

## ORIGINAL ARTICLES

# Does Affiliation of Physician Groups with One Another Produce Higher Quality Primary Care?

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**PURPOSE:** Recent reports have emphasized the importance of delivery systems in improving health care quality. However, few prior studies have assessed differences in primary care quality between physician groups that differ in size and organizational configuration. We examined whether larger physician group size and affiliation with networks of multiple groups are associated with higher quality of care.

**METHODS:** We conducted a cross-sectional observational analysis of 132 physician groups (including 4,358 physicians) who delivered primary care services in Massachusetts in 2002. We compared physician groups on performance scores for 12 Health Plan Employer Data and Information Set (HEDIS) measures reflecting processes of adult primary care.

**RESULTS:** Network-affiliated physician groups had higher performance scores than non-affiliated groups for 10 of the 12 HEDIS measures ( $p < 0.05$ ). There was no consistent relationship between group size and performance scores. Multivariable models including group size, network affiliation, and health plan showed that network-affiliated groups had higher performance scores than non-affiliated groups on 8 of the 12 HEDIS measures ( $p < 0.05$ ), and larger group size was not associated with higher performance scores. Adjusted differences in the performance scores of network-affiliated and non-affiliated groups ranged from 2% to 15%. For 4 HEDIS measures related to diabetes care, performance score differences between network-affiliated and non-affiliated groups were most apparent among the smallest groups.

**CONCLUSIONS:** Physician group affiliation with networks of multiple groups was associated with higher quality, and for measures of diabetes care the quality advantage of network-affiliation was most evident among smaller physician groups.

**KEY WORDS:** quality of care; primary care; HEDIS measures; health care organization.

J Gen Intern Med 22(10):1385-92

DOI 10.1007/s11606-007-0234-0

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## INTRODUCTION

Recent reports from the Institute of Medicine (IOM) have called for improvement in the quality of health care in the United States, advocating a focus on delivery systems rather than individual physicians.<sup>1-3</sup> The organization of primary care delivery in the U.S. is complex, with physician groups varying in both size (number of physicians) and degree of affiliation with other groups (forming "networks" of groups). Increasing numbers of primary care physicians practice in large physician groups or networks of physician groups,<sup>4</sup> but traditional small group practices still predominate in many parts of the U.S.<sup>5</sup>

Heterogeneity in the size and organization of primary care groups offers an opportunity to measure whether these features are associated with quality of care. Larger medical groups may have a greater capacity than smaller groups to dedicate resources to enhancing quality.<sup>6-15</sup> Conversely, managers of larger physician groups and networks may take actions that distract from providing high-quality care.<sup>16-18</sup> Prior empirical studies suggest that physicians working in larger groups are more likely to participate in quality improvement activities,<sup>19,20</sup> that physicians believe quality of care is higher in centrally administered staff-model HMOs than in independent office-based practices,<sup>21</sup> and that the smallest practices have lower rates of provision of some preventive services compared to larger practices.<sup>22</sup> Physician groups can affiliate with one another through "physician networks" (sets of groups that share common contracting and quality management programs), but whether they deliver higher quality of care than non-affiliated groups has not been previously studied.

Recently, the Massachusetts Health Quality Partners created a novel statewide database of physician group performance including many measures of primary care quality. In this study, we used this statewide database to assess whether the quality of care is associated with the size of groups and their organizational relationships to one another.

Received November 28, 2006

Revised March 22, 2007

Accepted May 4, 2007

Published online June 27, 2007

## METHODS

### Data and Sample

The Massachusetts Health Quality Partners (MHQP) is a nonprofit collaboration of consumers, health care providers, health plans, purchasers, state government, and academia (details available online: <http://www.mhqp.org>). The 5 health plans participating in the MHQP contract with approximately 5,000 primary care physicians (more than 90% of Massachusetts' practicing primary care physicians [PCPs]) and cover nearly 4 million enrollees. All 5 health plans are managed care organizations offering HMO products that serve as the basis for reporting measures from the Health Plan Employer Data and Information Set (HEDIS) maintained by the National Committee for Quality Assurance (NCQA). Since 2002 these health plans have shared HEDIS data with MHQP, aggregated at the individual physician level, to produce annual reports evaluating primary care services delivered by physician groups in Massachusetts. The vast majority of these data pertain to commercially insured enrollees. Because acceptance of Medicare managed care enrollees varies among medical groups, Medicare enrollees (6.6% of enrollees) were excluded from this analysis.

