

# Improving Chronic Illness Care

## A Longitudinal Cohort Analysis of Large Physician Organizations

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**Background:** An increasing number of people suffer from chronic illness. Processes exist to provide better chronic illness care and yet for the most part, they are not used.

**Objective:** To examine the change in use of commonly recommended chronic illness care management processes (CMPs) in large medical groups between 2000 and 2006 and the factors associated with the change.

**Design and Measures:** Cohort analysis of data from a national telephone survey in year 2000 and again in 2006. Participants provided information on their organizations' ownership, size, use of defined chronic illness CMPs, financial incentives, quality improvement involvement, profitability, and use of electronic medical records.

**Setting:** Medical groups and independent practice associations of 20 physicians or more (N = 369) that treat patients with asthma, congestive heart failure, depression, and diabetes, and that responded to the survey in 2000 and 2006.

**Results:** Use of CMP increased from 6.25 to 7.67 (of a total of 17;  $P \leq 0.001$ ), that is, by 23%, between 2000 and 2006. Increases were greatest for those practices receiving financial rewards for quality; those participating in quality improvement activities; and those practices that were profitable. Most of the increase was in use of registries and in patient self-management support services.

**Conclusions:** There is significant opportunity for improving chronic illness care even in larger physician organizations. Public policies that promote financial rewards for improving quality and that encourage quality improvement initiatives are likely to be associated with improved chronic illness care.

**Key Words:** chronic illness, chronic care model, quality improvement, financial incentives

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Approximately, 20 million Americans suffer from asthma; 5 million from congestive heart failure; 26 million from depression; and 21 million from diabetes.<sup>1–4</sup> Collectively, these 4 chronic illnesses amount to \$149 billion in direct costs and \$286 billion in total costs annually.<sup>1–4</sup> In recent years evidence has begun to emerge that the use by medical groups of organized care management processes (CMPs) to care for patients with these diseases improves the quality and outcomes of care.<sup>5–9</sup> Yet, many Americans do not receive such care<sup>10</sup> and many physician practices do not use recommended processes for managing patients with chronic illness.<sup>11</sup>

These processes include use of disease registries that enable physician organizations to identify their patients with chronic illnesses; development of patient education programs to help patients better manage their illnesses; use of nurse care managers for the sickest patients with the most complex needs; providing feedback to physicians on their performance; providing physicians and patients with reminders and decision support information at the time of care; and related items. These processes are key elements of the chronic care model.<sup>12–15</sup>

We examine whether greater use of these processes occurs when physician organizations have the capabilities to create and maintain them and when they are given incentives to invest in improving quality. In 2000, we created a national database to survey all large medical groups (20 or more physicians) and independent practice associations (IPAs) in the United States. We conducted a follow-up survey in 2006 to address 2 questions: has the use of CMPs increased among these organizations since 2000; and, if it has, what have been the factors associated with the increase?

We hypothesized that organizations that became or remained owned by a hospital/health maintenance organization (HMO)/or health system, as opposed to independent physician ownership, would increase their CMP use due to the greater financial resources likely to be available to them. We predicted that those that became or remained medical groups would increase their use of CMPs more than IPAs due to the medical groups' tighter degree of integration than the generally more loosely organized IPAs. We also hypothesized that organizations that became or remained profitable, increased their participation in organized quality improvement efforts, and/or increased their electronic medical record (EMR) capability would be more likely to increase their use of CMPs than organizations remaining less profitable, those not partic-

