure of volume, we ran analyses to ensure that any association observed between volume and quality performance was not due to a small number of outlier groups or due to an association between fraction of revenue from PacifiCare and quality performance. Our findings did not change substantively. We chose not to use the number of physicians in the group as a surrogate marker for volume. This measure had inherent biases because the IPAs in our sample often had large numbers of physicians who had only a partial affiliation with an IPA (19).

Quality Improvement Strategies

The survey also included questions regarding different quality improvement strategies. Our survey was developed with input from an advisory panel that included academic researchers and leaders in the California physician market. In addition, we conducted a series of case studies with selected groups in our sample. On the basis of this fieldwork and the advice of our advisory panel, we chose quality improvement strategies that were likely to be prevalent and effective. Some of these quality improvement strategies specifically targeted a clinical area addressed by 1 of the HEDIS quality measures in our study (for example, a diabetes disease management program might target diabetic eye screening), and some were more general and were not clearly related to any of the quality measures (for example, a reminder program for physical examinations). We studied both types of quality improvement strategies because both could impact performance on specific clinical quality measures. For example, a physician group that generally emphasizes quality of care might score highly on a quality measure through positive spillover effects even though that specific measure was not a focus for quality improvement. To gauge the group's overall level of focus on quality improvement, we totaled how many of 11 selected quality improvement strategies were reported from different clinical areas. The 11 strategies (**Table 1**) were chosen to represent a wide breadth of clinical issues. Although we asked about several quality improvement strategies related to diabetes and asthma management, we did not know a priori which quality improvement strategy would have a relationship with quality performance; therefore, we chose the most general strategy, the presence of a disease management program, to include in the measure. The Cronbach α value for the overall quality activity was 0.73, indicating that the measure reasonably captures a single construct.

Statistical Analyses

We first compared the organizational characteristics and the use of quality improvement strategies in the 3 types of physician groups: IMGs, hybrids, and IPAs. We then examined the unadjusted relationship between the clinical quality scores and reported type of group, other organizational characteristics, and the use of quality improvement strategies. These analyses account for the clustering of patient-level quality data within physician groups by using the Huber–White sandwich estimate of variance (20).

We next created multivariate logistic regression models to identify factors associated with physician group performance on the 6 HEDIS quality measures. The unit of analysis in the model was the physician group. The outcome variable was the fraction of eligible PacifiCare patients in the group who received appropriate care, as defined for the given measure. Dependent variables were volume of patients eligible for the quality measure (included as a continuous variable), the leader's report on the type of physician group (IMG, hybrid, or IPA), use of a quality bonus, fraction of board-certified physicians (included as a continuous variable), use of EMRs in the group, and total number of quality improvement strategies used. We did not include the age of the group as a dependent variable because it had substantial collinearity with type of physician group. We used a generalized linear model specifying a binomial distribution that accounts for clustering of patient-level quality data within physician groups by using the Huber–White sandwich estimator of variance. Because our outcomes are common, we report relative risks, instead of odds ratios, using a log-link function (21).

Finally, we examined whether measure-specific quality improvement strategies (for example, a program to contact patients who missed a mammography appointment) were associated with improved quality scores. We reran the same multivariate models, except that we replaced the covari-

ate—the total number of quality improvement strategies—with measure-specific quality improvement strategies.

Role of the Funding Sources

The study was supported by grants from the California HealthCare Foundation and the Commonwealth Fund. The funders had no role in the design, analyses, or decision to submit the manuscript for publication.

RESULTS

Leaders from 148 of the 153 physician groups were surveyed (97% response rate). The period of the study, 1999 to 2000, was a tumultuous period in the California physician market (14, 22). In the year between the survey and the quality report card, 14 (9.5%) of the physician groups went out of business and 15 (10.1%) additional physician groups merged into other organizations. Thus, PacifiCare was able to provide quality data for 119 groups.

Organizational Characteristics

The average number of physicians affiliated with or employed by IMGs, hybrids, and IPAs was reported to be 242, 318, and 390, respectively ($P = 0.26$) (**Table 1**). Compared with leaders of hybrids and IPAs, leaders of IMGs were more likely to report having an EMR (37% vs. 18% and 2%; $P \leq 0.001$) and implementation of quality improvement strategies. The average number of reported quality improvement strategies (on a scale of 0 to 11) was 7.2 in IMGs, 5.3 in hybrids, and 4.5 in IPAs ($P < 0.001$). There were statistically significant differences in implementation of 4 of 9 measure-specific quality improvement strategies (**Table 1**). For example, the strategy of contacting patients who missed mammography appointments was reported by the leaders of 74% of IMGs, 51% of hybrids, and 28% of IPAs ($P < 0.001$).