To assess quality, we used all 12 HEDIS process of care measures collected by MHQP (see Appendix A): appropriate asthma medications for adults ages 18 to 56, breast cancer screening, cervical cancer screening, *Chlamydia* screening in women ages 21 to 26, cholesterol screening after acute cardiovascular events, 3 measures of antidepressant medication management (effective acute phase treatment, effective continuation phase treatment, and optimal practitioner contacts during acute phase), and 4 measures of diabetes care (HbA1c testing, eye exams, low-density lipoprotein cholesterol (LDL-C) screening, and monitoring diabetic nephropathy).

The study sample consisted of the "measure opportunities" generated by each of the 4,959 physicians who had at least 1 HEDIS denominator observation during calendar year 2002 on at least 1 of the 12 HEDIS measures. Each patient could be included in more than 1 measure (e.g., a patient with diabetes eligible for inclusion in more than 1 HEDIS measure), so we defined a "measure opportunity" as a single patient sampled according to eligibility criteria specified by NCQA for inclusion in a HEDIS measure denominator. Using this definition, the sum of measure opportunities was greater than the total number of patients included in the sample. The structure of the data file prevented us from assessing the magnitude of this difference.

We excluded 601 physicians that were part of physician groups containing fewer than 3 PCPs ("2-physician" or "solo" practices) because of small sample sizes and lack of information to determine their group affiliation. The final sample size was 860,589 measure opportunities produced by 4,358 physicians.

### Assignment of Physicians into Groups and Networks

The MHQP defines a physician group as a distinct set of PCPs that: (1) practice together at 1 location (or rotate among locations together); (2) share resources and equipment; and (3) collectively assume responsibility for managing the quality of clinical care. MHQP staff developed an algorithm to make a preliminary assignment of each physician to 1 group based on

identifying information provided by the health plans, such as the physician's name, medical license number, Drug Enforcement Administration (DEA) number and Medicare Unique Physician Identifier Number (UPIN), practice address, and physician group billing data. Physicians not assigned by the algorithm to exactly 1 group were assigned by manual inspection of the identifying information from the health plans. Immediately after assignment of all physicians, physician group leaders were each given an opportunity to review and offer corrections to their group's roster of physicians.

Seven physician networks were included in MHQP data for 2002. Each of these networks was founded before 1997. "Network-affiliated" physician groups shared 2 important features. First, network-affiliated groups agreed that the network would negotiate their contracts with the health plans. Second, network-affiliated groups could take advantage of quality management services offered by a network medical director. Non-affiliated groups, in contrast, contracted directly with health plans and had no access to network-supplied services. We matched each physician group in the database to a network based on rosters of physician groups maintained by each network. Unmatched groups were classified as non-affiliated. To ensure accurate group classification, each network director reviewed the MHQP roster of groups identified as belonging to his or her network.

### Analysis

Our goal was to assess the relationship between HEDIS performance rates and the size and network affiliation of physician groups, while controlling for potential confounders available to us. We first compared the characteristics of network-affiliated and non-affiliated physician groups, including number of PCPs, total number of HEDIS measure opportunities, median group size, and mean number of measure opportunities per PCP and per group. Group size, defined as the number of PCPs in each group contributing at least 1 HEDIS measure observation, ranged from 3 to 270 physicians, with a median value of 21. After ranking the groups by size, we divided them into terciles for ease of presentation: small (3 to 12 PCPs), medium (13 to 32 PCPs), and large (33 to 270 PCPs). To assess the sensitivity of our results to this classification, we repeated the analyses after dividing the groups into deciles and noted that this produced substantially similar results.

HEDIS measures consist of a denominator (the number of patients considered eligible to receive the measured service), and a numerator (the number of patients among those eligible that received the specified care). The HEDIS numerators reported to the MHQP were based on claims data alone, but health plans can also use NCQA's "hybrid method" in which enrollees whose claims and administrative data lack evidence of receiving a clinical service are sampled for supplemental medical record review. By compensating for incomplete claims information, the hybrid method tends to raise performance scores.<sup>23</sup>

To improve the accuracy of the reported performance scores, MHQP developed a method for adjusting "claims-only" measure results. For each measure, each health plan reported the ratio of performance based on the hybrid method to performance based on claims data alone (a ratio which is always 1 or greater). The numerators contributed by each health plan were then multiplied by each health plan's ratio (for the corresponding measure) to generate "adjusted" numerators. Aggregate "adjusted" perfor-

mance scores for physician groups were produced by summing adjusted numerators (across plans) and dividing by the sum of the denominators. All performance results reported by MHQP are based on this method.