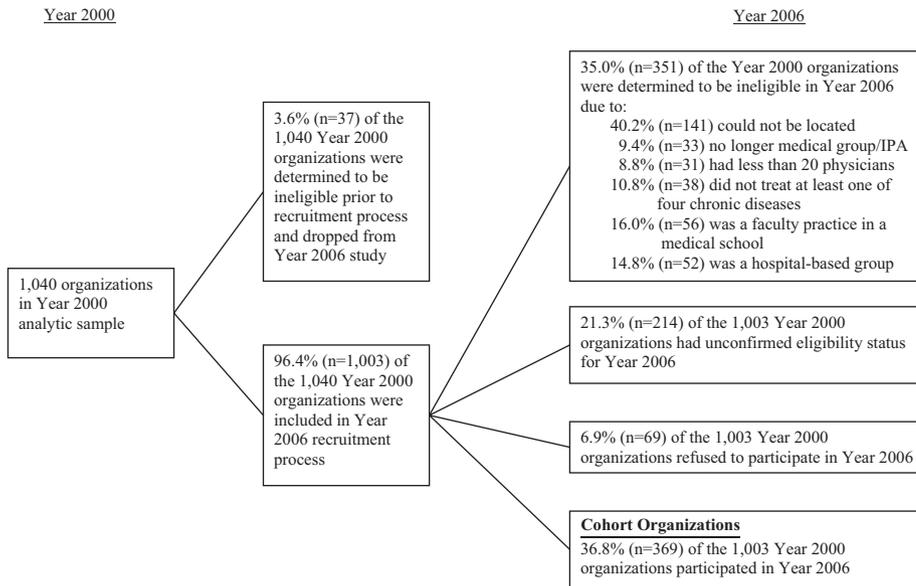


FIGURE 1. Distribution of Year 2000 Organizations in Year 2006.

icipating in organized quality improvement initiatives over time, and/or those with less EMR capability. Finally, we hypothesized that those organizations that began to receive or continued to receive incentive income and/or better health plan contracts for improving quality of care would increase their CMP use more than those organizations not receiving such incentives.

### STUDY DESIGN AND METHODS

We identified 369 physician organizations (medical groups and IPAs involving networks of physician practices) of 20 physicians or more that treated patients with asthma, congestive heart failure, depression, and diabetes and that responded to our survey of chronic illness care in both 2000 and 2006. The 369 physician organizations were a subset from a universe of 1040 organizations of 20 physicians or more that responded in 2000.<sup>11</sup> The 2000 universe was intended to be the most complete list available; we created it using lists from Dorland’s Healthcare Information Directory, the Medical Group Management Association, the American Hospital Association, the American Group Practice Association, the National IPA Coalition, and a master list of medical groups compiled at Virginia Commonwealth University. The survey was limited to practices of 20 physicians or more because it was felt that they were more likely to have the resources and infrastructure in place to implement CMPs.

Before beginning the contacting process for the 2006 survey, 37 organizations from the 1040 that participated in 2000 were determined to be no longer in business. The remaining 1003 organizations that responded in 2000 were subjected to a recruitment process in which each was contacted, eligibility confirmed, recruitment attempted, and, if successful, an interview conducted. The distribution of the organizations based on the recruitment process is shown in Figure 1. The 369 organizations that responded in both 2000 and 2006 comprised the set of cohort organizations used in this analysis.

The 369 cohort organizations did not differ significantly from the 671 organizations that responded in 2000 but not in 2006 with regard to their year 2000 responses on the type of practice (medical group vs. IPA), specialty composition (single specialty vs. multispecialty), size, or ownership (physician-owned vs. hospital/health system/HMO owned). On the other hand, based on their Year 2000 responses, the cohort organizations were somewhat more likely to report being profitable, treated fewer Medicaid patients, made greater use of EMR components, were more likely to have received financial rewards for their quality performance, and used a higher number of chronic illness CMP than their Year 2000 noncohort counterparts.

Based on Year 2006 responses, the 369 cohort organizations were significantly less likely to have income from Medicaid patients and were significantly more likely to have EMR components than 169, organizations that responded in 2006 but that did not participate in the 2000 survey. The cohort organizations and Year 2006 noncohort organizations did not differ in regard to their use of chronic illness CMPs.

In both years (2000 and 2006) data were collected by trained phone interviewers from the president, medical director, or top administrator of each physician organization. These respondents were selected based on focus group interviews and pilot tests of the survey confirming that the individuals occupying these positions were best informed about the use of CMPs in their organizations and related questions about their organization.<sup>16</sup> The interviews lasted 35 to 45 minutes. Participating organizations were offered \$150 for their time. Formal review and approval was obtained from the institutional review boards of each university involved in the study.