Quality of Care

The quality of care delivered to PacifiCare enrollees varied across the quality measures from a mean of 14% (range, 0% to 51%) for chlamydia screening to 75% (range, 33% to 100%) for use of an asthma controller medication by patients with moderate to severe asthma.

In unadjusted analyses looking at the relationship be-

Table 1. **Comparison of Types of Physician Groups***

Variable	IMGs (*n* = 19)	Hybrids (*n* = 39)	IPAs (*n* = 61)	*P* Value†
Organizational characteristics				
Mean physicians, (SD), *n*	242 (306)	318 (259)	390 (426)	>0.20
Age of group (SD), *y*	37 (27)	25 (19)	10 (5)	<0.001
Mean fraction of board-certified physicians (SD)	0.94 (0.07)	0.86 (0.13)	0.85 (0.10)	0.014
Having an electronic medical record, *n (%)*	7 (37)	7 (18)	1 (2)	<0.001
Quality bonus: physician compensation tied to quality of care, *n (%)*	6 (32)	4 (10)	8 (13)	0.086
Mean patients eligible for mammography (SD), *n*	4530 (4692)	3305 (3835)	2525 (2924)	0.106
Mean patients eligible for Papanicolaou smear screening (SD), *n*	19 821 (20 460)	15 383 (20 989)	10 805 (11 947)	0.110
Mean patients eligible for chlamydia screening (SD), *n*	963 (1244)	618 (1047)	384 (446)	0.035
Mean patients eligible for diabetic eye examination (SD), *n*	3675 (3442)	3173 (4475)	2270 (3119)	>0.20
Mean patients eligible for asthmatic medication (SD), *n*	293 (310)	189 (138)	147 (190)	0.063
Mean patients eligible for β-blockers after myocardial infarction (SD), *n*	257 (301)	140 (228)	124 (175)	0.059
Quality improvement strategies				
Mean total quality improvement strategies reported (SD), *n*‡	7.2 (2.3)	5.3 (2.4)	4.5 (2.2)	<0.001
Measure-specific quality improvement strategies, *n (%)*				
Remind eligible women of missed mammography appointments	14 (74)	20 (51)	17 (28)	<0.001
Collect data on appropriate cervical cancer screening	17 (89)	25 (64)	41 (67)	0.18
Use practice guidelines specific to diabetic eye screening	12 (63)	27 (69)	31 (51)	0.173
Use diabetes disease management program	17 (89)	34 (87)	42 (69)	0.041
Contact patients who have missed diabetic eye screening	10 (53)	14 (36)	11 (18)	0.009
Provide feedback to physicians about diabetic eye screening	10 (53)	17 (44)	17 (28)	0.086
Collect data on patients treated with β-blockers after myocardial infarction	14 (74)	15 (38)	26 (43)	0.030
Provide feedback to physicians about quality of asthma care	4 (21)	11 (28)	11 (18)	>0.20
Use asthma disease management program	12 (63)	24 (62)	25 (41)	0.067
General quality improvement strategies, *n (%)*				
Remind parents of missed well-child visits or immunizations	9 (47)	15 (38)	6 (10)	<0.001
Collect data on patient satisfaction	19 (100)	30 (77)	47 (77)	0.067
Collect data on time patients spend in waiting room	18 (95)	21 (54)	48 (79)	0.002
Contact patients who missed influenza vaccine	10 (53)	13 (33)	15 (25)	0.071
Remind patients when they missed a prescription refill	2 (11)	4 (10)	2 (3)	>0.20
Remind patients >40 years of age that they missed a physical examination	4 (21)	5 (13)	4 (7)	0.188

0.188

* IMGs = integrated medical groups; IPAs = independent practice associations.
† Statistical test comparing 3 groups based on analysis of variance for continuous variables and chi-square test for binary variables.
‡ Leader's report on use of 11 quality improvement strategies: Remind eligible women of missed mammography appointments, collect data on percentage of women receiving appropriate cervical cancer screening, remind parents of children who missed well-child visits or immunizations, use diabetes disease management program, collect data on the percentage of persons with myocardial infarction who are treated with a β-blocker, use asthma disease management program, collect data on patient satisfaction, collect data on average time patients spend in waiting room, contact patients who missed influenza vaccine, remind patients taking medication when they missed a prescription refill, and remind patients older than 40 years of age that they missed a physical examination.