For each of the 12 HEDIS measures, we compared mean performance scores across the small, medium, and large group size categories, equally weighting all measure opportunities. We then compared mean performance scores for network-affiliated and non-affiliated groups using the same approach. We calculated odds ratios and 95% confidence intervals for each measure result in the network affiliation status comparison.

Other characteristics of primary care groups might confound the relationship between HEDIS performance scores, group size, and network affiliation. For example, some health plans may exert a stronger positive influence on performance scores than others. If large or network-affiliated groups preferentially contract with high-quality health plans, then the selection of health plan contracts, rather than group size or physician network affiliation, might be the cause of higher performance scores for large or network-affiliated groups.

To account for these potential confounders, we developed multivariable models for each measure, with receipt of the measured service as the dependent variable and network affiliation, group size tercile, and the health plan associated with each measure opportunity as the independent variables. Using the results from each model we calculated the probability of receiving HEDIS services (adjusted for group size and health plan) and generated adjusted odds ratios comparing the performance of network-affiliated and non-affiliated physician groups. We also used these models to test whether there were statistically significant interactions between group size and network affiliation.

All statistical analyses were performed using SAS software, version 9.1.3 (SAS Institute, Inc., Cary, NC). We used Generalized Estimation Equation models with exchangeable working correlation structures and robust standard errors to adjust estimated variances for clustering of performance data at the level of the medical group.<sup>24,25</sup> *P* values less than 0.05 were considered statistically significant for all comparisons. There was no adjustment for multiple comparisons. All adjusted performance scores were calculated as multivariable model predictions, holding the covariates at their mean values.

## RESULTS

Of the 132 physician groups included in the study, 79 (60%) were affiliated with a network, and 53 (40%) had no network affiliation (Table 1). Approximately 59% of the physicians practiced in network-affiliated groups, but median number of PCPs per group was nearly twice as large in non-affiliated groups (26) as it was in network-affiliated groups (14). The study database included 860,589 measure opportunities across the 12 HEDIS measures we studied. Approximately 63% of measure opportunities occurred in network-affiliated groups. Each category of network affiliation and group size had an adequate number of measure opportunities for analysis.

Group size was weakly and inconsistently related to HEDIS performance scores. There were statistically significant differences in mean HEDIS performance rates between small, medium, and large physician group size categories for only 3 of the 12 HEDIS measures (monitoring diabetic nephropathy, acute phase antidepressant medication management, and continuation phase

**Table 1. Characteristics of Network-affiliated and Non-affiliated Physician Groups**

	All	Network-affiliated	Non-affiliated
	<i>n</i>	<i>n</i>	<i>n</i>
<b>Number of groups</b>	<b>132</b>	<b>79</b>	<b>53</b>
Small groups* (3–12 physicians)		35	12
Medium groups (13–32 physicians)		21	22
Large groups (33–270 physicians)		23	19
<b>Number of PCPs</b>	<b>4,358</b>	<b>2,571</b>	<b>1,787</b>
Small groups (3–12 physicians)		225	89
Medium groups (13–32 physicians)		430	507
Large groups (33–270 physicians)		1,916	1,191
<b>Number of measure opportunities†</b>	<b>860,589</b>	<b>544,367</b>	<b>316,222</b>
Small groups (3–12 physicians)		63,193	10,493
Medium groups (13–32 physicians)		130,360	106,807
Large groups (33–270 physicians)		350,814	198,922
<b>Median number of PCPs per group</b>	<b>21</b>	<b>14</b>	<b>26</b>
Small groups (3–12 physicians)		5	8
Medium groups (13–32 physicians)		19	24
Large groups (33–270 physicians)		68	57
<b>Mean number of measure opportunities per PCP</b>	<b>197</b>	<b>212</b>	<b>177</b>
Small groups (3–12 physicians)		281	118
Medium groups (13–32 physicians)		303	211
Large groups (33–270 physicians)		183	167

\*Group sizes are defined by the number of PCPs in a group who contributed HEDIS observations. Groups were ranked by size and cutoffs were placed at the 33rd and 67th percentiles, yielding terciles: small (3–12 PCPs), medium (13–32 PCPs), and large (33–270 PCPs).