### MEASURES

#### Care Management Processes

Information was collected on the use of disease registries, guidelines, feedback to physicians, and use of care

managers for each of the 4 chronic illness conditions—asthma, congestive heart failure, depression, and diabetes. In addition, information was collected on whether or not group visits were used and whether or not patient self-management education programs existed. Identical or equivalent questions were asked in both years (a technical appendix indicating as to how the 2000 and 2006 questions were matched, as well as the full 2000 and 2006 survey instruments are available at the NSPO web site, <http://nspo.berkeley.edu/>). For each of the 4 chronic illnesses, an organization was given one point for a “yes” response to the use of disease registries, guidelines, physician feedback, and use of care managers, resulting in a maximum of 15 points (feedback to physicians was not included in the survey with regard to depression). An additional point was given if the organization used group visits and if it provided patient education for self-management, yielding an overall care management score ranging from 0 to 17 (4 + 4 + 4 + 3 + 2 = 17). In addition, we created sub indices for each of the 4 conditions ranging from 0 to 4 for asthma, congestive heart failure, and diabetes, respectively, and 0 to 3 for depression.

### Organizational Capabilities

The type of practice was measured by whether or not the organization was a medical group or IPA. Ownership was measured by whether the practice was physician-owned or owned by a hospital/health system/HMO or related arrangement. Size was measured by the number of physicians associated with each practice. Profitability was measured by asking each physician organization leader if the organization had a net profit, loss, or broke even during the most recent fiscal year.

Over the past 6 years, considerable attention in policy circles has been given to quality improvement initiatives.<sup>17</sup> These have included a number of demonstration programs such as Bridges to Excellence, Pursuing Perfection, Improving Chronic Illness Care, and Quality Collaboratives sponsored by the Institute of Healthcare Improvement.<sup>18–21</sup> We asked whether the physician organizations participated in any such programs (not limited to the above) and scored the variable as “one” if they answered “yes” to one or more and “zero” if they participated in none.

Much has been written about the importance and advantages of incorporating electronic medical records into physician practices.<sup>22,23</sup> We measured EMR capability by a 6-item index comprised of whether or not ambulatory care progress notes, a patient problem list, a patient medication list, automatic alerts for drug interactions, laboratory results, and radiology results were present in an electronic medical record.

### Incentives

Two incentive measures were used in both time periods: (1) whether or not the practice received additional income for its quality performance, and (2) whether or not the practice reported receiving better contracts with health plans based on the practice’s quality performance. Specific examples of better contracts included receiving higher payment

rates, being designated as a preferred provider, and having longer term contracts.

### Statistical Analysis

The data were analyzed using a “difference in differences” approach in which the difference in CMP scores between 2006 and 2000 is explained by changes at the organizational level between 2000 and 2006 in practice type, ownership, size, and the set of capability and incentives variables. By examining differences between 2000 and 2006, the differences-in-differences approach also controls for any organization specific time-invariant variables that are not in the model.<sup>24</sup> It also makes it possible to infer potentially causal relationships among the study variables.

Since the variables involving ownership, profit, quality improvement, income for quality, and contracts for quality are binary, we could not create just one change score for each. So we created categories that represent the different permutations of those variables. The 4 possible classifications are as follows: the variable was scored as a “yes” in both 2000 and 2006; the variable was a “yes” in 2000 and a “no” in 2006; was a “no” in 2000 and a “yes” in 2006; and was a “no” in both 2000 and 2006. By omitting this last classification so that it is the reference category in the analysis, the coefficients on the remaining variables can be interpreted as the difference in CMP use between 2006 and 2000 for the included category minus the difference in CMP use for the omitted category.

The size and EMR scale variables entered our models as the difference between the 2006 value and the 2000 value. The regression coefficients for these variables can then be interpreted as the change in CMP score between 2000 and 2006 that corresponds to a 1 unit increase in the size or EMR variable from 2000 to 2006.

Since only 4 organizations reported changing their practice type, we kept all organizations at their year 2000 category. To adjust for baseline differences (year 2000) in CMP use among the different organizations, we also included CMP use in 2000 as an independent variable.

Although no more than 5% of any variable was missing, to make full use of all available information, we multiply imputed disease-specific CMP indices, using a predictive mean matching hot-deck.<sup>25,26</sup> Overall CMP use was based on the sum of the imputed disease-specific indices. Regression results described below are based on these imputed data. All analyses used SAS version 9.1.