Table 2. **Unadjusted Relationship between Organizational Characteristics and Performance on Quality Measures***

Quality Measures	Type of Physician Group				EMR			Volume of Patients		
	IMG (*n* = 19)	Hybrid (*n* = 39)	IPA (*n* = 61)	*P* Value	Yes (*n* = 15)	No (*n* = 114)	*P* Value	Highest Quartile	Lowest Quartile	*P* Value†
Percentage of eligible patients who received mammography, *(n)*	73 (16 501)	63 (26 712)	58 (33 482)	<0.001	69 (15 512)	61 (61 183)	0.042	67 (42 928)	47 (5874)	<0.001
Percentage of eligible patients who received Papanicolaou smear screening, *(n)*	53 (63 264)	35 (104 252)	30 (134 573)	0.002	33 (50 959)	37 (251 130)	0.97	38 (158 392)	34 (24 647)	0.47
Percentage of eligible patients who received chlamydia screening, *(n)*	23 (3007)	13 (4216)	9 (5084)	0.005	20 (2249)	12 (10 058)	0.060	17 (6975)	7 (669)	0.008
Percentage of eligible patients who received diabetic eye screening, *(n)*	42 (14 813)	34 (25 601)	29 (28 846)	<0.001	39 (14 180)	32 (55 080)	0.29	37 (36 195)	28 (4354)	0.007
Percentage of eligible patients who received asthma controller medication, *(n)*	77 (863)	76 (1425)	76 (1910)	0.99	77 (810)	76 (3388)	0.43	80 (2333)	71 (266)	<0.001
Percentage of eligible patients who received β-blocker after acute MI, *(n)*	80 (893)	81 (1309)	69 (1535)	0.184	85 (984)	73 (2753)	0.006	82 (2114)	77 (154)	0.31

* Scores on quality measures are based only on PacifiCare enrollees. EMR = electronic medical record; IMGs = integrated medical groups; IPAs = independent practice associations; MI = myocardial infarction.
† Statistical test comparing highest- lowest-quintile physician groups.

tween organizational characteristics and HEDIS quality measures, patients in groups reported by physician leaders to be IMGs were significantly more likely than those in groups reported to be IPAs to receive 4 of 6 quality measures: mammography (relative risk, 1.26 [CI, 1.12 to 1.41]), Papanicolaou smear screening (relative risk, 1.81 [CI, 1.27 to 2.58]), chlamydia screening (relative risk, 2.20 [CI, 1.31 to 3.72]), and diabetic eye screening (relative risk, 1.43 [CI, 1.24 to 1.66]) (**Table 2**). In each of these cases, hybrid groups performed somewhere in the middle. In general, groups with higher volume and those that reported having an EMR had higher scores on the HEDIS quality measures (**Table 2**). The other organizational characteristics had no consistent relationship with the 6 quality scores.

The results of multivariate regression suggest a similar relationship between organizational characteristics and quality of care observed in the unadjusted analyses. When comparing types of physician groups, IMGs had higher quality than IPAs on the same 4 measures; hybrid groups were in the middle (**Table 3**). A higher volume of patients was associated higher quality scores on 4 measures. To reflect a change in volume that is meaningfully related to our range of observations, we report the relative risks associated with the difference between the average number of patients in groups with the highest quartile and lowest quartile of volume for each measure: mammography (relative risk, 1.62 [CI, 1.17 to 2.25]), chlamydia screening (relative risk, 4.00 [CI, 2.14 to 7.46]), diabetic eye screening (relative risk, 1.54 [CI, 1.05 to 2.27]), and use of asthma controller medication (relative risk, 1.32 [CI, 1.13 to 1.54]). The other variables in the multivariate model had inconsistent relationships with quality. The physician group leader's report of having an EMR was predictive of lower rates of Papanicolaou smear screening and higher rates of β-blocker use. On 2 of the 6 HEDIS measures, diabetic eye screening and Papanicolaou smear screening, use of a quality bonus was associated with lower-quality scores (results not shown).