†Across the 12 HEDIS measures, the number of measure opportunities in each physician group size and network affiliation category ranged from 53 (cholesterol screening test after acute cardiovascular events among small non-affiliated groups) to 160,582 (cervical cancer screening among large network-affiliated groups).

antidepressant medication management; Table 2). Small groups had higher performance scores than others on these 3 measures.

Network affiliation was associated with higher HEDIS performance scores. Patients of network-affiliated physician groups were more likely than patients of non-affiliated groups to receive indicated services for 10 of the 12 HEDIS measures ( $p < 0.05$ ; Table 3). Mean performance rate differences between network-affiliated and non-affiliated groups ranged from 2 percentage points (for cervical cancer screening, HbA1c testing, LDL screening, asthma medications, and antidepressant medication management: acute phase) to 14 percentage points (for monitoring diabetic nephropathy). Across the 12 HEDIS measures, there was no consistent relationship between group size and performance scores within either network affiliation category.

The multivariable models revealed statistically significant relationships between physician group size and performance score for only 3 of the 12 HEDIS measures (data not shown). Compared to other groups, the medium-sized groups had higher performance scores on diabetic eye exams ( $OR = 1.24$ ;  $p = 0.02$ ) and monitoring of diabetic nephropathy ( $OR = 1.39$ ;  $p = 0.02$ ). Compared to large and medium-sized groups, the small groups had lower performance scores on LDL-C screening for patients with diabetes ( $OR = 0.74$ ;  $p = 0.02$ ).

Network affiliation was consistently associated with higher performance scores in the multivariable models. Patients of

Table 2. Mean HEDIS Performance Scores by Physician Group Size Tercile

HEDIS measure	Measure opportunities*	Performance score			P value†
		Small groups	Medium groups	Large groups	
	<i>n</i>		%		
Breast cancer screening	152,873	87	86	85	0.75
Cervical cancer screening	385,141	91	89	88	0.14
<i>Chlamydia</i> screening in women ages 21 to 26	42,020	38	32	35	0.07
Comprehensive diabetes care: HbA1c testing	56,032	89	87	86	0.09
Comprehensive diabetes care: eye exams	56,032	68	69	62	0.18
Comprehensive diabetes care: LDL-C screening	56,032	87	88	86	0.43
Comprehensive diabetes care: monitoring diabetic nephropathy	56,032	69	63	56	0.02
Appropriate asthma medications for adults ages 18 to 56	23,632	70	70	70	0.56
Cholesterol screening test after acute cardiovascular events	3,116	80	83	81	0.43
Antidepressant medication management: effective acute phase treatment	9,893	73	67	66	0.02
Antidepressant medication management: effective continuation phase treatment	9,893	57	51	50	0.01
Antidepressant medication management: optimal practitioner contacts during acute phase	9,893	35	31	31	0.20

\*N=number of measure opportunities for each HEDIS measure.

†Z test comparing performance scores of the group size terciles from GEE model accounting for clustering at the physician group level.

network-affiliated groups were more likely to receive HEDIS services than patients of non-affiliated groups on 8 of the 12 HEDIS measures (Table 4). Statistically significant odds ratios ranged from 1.10 to 1.97, with differences in mean adjusted performance scores ranging from 2 percentage points (for appropriate asthma medications) to 15 percentage points (for monitoring diabetic nephropathy).

Tests for interactions between group size and network affiliation revealed statistically significant interactions on the 4 HEDIS measures related to diabetes care: HbA1c testing, eye exams, LDL-C screening, and monitoring of diabetic nephropathy. Patients of non-affiliated groups were less likely to receive these 4 services than patients of network-affiliated groups. However, this difference in clinical performance between non-affiliated and network-affiliated groups was of greater magnitude among small groups than among groups in the "medium" and "large" terciles (data not shown). There were no statistically significant interactions between group size and network affiliation for the other 8 HEDIS measures in our analysis.

To ensure that the higher HEDIS performance scores observed for network-affiliated groups were not an artifact of 1 or 2 dominant high-performing or large networks, we calculated adjusted performance scores for each of the 7 networks on all 12 HEDIS measures. Across the 12 measures, 2 networks exhibited higher performance than the others. After excluding data from these 2 networks, statistically significant differences persisted for 6 of the 8 measures for which the main multivariable models showed higher performance scores for network-affiliated groups. After excluding data from the 2 largest networks (which were not the same as the 2 highest performing networks), statistically significant performance score differences persisted for 7 of these 8 measures.