## RESULTS

Table 1 shows the differences on each of the measured variables between 2000 and 2006. The mean number of CMPs used increased from 6.25 to 7.67—small in absolute terms, but a 23% increase between 2000 and 2006 ( $P \leq 0.001$ ). Most of this increase was accounted for by the increased use of disease registries and an increase in the percentage of physician organizations implementing patient self-management support services. The percentage of organizations that made a profit increased from 49% in 2000 to 59% in 2006; participation in quality improvement demonstration programs increased from 45% to 54%; and the mean number of EMR elements present increased from 1.55 to 2.36 (of 6).

**TABLE 1.** Descriptive Statistics for 369 Cohort Physician Organizations

	Year 2000	Year 2006	P	Difference
Practice type, No. (%)				
Medical group	244 (66.1)	240 (65.0)	0.76	-1.1%
IPA	125 (33.9)	129 (35.0)		1.1%
Ownership, No. (%)				
MD owned	187 (50.7)	240 (65.0)	<0.001	14.3%
Hospital/Health System/HMO owned	130 (35.2)	90 (24.4)	<0.001	-13.5%
Other (non-MD owned)	52 (14.1)	39 (10.6)	0.15	-3.5%
Size, Mean (SD)				
No. MDs	250.22 (513.74)	292.66 (562.34)	0.28	42.44
Median	86	105		19
Log of No. MDs	4.69 (1.16)	4.88 (1.18)	0.03	0.19
Organizational capabilities				
Made profit last year, No. (%)	180 (48.8)	218 (59.1)	0.005	10.3%
Participates in at least one quality improvement demonstration program, No. (%)	166 (45.0)	198 (53.7)	0.02	8.7%
Electronic medical record (EMR) components, No. (%)				
Progress notes	46 (12.5)	124 (33.6)	<0.001	21.1%
Patient problem list	78 (21.1)	156 (42.3)	<0.001	21.2%
Patient medication list	105 (28.5)	159 (43.1)	<0.001	14.6%
Automatic alert for drug interactions	64 (17.3)	133 (36.0)	<0.001	18.7%
Lab results in EMR	160 (43.4)	156 (42.3)	0.77	-1.1%
Radiology results in EMR	120 (32.5)	143 (38.8)	0.08	6.3%
EMR Capability Scale (0-6)				
Mean (SD)	1.55 (1.85)	2.36 (2.54)	<0.001	0.81
External incentives				
Income for quality, No. (%)	179 (48.5)	199 (53.9)	0.14	5.4%
Better contracts for quality, No. (%)	93 (25.2)	108 (29.3)	0.21	4.1%
Use of care management processes				
Treats asthma, No. (%)	352 (95.4)	358 (97.0)	0.25	1.6%
Asthma registry	129 (36.6)	205 (57.3)	<0.001	20.7%
Asthma guidelines	129 (36.6)	130 (36.3)	0.95	-0.3%
Asthma feedback	97 (27.6)	170 (47.5)	<0.001	19.9%
Asthma case managers	155 (44.0)	127 (35.5)	0.02	-8.5%
Asthma index (0-4), mean (SD)	1.45 (1.35)	1.76 (1.36)	0.002	0.31
Treats congestive heart failure (CHF), No. (%)	360 (97.6)	361 (97.8)	0.85	0.2%
CHF registry	139 (38.6)	209 (57.9)	<0.001	19.3%
CHF guidelines	109 (30.3)	120 (33.2)	0.39	2.9%
CHF feedback	173 (48.1)	163 (45.2)	0.43	-2.9%
CHF case managers	169 (46.9)	151 (41.8)	0.17	-5.1%
CHF index (0-4), mean (SD)	1.64 (1.44)	1.78 (1.35)	0.17	0.14
Treats depression, No. (%)	326 (88.3)	342 (92.7)	0.04	4.4%
Depression registry	46 (14.1)	135 (39.5)	<0.001	25.4%
Depression guidelines	50 (15.3)	79 (23.1)	0.011	7.8%
Depression case managers	69 (21.2)	73 (21.3)	0.95	0.1%
Depression index (0-3), mean (SD)	0.51 (0.80)	0.84 (0.94)	<0.001	0.33
Treats diabetes, No. (%)	354 (95.9)	358 (97.0)	0.42	1.1%
Diabetes registry	163 (46.0)	244 (68.2)	<0.001	22.2%
Diabetes guidelines	155 (43.8)	182 (50.8)	0.06	7.0%
Diabetes feedback	201 (56.8)	215 (60.1)	0.37	3.3%
Diabetes case managers	158 (44.6)	175 (48.9)	0.26	4.3%
Diabetes Index (0-4), mean (SD)	1.91 (1.35)	2.28 (1.36)	<0.001	0.37
PO uses group visits, No. (%)	80 (21.7)	90 (24.4)	0.38	2.7%
Self-management support, No. (%)	203 (55.0)	271 (73.4)	<0.001	18.4%
Care management process (CMP) index, mean (SD)*				
Overall CMP use (range: 0-17)	6.25 (4.44)	7.67 (4.68)	<0.001	1.42