In the multivariate models, neither the reported total number of quality improvement strategies nor measure-specific quality improvement strategies (results not shown) were associated with higher quality, with one exception: An asthma feedback program to physicians was associated with higher use of asthma controller medications (relative risk, 1.06 [CI, 1.02 to 1.10]).

DISCUSSION

Our analyses showed that, consistent with our hypothesis, patients in self-identified IMGs were more likely than patients in self-identified IPAs to receive 4 of the 6 clinical quality measures. The relative risk of quality scores between IMGs and IPAs in Papanicolaou smear screening (relative risk, 2.3) was particularly striking. Although other studies have suggested that the organizational structure of physician groups can impact quality (2, 19), to our knowledge this is the first study that demonstrates this empirically. Physician group leaders of IMGs were more likely to report using EMRs and quality improvement strategies, but their use did not explain why IMGs had higher quality.

It makes intuitive sense that IMGs, with their centralized decision making and closer physician affiliations, are

Table 2—Continued

Given Quality Bonus			Fraction of Board-Certified Physicians			Quality Improvement Score (0–11)		
Yes (n = 18)	No (n = 101)	P Value	Highest Quartile (>0.96) (n = 29)	Lowest Quartile (<0.78) (n = 26)	P Value†	Highest Quartile (>7) (n = 36)	Lowest Quartile (<3) (n = 32)	P Value†
66 (14 236)	62 (62 459)	0.28	68 (22 671)	61 (12 072)	0.119	69 (32 758)	54 (12 864)	<0.001
34 (55 029)	37 (247 060)	0.97	43 (89 272)	29 (47 600)	0.140	43 (127 387)	36 (54 168)	0.35
13 (2373)	14 (9934)	0.99	20 (3821)	12 (1967)	0.074	17 (5512)	16 (2118)	0.57
33 (12 010)	34 (57 250)	0.59	36 (20 240)	34 (11 899)	0.26	35 (27 272)	34 (12 386)	0.67
76 (751)	76 (3447)	0.40	77 (1265)	75 (649)	0.34	78 (1985)	74 (642)	0.088
82 (596)	74 (3141)	0.44	80 (1194)	81 (586)	0.52	71 (1552)	76 (711)	0.29

able to provide higher-quality care at least for the types of medical services that are routinely provided by using an algorithm. Of course, another potential explanation is that IMGs attract primary care physicians who differ systematically from those who work in IPAs. Board certification was not associated with performance on the quality mea-

Table 3. **Adjusted Associations among Type of Group, Quality Scores, and Measure-Specific Quality Improvement Strategies***

Quality Measure	Specific Quality Improvement Strategies	Risk Ratios for Good Performance on Quality Measures Comparing IMGs and Hybrids with IPAs (95% CI)†			P Value‡	Risk Ratio for Good Performance on Quality Measures Comparing Groups that Do and Groups that Do Not Use Quality Improvement Strategies (95% CI)†	P Value
		IMGs (n = 19)	Hybrids (n = 39)	IPAs (n = 61)§			
Mammography		1.15 (1.01–1.33)	1.06 (0.93–1.20)	1.0	0.041	—	—
	Patient reminder program (n = 51)	—	—	—	—	1.08 (0.95–1.23)	0.22
Papanicolaou smears		2.29 (1.53–3.42)	1.33 (0.94–1.88)	1.0	<0.001	—	—
	Collect data (n = 83)	—	—	—	—	1.02 (0.96–1.09)	0.47
Chlamydia screening		2.17 (1.04–4.55)	1.31 (0.83–2.08)	1.0	0.040	—	—
Diabetic eye screening		1.55 (1.28–1.88)	1.14 (0.98–1.32)	1.0	<0.001	—	—
	Disease management program (n = 93)	—	—	—	—	1.07 (0.91–1.27)	0.82
	Feedback program (n = 44)	—	—	—	—	0.93 (0.82–1.06)	0.29
	Guideline use (n = 70)	—	—	—	—	1.02 (0.89–1.17)	0.26
	Patient reminder program (n = 35)	—	—	—	—	1.02 (0.89–1.18)	0.74
β-Blocker after acute myocardial infarction		0.96 (0.88–1.04)	1.01 (0.95–1.07)	1.0	0.29	—	—
	Collect data (n = 55)	—	—	—	—	1.02 (0.95–1.10)	0.45
Asthma medication use		0.96 (0.90–1.02)	0.98 (0.94–1.03)	1.0	0.22	—	—
	Disease management program (n = 61)	—	—	—	—	0.99 (0.95–1.04)	0.81
	Feedback program (n = 26)	—	—	—	—	1.06 (1.02–1.10)	0.001