## CONCLUSIONS

The past decade has witnessed consolidation of primary care physicians into larger groups with a variety of organizational forms.<sup>4,5</sup> Whereas much of the motivation for this consolida-

tion may have come from a perceived need for leverage in negotiating managed care contracts, some commentators assert that larger organizations offer a better platform for the delivery of high-quality primary care.<sup>6-8</sup> However, very few studies have examined whether primary care quality varies according to group size or network affiliation.

We found that group size, measured as the number of physicians, was not consistently associated with HEDIS performance. On the few measures for which performance did vary by group size, smaller groups tended to have the highest scores. In contrast, affiliation of groups with networks was consistently associated with the higher HEDIS performance scores. In multivariable modeling, network affiliation continued to have a statistically significant relationship to performance scores, whereas group size did not. Patients of network-affiliated physician groups were significantly more likely to receive 8 of 12 clinically indicated services than patients of non-affiliated physician groups. Significant interactions between group size and network affiliation on 4 measures related to diabetes care suggest that for this particular condition, small groups may gain more from network affiliation than larger groups. We lacked data to identify the mediators of this interaction. However, one could speculate that network-provided diabetes management resources are redundant with those available within larger groups.

With few exceptions, the magnitude of the performance differences between network-affiliated and non-affiliated groups was not large, but the direction of the relationship was remarkably consistent across measures. Why does network affiliation matter? There are many potential explanations. Network-affiliated groups may gain access to quality management expertise and information technology tools that enable them to deliver primary care more effectively. In particular, measurement and feedback on clinical performance as well as guidelines and decision support tools for clinicians and patients may be important. Whereas pay-for-performance contracts are increasingly of interest, they were still relatively uncommon in Massachusetts during 2002, the year that we studied. Selective affiliation arrangements between physician



Table 3. Comparison of Mean HEDIS Performance Scores for Patients of Network-affiliated and Non-affiliated Physician Groups

HEDIS measure	Performance score		Odds ratio*	95 C.I.†
	Network-affiliated	Non-affiliated		
	%			
<b>Breast cancer screening</b>	<b>87</b>	<b>84</b>	<b>1.29</b>	<b>(1.23–1.72)</b>
Small groups	87	87		
Medium groups	89	83		
Large groups	86	84		
<b>Cervical cancer screening</b>	<b>89</b>	<b>87</b>	<b>1.23</b>	<b>(1.13–1.64)</b>
Small groups	92	86		
Medium groups	90	88		
Large groups	89	87		
<b>Chlamydia screening in women ages 21 to 26</b>	<b>36</b>	<b>32</b>	<b>1.20</b>	<b>(1.03–1.45)</b>
Small groups	38	33		
Medium groups	34	31		
Large groups	36	32		
<b>Comprehensive diabetes care: HbA1c testing</b>	<b>87</b>	<b>85</b>	<b>1.20</b>	<b>(1.21–1.73)</b>
Small groups	91	83		
Medium groups	89	84		
Large groups	86	86		
<b>Comprehensive diabetes care: eye exams</b>	<b>66</b>	<b>62</b>	<b>1.22</b>	<b>(1.16–1.95)</b>
Small groups	70	60		
Medium groups	73	63		
Large groups	63	61		
<b>Comprehensive diabetes care: LDL-C screening</b>	<b>87</b>	<b>85</b>	<b>1.19</b>	<b>(1.14–1.78)</b>
Small groups	89	80		
Medium groups	90	85		
Large groups	86	86		
<b>Comprehensive diabetes care: monitoring diabetic nephropathy</b>	<b>65</b>	<b>51</b>	<b>1.75</b>	<b>(1.54–2.62)</b>
Small groups	72	49		
Medium groups	73	52		
Large groups	60	51		
<b>Appropriate asthma medications for adults ages 18 to 56</b>	<b>71</b>	<b>69</b>	<b>1.11</b>	<b>(1.02–1.21)</b>
Small groups	71	68		
Medium groups	72	69		
Large groups	70	68		
<b>Cholesterol screening test after acute cardiovascular events</b>	<b>81</b>	<b>82</b>	<b>0.94</b>	<b>(0.76–1.22)</b>
Small groups	78	85		
Medium groups	85	80		
Large groups	79	82		
<b>Antidepressant medication management: effective acute phase treatment</b>	<b>68</b>	<b>66</b>	<b>1.08</b>	<b>(1.00–1.28)</b>
Small groups	74	66		
Medium groups	68	66		
Large groups	66	66		
<b>Antidepressant medication management: effective continuation phase treatment</b>	<b>51</b>	<b>50</b>	<b>1.07</b>	<b>(0.99–1.25)</b>
Small groups	58	50		
Medium groups	52	50		
Large groups	49	49		
<b>Antidepressant medication management: optimal practitioner contacts during acute phase</b>	<b>33</b>	<b>29</b>	<b>1.18</b>	<b>(1.04–1.41)</b>
Small groups	36	28		
Medium groups	34	28		
Large groups	31	30		

