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# Improving Chronic Illness Care: Findings From a National Study of Care Management Processes in Large Physician Practices

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## Abstract

The use of evidence-based care management processes (CMPs) in physician practice is an important component of delivery-system reform. The authors used data from a 2006–2007 national study of large physician organizations—medical groups and independent practice associations (IPAs) to determine the extent to which organizations use CMPs, and to identify external (market) influences and organizational capabilities associated with CMP use. The study found that physician organizations use about half of recommended CMPs, most commonly disease registries, specially trained patient educators, and performance feedback to physicians. Physician organizations that reported participating in quality improvement programs, having a patient-centered focus, and being owned by a hospital or health maintenance organization used more CMPs. IPAs and very large medical groups used more CMPs than smaller groups. Organizations externally evaluated on quality measures used more CMPs than other organizations. These findings can inform efforts to stimulate the adoption of best practices for chronic illness care.

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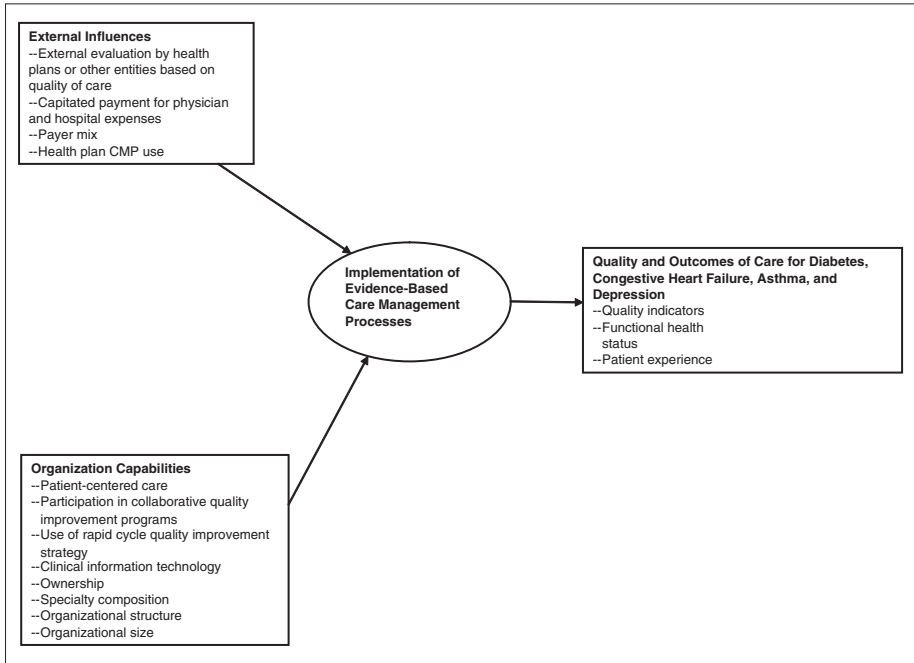
**Keywords**

chronic disease, disease management, patient-centered care, care management process, physician group

An important element of health reform is redesigning the delivery system to improve health care quality and slow the rate of health care spending. An important focus within this effort is redesigning care for people with chronic illness. More than 90 million people in the United States live with chronic illness (Department of Health and Human Services, Centers for Disease Control and Prevention [DHHS, CDC], n.d.). Medical care for these individuals accounts for more than 75% of the nation's \$1.4 trillion medical care costs (DHHS, CDC, n.d.). Recent reports highlight serious deficits in medical care for the chronically ill, and call for fundamental change in the way that care is delivered (Institute of Medicine, Committee on Quality of Health Care in America, 2001; McGlynn et al., 2003). Health plans and purchasers increasingly are using incentives such as pay-for-performance and public reporting to stimulate quality improvement among providers and provider groups (Epstein, 2006; Integrated Healthcare Association, 2009b; National Committee for Quality Assurance, n.d.). In the ambulatory care setting, many physician practices are engaging in quality improvement activities and exploring new models of care delivery (Rittenhouse & Shortell, 2009). The chronic care model is a prominent and comprehensive approach to redesigning chronic care delivery within the physician practice (Bodenheimer, Wagner, & Grumbach, 2002). This model incorporates evidence-based care management processes (CMPs) such as maintaining lists of patients with particular diagnoses and sending reminders for recommended care, providing patients with self-management education and care coordinators, and supporting physicians with point-of-care decision support and feedback on their clinical performance. Evaluations of the chronic care model and its CMP components demonstrate improvements in quality of chronic illness care (Minkman, Ahaus, & Huijsman, 2007; Ouwens, Wollersheim, Hermens, Hulscher, & Grol, 2005; Tsai, Morton, Mangione, & Keeler, 2005).

Numerous published studies have documented the association between CMP use and improved quality for a range of chronic illnesses in a variety of settings, but the current national prevalence of CMP use is not known. The only prior national study of CMP use for chronic illness was conducted in 2000-2001 (Casalino et al., 2003). That study found that large physician organizations (medical groups and independent practice associations [IPAs] with 20 or more physicians), theorized to be well-positioned to support implementation of care management processes, had adopted less than one third of the CMPs studied. Incentives from health plans and purchasers and greater clinical information technology infrastructure were associated with CMP use (Casalino et al., 2003).