* IMGs = integrated medical groups; IPAs = independent practice associations; MI = myocardial infarction.
† Multivariate model adjusts for reported use of electronic medical records, volume of patients, overall quality improvement score, quality bonus, and fraction of board-certified physicians. Scores on quality measures are based only on PacifiCare enrollees.
‡ P value reflects association of quality performance of IMGs versus IPAs.
§ Referent group.

sures, but other unmeasured physician characteristics may vary between IMGs and IPAs.

Our finding that patients in larger-volume groups are more likely to receive higher-quality care than those in lower-volume groups might be because the former have more resources to invest in improving care. These findings are particularly important because most physicians in the United States continue to work independently in small practices (23). Some have argued that a move toward large IMGs will result in higher-quality care (24), but to our knowledge, our study is the first to provide any empirical evidence to back this claim.

Of note, for 2 quality measures, use of β-blockers after a myocardial infarction and use of a controller medication for asthma, there were no substantial differences in scores by organizational structure. Almost all of the physician groups performed well on these 2 measures. It might be that it is hard to detect a difference in the setting of overall high quality. It is also possible that IMGs possess an advantage on quality measures that focus on screening but not on medication management of chronic diseases.

Our study has limitations. Our survey depended on self-report and did not assess the sophistication of the decision support in an EMR or the composition of the individual parts of a diabetes disease management program. The survey instrument also only captured whether an IPA implemented an EMR as an entire group and not whether individual practices in the IPA implemented an EMR independently. Our use of a simple count of quality improvement strategies does not account for the fact that these strategies could have differing impacts. Future analyses could make use of factor analysis, principle component analysis, or clustering algorithms to construct a properly weighted composite scale. These issues could explain the lack of a consistent relationship between the quality scores and reported use of quality improvement strategies or an EMR. Nonetheless, studies have shown that quality improvement strategies have limited and inconsistent benefits (25, 26).

Another concern is the cross-sectional nature of our study. Some groups with low quality scores may have recently initiated a quality improvement initiative; although our quality data reflect care 1 year after the survey, it is possible that not enough time had passed for this initiative to have an impact in such groups. This limitation could also explain why the reported use of quality bonuses was associated with lower scores on several measures. We could not adjust for patient-level sociodemographic characteristics in this study, and previous analyses of HEDIS scores have shown that sociodemographic characteristics are associated with whether an individual patient receives the necessary care (27). However, adjusting for these characteristics at the more aggregated level of a health plan does not appreciably change HEDIS scores because patients who are privately insured by different health plans have relatively similar sociodemographic characteristics (28, 29). Moreover, process measures (for example, testing for hemoglobin A_{1c}) are generally less affected by patient characteristics than by outcome measures (for example, control of hemoglobin A_{1c}) (30). Nonetheless, it is possible that differences in the patient sample explain some of the higher performance we attribute to IMGs compared with the other 2 forms of organization.

The HEDIS measures in our study, although commonly used, capture only a fraction of what would be considered quality primary care. Because the preventive care measures in our study focused on women, it is possible that our findings are sex-specific. The physician group leaders self-identified their groups as an IPA, hybrid, or IMG. In reality, the groups within each of these categories probably vary greatly in their management and operation, leading to some heterogeneity within groups. In addition, compared with the period of our survey, quality improvement processes and EMRs are more established today and therefore might now be associated with higher quality scores. In our study, we estimated the total volume of patients eligible for a quality measure. Although the association between volume and quality scores did not change in our sensitivity analyses, we cannot exclude the possibility that measurement bias explains the association observed, and therefore these results need to be confirmed in future studies. California physician groups are unique in several ways, including their larger size and greater use of capitated payments, compared with those in most other parts of the United States. This limits the generalizability of these results to other settings (31).