\*Odds ratio comparing mean performance score for patients in network-affiliated groups to those in non-affiliated groups.

†Confidence intervals from GEE model accounting for clustering at the physician group level.

Table 4. Comparison of Adjusted Mean HEDIS Performance Scores for Patients of Network-affiliated and Non-affiliated Physician Groups

HEDIS measure	Adjusted performance score*		Odds ratio†	95% C.I.
	Network-affiliated	Non-affiliated		
	%			
Breast cancer screening	89	84	1.48	(1.27–1.72)
Cervical cancer screening	92	90	1.34	(1.13–1.58)
<i>Chlamydia</i> screening in women ages 21 to 26	38	33	1.19	(1.00–1.42)
Comprehensive diabetes care: HbA1c testing	91	88	1.39	(1.17–1.65)
Comprehensive diabetes care: eye exams	73	66	1.40	(1.20–1.64)
Comprehensive diabetes care: LDL-C screening	91	88	1.42	(1.15–1.76)
Comprehensive diabetes care: monitoring diabetic nephropathy	74	59	1.97	(1.54–2.51)
Appropriate asthma medications for adults ages 18 to 56	71	69	1.10	(1.02–1.20)
Cholesterol screening test after acute cardiovascular events	79	79	0.98	(0.78–1.23)
Antidepressant medication management: effective acute phase treatment	70	69	1.06	(0.95–1.18)
Antidepressant medication management: effective continuation phase treatment	54	53	1.04	(0.94–1.15)
Antidepressant medication management: optimal practitioner contacts during acute phase	33	30	1.16	(1.01–1.33)

\*Adjusted HEDIS performance scores are estimated probabilities from logistic regression models fitted with GEE to account for clustering at the physician group level. Covariates for performance score adjustment are physician group size and health plan associated with each measure opportunity.

†Odds ratio comparing mean adjusted performance scores for patients in network-affiliated groups to those in non-affiliated groups.

networks and groups could also explain our results. Managers of networks may choose to affiliate with particular physician groups, recognizing that the selected groups are able to produce higher quality care than groups not selected.

Our analysis has some limitations. Data were not available to identify network-provided resources that might be related to the delivery of high-quality care (such as use of health information technology). We lacked data to adjust for patients' clinical and sociodemographic characteristics. Prior studies suggest an association between sociodemographic characteristics and HEDIS scores, but it is not known whether this association exists at the physician group level, nor is it known whether variation in the clinical complexity of groups' patients influences HEDIS performance.<sup>26,27</sup> The HEDIS measures available to us were process measures. The link between process measures and patient outcomes has been difficult to ascertain.<sup>28</sup> The relationships we observed might not extend to outcomes or patient experiences.<sup>29,30</sup> We lacked sufficient data to analyze solo and two-physician practices, so our results may not extrapolate to groups of fewer than 3 physicians. Given our cross-sectional observational study design, we cannot conclude that the relationship between network affili-

ation and quality of care is causal. Our results were obtained from Massachusetts and may not generalize to states where physician groups are organized differently.

Our results have 3 key policy implications in the setting of the fiscal and quality improvement challenges facing primary care. First, there is a measurable association between affiliation of groups with physician networks and the quality of care patients receive. This implies that the current trend toward primary care groups joining together into networks is not detrimental to quality and may be beneficial.<sup>1,6–9</sup> Second, larger group size may not be consistently associated with higher quality. Across different measures, group size *per se* seems to matter less than affiliation of groups with networks. Our results raise the prospect that, as an alternative to adding physicians, smaller physician groups might improve their quality by affiliating with networks of groups. Before this can be recommended, additional research might be useful to identify the specific quality advantages conferred by network affiliation. Finally, programs that measure quality of care at the group level, expanded to include outcomes and other measures of quality, may help to identify the configurations of primary care practice that are most conducive to delivering high quality primary care.