\*For groups that treat 3 or more chronic illnesses.

In regard to incentives, the percentage of organizations that received additional income for their quality performance increased slightly from 48% to 54%; and those receiving better contracts from health plans for quality performance increased from 25% to 29%.

Table 2 shows the difference in the CMP index scores between 2000 and 2006 by the explanatory variables. In this

bivariate analysis, medical groups relative to IPAs showed significantly greater increase in CMP use from 2000 to 2006. Physician-owned groups also showed a significant increase in CMP use. Also, organizations that made a profit in both time periods or that went from not making a profit to making a profit show significantly greater increase in CMP use. Further, those involved in quality improvement demonstration

**TABLE 2.** Bivariate Statistics for Care Management Process Index (CMP)

	N (%) or Mean (SD)	Time 1 Overall CMP	Time 2 Overall CMP	Overall CMP Difference	P for Difference
Overall	369 (100%)	6.25	7.67	1.42	<0.001
Group type, No.					
Medical group in Time 1	244 (66%)	5.97	7.50	1.53	<0.001
IPA in time 1	125 (34%)	6.79	8.00	1.21	0.08
Ownership, No.					
MD or other owned both times	229 (62%)	5.77	7.17	1.40	0.001
MD or Other then became HMO	7 (2%)	5.00	7.00	2.00	0.23
HMO then became MD or Other	49 (13%)	6.91	8.78	1.87	0.03
HMO Both times	84 (23%)	7.21	8.44	1.23	0.04
Change in size*	42 (SD = 359, P = 0.02)	0.0004	0.0011	0.0007	0.31
Organizational capabilities					
Profit both times	128 (35%)	6.45	8.38	1.93	<0.001
Profit then (2000) no profit (2006)	52 (14%)	5.06	6.31	1.25	0.15
No profit then (2000) profit (2006)	90 (24%)	6.72	8.62	1.90	0.00
No profit both times	99 (27%)	6.23	6.56	0.33	0.81
QI participation both times	109 (30%)	7.96	9.50	1.54	0.004
QI participation then (2000) No QI participation (2006)	57 (15%)	6.93	7.92	0.99	0.68
No QI participation then (2000) QI participation (2006)	89 (24%)	5.69	8.29	2.60	<0.001
No QI participation both times	114 (31%)	4.67	5.22	0.55	0.33
Change in EMR capability scale*	0.80 (SD = 2.49, P <0.0001)	-0.17	-0.05	0.12	0.24
External incentives					
Income for quality both times	130 (35%)	7.76	9.27	1.51	0.001
Income for quality then (2000) no income for quality (2006)	49 (13%)	5.79	5.73	-0.06	0.65
No Income for quality then (2000) income for quality (2006)	69 (19%)	6.11	8.79	2.68	0.002
No Income for quality both times	121 (33%)	4.76	5.96	1.20	0.07
Contracts for quality both times	38 (10%)	8.48	9.94	1.46	0.34
Contracts for quality then (2000) no contracts (2006)	55 (15%)	6.61	7.94	1.33	0.08
No contracts for quality then (2000) contracts (2006)	70 (19%)	6.16	8.08	1.92	0.04
No contracts for quality both times	206 (56%)	5.84	7.06	1.22	0.001

\*For these continuous variables we report the regression coefficient from regressing the column variable on the row variable.

programs in both time periods or that were not involved in 2000 but were involved in 2006 show significantly greater increase. For incentives, organizations that received additional income for quality in both time periods showed significantly greater increase in use of CMPs as did those who received no quality-based payment in 2000 but did so in 2006. Those that did not receive better contracts for quality performance in 2000 but did in 2006 also showed significant increase. However, so did those that did not receive better contracts for quality in either time periods. Similar results were obtained for each of the specific diseases—asthma, congestive heart failure, depression, and diabetes.