In summary, we found that physician organizations identified as IMGs by physician leaders delivered higher quality on 4 of 6 primary care measures. Although physician group leaders who identified their groups as IMGs were also more likely to report use of EMR and implementation of quality improvement strategies, these strategies did not explain the differences in quality. To date, substantial effort has been focused on encouraging physicians to use an EMR and to implement quality improvement strategies. Our findings do not imply that this strategy is wrong, but they do underscore the importance of understanding how organizational setting influences the quality of care provided.

From University of Pittsburgh and RAND Health, Pittsburgh, Pennsylvania; and Harvard School of Public Health and Brigham and Women's Hospital, Boston, Massachusetts.

Acknowledgments: The authors thank Sam Ho and colleagues at PacifiCare and the leaders of the physician organizations in their network for their cooperation and assistance. They also thank Alan Zaslavsky for statistical advice.

Grant Support: Data collection for this study was supported by the California HealthCare Foundation and the Commonwealth Fund. Dr. Mehrotra was supported by an institutional National Research Service Award (5 T32 HP11001-15).

Potential Financial Conflicts of Interest: None disclosed.

Requests for Single Reprints: Ateev Mehrotra, MD, MPH, RAND Health and University of Pittsburgh School of Medicine, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA 15213-2665; e-mail, mehrotra@rand.org.

Current author addresses are available at www.annals.org.