## APPENDIX

Table 5. Appendix: HEDIS Service Definitions

Measure name	Definition†
Breast cancer screening	Percentage of women aged 52–69 years (as of Dec 31 of the measurement year) who had at least 1 mammogram in the past 2 years.
Cervical cancer screening	Percentage of women aged 21–64 years (as of Dec 31 of the measurement year) who had at least 1 Pap test in the past 3 years.
<i>Chlamydia</i> screening in women ages 21 to 26	Percentage of sexually active women who had at least 1 test for <i>Chlamydia</i> during the previous year.

(continued on next page)

Table 5. (continued)

Measure name	Definition†
Comprehensive diabetes care: HbA1c testing	Percentage of patients with type 1 or type 2 diabetes who were 18–75 years old and had a hemoglobin A1c test during the measurement year.
Comprehensive diabetes care: eye exams	Percentage of patients with type 1 or type 2 diabetes who were 18–75 years old and had a retinal or dilated eye exam by an eye care professional in the measurement year or a negative retinal exam (no evidence of retinopathy) by an eye care professional in the year before the measurement year.
Comprehensive diabetes care: LDL-C screening	Percentage of patients with type 1 or type 2 diabetes who were 18–75 years old and had a low-density lipoprotein cholesterol (LDL-C) test performed during the measurement year or year before the measurement year.
Comprehensive diabetes care: monitoring diabetic nephropathy	Percentage of patients with type 1 or type 2 diabetes who were 18–75 years old and have been screened, during the measurement year or year before the measurement year, for urine microalbumin or have nephropathy, as demonstrated by either evidence of medical attention for nephropathy, a visit to a nephrologist, or a positive urine macroalbumin test.
Appropriate asthma medications for adults ages 18 to 56	Percentage of enrolled members aged 18 to 56 years during the measurement year who were identified as having persistent asthma during the year before the measurement year and who were appropriately prescribed medication during the measurement year (i.e., those who had at least 1 dispensed prescription for inhaled corticosteroids, nedocromil, cromolyn sodium, leukotriene modifiers, or methylxanthines during the measurement year).
Cholesterol screening test after acute cardiovascular events	Percentage of patients ages 18 through 75 who, from January 1 through November 1 of the year before the measurement year, were discharged alive for acute myocardial infarction (AMI), coronary artery bypass graft (CABG), or percutaneous transluminal coronary angioplasty (PTCA), or who had a diagnosis of ischemic vascular disease (IVD) and who had low-density lipoprotein cholesterol (LDL-C) test performed any time during the measurement year.
Antidepressant medication management: effective acute phase treatment	Percentage of patients 18 years of age and older as of April 30 of the measurement year, who were diagnosed with a new episode of depression, were treated with antidepressant medication, and remained on an antidepressant drug during the entire 84-day (12-week) acute treatment phase.
Antidepressant medication management: effective continuation phase treatment	Percentage of members 18 years of age and older as of April 30 of the measurement year who were diagnosed with a new episode of depression, were treated with antidepressant medication, and who remained on an antidepressant drug for at least 180 days (6 months).
Antidepressant medication management: optimal practitioner contacts during acute phase	Percentage of members 18 years of age and older as of April 30 of the measurement year, who were diagnosed with a new episode of depression and treated with antidepressant medication, and who had at least 3 follow-up contacts with a non-mental health practitioner or mental health practitioner coded with a mental health diagnosis during the 84-day (12-week) acute treatment phase.

†Definitions taken from National Committee for Quality Assurance (NCQA). HEDIS 2002. Health plan employer data & information set. Vol. 2, Technical specifications. Washington (DC): National Committee for Quality Assurance (NCQA); 2001.

**Acknowledgments:** This study was funded by the Martin Solomon Education Fund at Brigham and Women's Hospital. The Robert Wood Johnson Foundation supported the development of the MHQP database. The findings of this paper were presented at the 2006 Annual Meeting of the Society of General Internal Medicine on April 28, 2006.

**Potential conflicts of interest:** Dr. Pearson reports that he is a consultant for America's Health Insurance Plans (AHIP). No other authors have any potential conflicts of interest to report.

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