Table 3 presents the multivariate results. The negative coefficient for the baseline (year 2000) CMP variable indicates that those organizations that used fewer CMPs in year 2000 increased their CMP use by 2006 the most relative to the high CMP users at baseline. There was no difference between medical groups and IPAs. Organizations owned by

physicians during both time periods showed less increase than those owned by HMOs or health systems both periods despite showing an absolute increase in their CMP use (Table 2). There was no association with increases in the size of physician organizations. Holding other factors constant, organizations that were profitable at both time periods increased their CMPs by an average of 2.05 additional items versus those organizations that were not profitable either time. Of particular note is that those organizations that went from not making a profit in 2000 to making a profit in 2006 also increased their CMP use by 2.08 processes over those that were not profitable either time. Those practices that participated in QI both time periods increased their use of CMPs by 2.6 versus those that did not participate in QI at either time period. Those that did not participate in quality improvement programs in 2000 but did so in 2006 added 2.01 CMP versus those that did not participate in QI. In regard to incentives, those that received additional income for quality performance

**TABLE 3.** Multivariate Analysis of Changes in Care Management Process Index

Parameter	Estimate	95% Confidence Interval		T Statistics	P > t
Intercept	2.77	1.08	4.46	3.21	0.001
Baseline year 2000 CMP	-0.64	-0.75	-0.54	-12.25	<0.001
Medical group	-0.28	-1.24	0.67	-0.59	0.56
IPA	Ref				
Physician owned both years	-1.20	-2.40	0.01	-1.95	0.05
Became non-physician owned	-0.19	-3.20	2.81	-0.13	0.90
Became physician owned	-0.36	-1.84	1.12	-0.47	0.64
Non-physician owned both years	Ref				
Change in no. physicians	0.00	0.00	0.00	0.72	0.47
Profitable both years	2.05	0.90	3.20	3.49	<0.001
Profitable in 2000, not profitable in 2006	0.89	-0.53	2.30	1.22	0.22
Not profitable in 2000, profitable in 2006	2.08	0.87	3.28	3.37	<0.001
Not profitable either year	Ref				
QI participation both years	2.62	1.49	3.76	4.53	<0.001
QI participation in 2000, but not 2006	0.82	-0.49	2.13	1.22	0.22
No QI participation in 2000, but participation in 2006	2.01	0.86	3.16	3.43	<0.001
No QI participation either year	Ref				
Change in EMR capability	0.01	-0.15	0.18	0.17	0.86
Income for quality both years	1.55	0.48	2.63	2.83	0.005
Income for quality in 2000, but not in 2006	-0.77	-2.11	0.58	-1.12	0.26
No income for quality in 2000, but income in 2006	1.44	0.14	2.74	2.18	0.03
No income for quality either year	Ref				
Better contracts both years	0.69	-0.76	2.14	0.93	0.35
Better contracts in 2000, but not in 2006	0.07	-1.11	1.25	0.12	0.91
No better contracts in 2000, but better contracts in 2006	-0.05	-1.20	1.09	-0.09	0.93
No better contracts either year	Ref				

Adjusted R<sup>2</sup> = 0.34; F value = 4.24; P < 0.0001.  
Ref indicates referent category.

in both years used 1.55 more CMPs than those not receiving any quality bonus in either year. Those that had no income for quality in 2000 but that did receive additional income for quality performance in 2006 added 1.44 CMPs relative to those not receiving a quality bonus in either year.

The results were essentially the same for the asthma-specific, diabetes-specific, congestive heart failure-specific, and depression-specific analyses; the one exception was for depression in which there was no significant association with additional income based on quality. This may be explained by the fact that, for the most part, pay for performance programs during the study period did not include measures of the quality of care for patients with depression.

**DISCUSSION**

These are the first US national data on changes in the use of chronic illness CMPs over time in large physician organizations. There was a 23% increase (6.25 to 7.67; P ≤ 0.001) between 2000 and 2006 in the number of CMPs used by large physician organizations, but 7.67 represents only 45% of the total 17 processes that could be used. The greatest number of processes was used for diabetes (2.3 of 4) and the fewest for depression (0.8 of 3). There appears to be significant room for improvement.