References

1. **Solomon LS, Zaslavsky AM, Landon BE, Cleary PD.** Variation in patient-reported quality among health care organizations. Health Care Financ Rev. 2002; 23:85-100. [PMID: 12500472]
2. **Landon BE, Wilson IB, Cleary PD.** A conceptual model of the effects of health care organizations on the quality of medical care. JAMA. 1998;279:1377-82. [PMID: 9582046]
3. **McBean AM, Jung K, Virnig BA.** Improved care and outcomes among elderly Medicare managed care beneficiaries with diabetes. Am J Manag Care. 2005;11: 213-22. [PMID: 15839182]
4. **Himmelstein DU, Woolhandler S, Hellander I, Wolfe SM.** Quality of care in investor-owned vs not-for-profit HMOs. JAMA. 1999;282:159-63. [PMID: 10411197]
5. **Hunt DL, Haynes RB, Hanna SE, Smith K.** Effects of computer-based clinical decision support systems on physician performance and patient outcomes: a systematic review. JAMA. 1998;280:1339-46. [PMID: 9794315]
6. **Stone EG, Morton SC, Hulscher ME, Maglione MA, Roth EA, Grimshaw JM, et al.** Interventions that increase use of adult immunization and cancer screening services: a meta-analysis. Ann Intern Med. 2002;136:641-51. [PMID: 11992299]
7. **Casalino L, Gillies RR, Shortell SM, Schmittdiel JA, Bodenheimer T, Robinson JC, et al.** External incentives, information technology, and organized processes to improve health care quality for patients with chronic diseases. JAMA. 2003;289:434-41. [PMID: 12533122]
8. **Schmittdiel J, McMenamin SB, Halpin HA, Gillies RR, Bodenheimer T, Shortell SM, et al.** The use of patient and physician reminders for preventive services: results from a National Study of Physician Organizations. Prev Med. 2004;39:1000-6. [PMID: 15475035]
9. **Malin JL, Kahn K, Dulai G, Farmer MM, Rideout J, Simon LP, et al.** Organizational systems used by California capitated medical groups and independent practice associations to increase cancer screening. Cancer. 2000;88:2824-31. [PMID: 10870067]
10. **Kerr EA, Mittman BS, Hays RD, Leake B, Brook RH.** Quality assurance in capitated physician groups. Where is the emphasis? JAMA. 1996;276:1236-9. [PMID: 8849751]
11. **Rittenhouse DR, Grumbach K, O'Neil EH, Dower C, Bindman A.** Physician organization and care management in California: from cottage to Kaiser. Health Aff (Millwood). 2004;23:51-62. [PMID: 15537586]
12. **National Committee for Quality Assurance.** Health Plan Employer Data and Information Set 4.0. Washington, DC; National Committee for Quality Assurance;1998.
13. **Rosenthal MB, Frank RG, Buchanan JL, Epstein AM.** Scale and structure of capitated physician organizations in California. Health Aff (Millwood). 2001;20: 109-19. [PMID: 11463068]
14. **Robinson JC.** Physician organization in California: crisis and opportunity. Health Aff (Millwood). 2001;20:81-96. [PMID: 11463094]
15. **Halm EA, Lee C, Chassin MR.** Is volume related to outcome in health care? A systematic review and methodologic critique of the literature. Ann Intern Med. 2002;137:511-20. [PMID: 12230353]
16. **Birkmeyer JD, Siewers AE, Finlayson EV, Stukel TA, Lucas FL, Batista I, et al.** Hospital volume and surgical mortality in the United States. N Engl J Med. 2002;346:1128-37. [PMID: 11948273]
17. **Kitahata MM, Koepsell TD, Deyo RA, Maxwell CL, Dodge WT, Wagner EH.** Physicians' experience with the acquired immunodeficiency syndrome as a factor in patients' survival. N Engl J Med. 1996;334:701-6. [PMID: 8594430]
18. **Stone VE, Seage GR 3rd, Hertz T, Epstein AM.** The relation between hospital experience and mortality for patients with AIDS. JAMA. 1992;268: 2655-61. [PMID: 1433685]
19. **Robinson JC, Casalino LP.** Vertical integration and organizational networks in health care. Health Aff (Millwood). 1996;15:7-22. [PMID: 8920566]
20. **Williams RL.** A note on robust variance estimation for cluster-correlated data. Biometrics. 2000;56:645-6. [PMID: 10877330]
21. **McNutt LA, Wu C, Xue X, Hafner JP.** Estimating the relative risk in cohort studies and clinical trials of common outcomes. Am J Epidemiol. 2003;157: 940-3. [PMID: 12746247]
22. **Bodenheimer T.** California's beleaguered physician groups—will they survive? N Engl J Med. 2000;342:1064-8. [PMID: 10749972]
23. **Casalino LP, Devers KJ, Lake TK, Reed M, Stoddard JJ.** Benefits of and barriers to large medical group practice in the United States. Arch Intern Med. 2003;163:1958-64. [PMID: 12963570]
24. **Enthoven AC, Tollen LA.** Competition in health care: it takes systems to pursue quality and efficiency. Health Aff (Millwood). 7 September 2005 [Epub ahead of print]. [PMID: 16148024]
25. **Shojania KG, Grimshaw JM.** Evidence-based quality improvement: the state of the science. Health Aff (Millwood). 2005;24:138-50. [PMID: 15647225]
26. **Keating NL, Landrum MB, Landon BE, Ayanian JZ, Borbas C, Wolf R, et al.** The influence of physicians' practice management strategies and financial arrangements on quality of care among patients with diabetes. Med Care. 2004; 42:829-39. [PMID: 15319608]
27. **Franks P, Fiscella K, Beckett L, Zwanziger J, Mooney C, Gorthy S.** Effects of patient and physician practice socioeconomic status on the health care of privately insured managed care patients. Med Care. 2003;41:842-52. [PMID: 12835608]
28. **Zaslavsky AM, Epstein AM.** How patients' sociodemographic characteristics affect comparisons of competing health plans in California on HEDIS quality measures. Int J Qual Health Care. 2005;17:67-74. [PMID: 15668313]
29. **Zaslavsky AM, Hochheimer JN, Schneider EC, Cleary PD, Seidman JJ, McGlynn EA, et al.** Impact of sociodemographic case mix on the HEDIS measures of health plan quality. Med Care. 2000;38:981-92. [PMID: 11021671]
30. **Trivedi AN, Zaslavsky AM, Schneider EC, Ayanian JZ.** Trends in the quality of care and racial disparities in Medicare managed care. N Engl J Med. 2005;353:692-700. [PMID: 16107622]
31. **Gillies RR, Shortell SM, Casalino L, Robinson JC, Rundall TG.** How different is California? A comparison of U.S. physician organizations. Health Aff (Millwood). 2003;Suppl Web Exclusives:W3-492-502. [PMID: 15506154]

Current Author Addresses: Dr. Mehrotra: RAND Health and University of Pittsburgh School of Medicine, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA 15213-2665.
Dr. Epstein: Harvard School of Public Health, Kresge Building, Room 403, 677 Huntington Avenue, Boston, MA 02115.
Dr. Rosenthal: Harvard School of Public Health, Kresge Building, Room 405, 677 Huntington Avenue, Boston, MA 02115.