This study is also the first to provide US national, longitudinal data on the factors associated with CMP use. Physician leaders and policymakers who want to increase the use of CMPs might pay particular attention to these factors.

First, providing physician organizations with financial rewards for quality appears to be associated with organizations using more CMPs. Organizations that did not receive financial rewards in 2000 but that did receive them in 2006 significantly increased their use of CMPs. Such incentives, however, must be carefully designed to take into account such issues as patient severity of illness risk-adjustment, the level of incentive needed to ensure desired changes, whether payment should go to the physician organization or individual physician,<sup>27</sup> and whether improvement in performance should be rewarded in addition to meeting established targets.<sup>28,29,30</sup>

Second, policies that encourage the implementation and spread of quality improvement initiatives into physician practices are likely to be associated with improvements in chronic illness care. Many quality improvement demonstration programs directly target chronic illnesses, such as diabetes, congestive heart failure, and asthma so it is understandable that they might be associated with improvements in care for these conditions. A number of organizations exist to provide assistance to practices in implementing quality improvement methods.<sup>19-21,31</sup>

Third, physician organizations that are unprofitable—ie, under financial stress—are less likely to invest in implementing organized processes to improve quality. Organizations may be unprofitable because they are poorly managed and/or because they see patients with low reimbursement from health plans, Medicaid, or Medicare.

Interestingly, among the studied cohort organizations, an increase in EMR capabilities was not associated with an increase in the use of CMPs. Although there is some evidence of a cross-sectional association between EMR capability and the use of CMPs,<sup>11</sup> it may be that the current level of implementation of EMRs in physician practices (only 2.36 components of 6 in the current analysis) has not yet reached the threshold point to significantly increase the use of CMPs over time. Other studies have also found no relationship between EMR use and the quality of chronic illness care.<sup>32,33</sup>

Recently, there has been great interest in the concept of the “medical home” as a means to provide greater access to coordinated care for patients; particularly, those with chronic illness.<sup>34,35</sup> The present findings suggest that even large physician practices lack some of the essential features (eg, having a registry of patients) of a medical home. For the medical home concept to work, there is need to develop external incentives and support to encourage physician organizations to develop the internal capabilities to become medical homes.<sup>35</sup>

### LIMITATIONS

Although these findings hold potentially important implications for all physician practices in the United States, they are based on a set of large, mostly multispecialty practices treating patients with chronic illness. Further, these practices had a lower percentage of Medicaid patients and were more likely to have EMR capabilities than other practices. Thus, they are not representative of all physician practices. In particular, research is needed on smaller practices.

A major strength of the current analysis is that the computation of change scores associated with the “difference in differences” analysis increases the probability of identifying plausible causal relationships. For example, changing from no involvement in quality improvement to involvement in quality improvement being associated with an increase in the use of CMPs makes it more probable that such an increase might be attributed at least in part to the involvement in quality improvement. Still in the absence of a controlled experiment, caution should be exercised in strictly inferring causality.

It is also important to note that the data were provided by the person judged to be the best source of knowledge about the questions of interest (president, medical directors, or other leader). Others have found greater agreement and reliability in self-reports among such lead physicians than among other personnel.<sup>9</sup> To the extent that these respondents wanted to present their organization in a positive light, our results regarding CMP use may overestimate the extent to which CMPs are actually used. But this is true for all respondents in the study and, thus, does not result in any systematic bias to the results.

The present study is limited to the examination of certain CMPs that have been linked to better patient outcomes in the current literature.<sup>5–9</sup> Future research should continue to examine the relationships among practice structure, external incentives, organizational capabilities, CMPs, and patient outcome data.

Finally, we did not collect longitudinal data on physician leadership or on the organizational culture of the physician groups; these are likely to be important for quality improvement and are particularly promising avenues for further investigation.<sup>36</sup>

### CONCLUSION

The use of organized CMPs to improve quality is slowly increasing in larger physician organizations, but it is still not common. Providing these organizations with financial incentives to improve quality appears to lead to increased use of organized processes to improve quality. Participation in organized quality improvement initiatives also appears to lead to increased use of chronic illness CMPs. Given the profitability findings, policies that increase financial stress on physician organizations are likely to lead to less use of organized processes to improve quality.

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