For this study, we surveyed all large physician organizations in the United States on their use of CMPs in 2006-2007. We focused on diabetes, asthma, congestive heart failure (CHF), and depression, because of their high prevalence and substantial costs



**Figure 1.** Conceptual framework for the study

of care (DHHS, CDC, n.d.). We used multivariate analysis to determine empirically the organizational capabilities and external (market) influences associated with CMP use in 2006-2007.

### *Conceptual Framework*

The overall framework for this study is shown in Figure 1. Working backward from left to right the quality and outcomes of care for patients with diabetes, CHF, asthma, and depression are positively linked to the extent to which physician organizations use CMPs. This link between CMPs and quality outcomes is supported by a growing body of evidence in the published literature (Kahn et al., 2007; Solberg, Asche, Pawlson, Scholle, & Shih, 2008). In turn, use of CMPs is a function of both external (market) influences for undertaking such work and the organization’s own internal capabilities to develop and implement these often complex initiatives.

External influences that are hypothesized to increase CMP use for chronic illness include external evaluation by health plans or other entities, based on quality of care, and capitated payment for physician and hospital expenses, which creates an incentive to maximize chronic care management in order to decrease hospitalizations for

ambulatory care sensitive conditions. Payer mix is hypothesized to affect CMP use by influencing the financial resources available to invest in CMPs, with Medicaid reimbursement typically less generous than Medicare and commercial insurance. Finally, CMPs can be implemented by physician organizations and/or health plans and these efforts might complement, or substitute for, one another. Prior work with Medicaid provider organizations in California suggests that when health plans provide CMPs for physician organizations, physician organizations increase, rather than decrease, their implementation of these same CMPs internally within their organization (Rittenhouse & Robinson, 2006).

Whether or not an organization responds to the presence of external influences by increasing CMP use depends in part on the internal capabilities of the organization. The two types of physician organizations we included in our study were medical groups and IPAs. Medical groups are partnerships of primary care and, often, specialty physicians who are employed by a single professional corporation or limited liability corporation. IPAs are network-type physician organizations that include solo and small physician practices as members and subcontractors, not employees. We hypothesized that organizational size and structure (medical group vs. IPA) would be associated with CMP use, with very large medical groups using more organized processes of care compared to either smaller groups or IPAs. Organizations owned by a hospital, health system, health maintenance organization (HMO), or other large entity were hypothesized to have more resources to implement CMPs compared with organizations owned solely by physicians. Other organizational capabilities hypothesized to support the implementation of CMPs included more advanced clinical information technology, the use of rapid cycle quality improvement strategies such as the plan–do–study–act cycle, and participation in national or regional collaborative quality demonstration projects. Existing research also suggests that organizational culture plays an important role in implementing quality improvement efforts (Shortell et al., 1995). In particular, a culture emphasizing patient needs and preferences (i.e., patient-centeredness) has been emphasized by the Institute of Medicine and others as an essential component of high-quality care (Department of Commerce, National Institute of Standards and Technology, 2007; Institute of Medicine, Committee on Quality of Health Care in America, 2001). We hypothesized that a focus on patient-centered care would increase the likelihood that an organization would implement CMPs for chronic illness care. A focus on patient-centered care has also been found to be associated with other health care quality improvement processes such as perceived team effectiveness (Shortell et al., 2004).

### *New Contribution*

This study builds on the prior work of the National Study of Physician Organizations and the Management of Chronic Illness (NSPO) conducted in 2000–2001. We report here the results of a follow-up cross-sectional survey (NSPO2) conducted in 2006–2007. We built on our experience with the prior study, using a similar study design, but updated the survey instrument based on changes in the health care environment in the

intervening years. We maintained the focus on diabetes, asthma, CHF, and depression, because of their high prevalence and substantial costs of care. Based on the growing literature, we added new correlates to CMP use, including the importance of patient-centered care, the use of rapid cycle quality improvement strategies, and the growth of collaborative quality improvement programs. In this article, we report the prevalence of CMP use among large physician organizations in 2006-2007. Building on our prior work, we use multivariate analysis to determine empirically the external influences and organizational capabilities associated with CMP use in 2006-2007, using a broader set of variables. Understanding the organizational capabilities and external influences associated with CMP implementation can help inform current efforts by health plans, purchasers, provider organizations, and policy makers to promote best practices for chronic illness care.

## Methods

### *Study Population*

The study population included all physician organizations in the United States with 20 or more physicians. These organizations are well-positioned to support the implementation of care management processes (Enthoven & Tollen, 2004). No comprehensive list of all U.S. medical groups and IPAs exists, so our team compiled a list building on our prior work and using information from the Medical Group Management Association (2004), Cattaneo & Stroud Inc. (2004), Dorland Healthcare Information (2005), and the Integrated Healthcare Association (2009a). Physician organizations were excluded if they did not treat any of the four chronic illnesses of interest to the study. Single specialty groups were included if they comprised primary care physicians (internal medicine, pediatrics, family medicine, or general practice) or relevant specialty physicians (endocrinologists, pulmonologists, cardiologists, or psychiatrists). The final study sample frame included a preliminary list of 1,520 organizations.

Between March 2006 and March 2007, we attempted to contact each organization in order to conduct a 35-minute telephone survey with the medical director, president, or chief administrator. Participants were offered \$150 for their time. Formal review and approval was obtained by the institutional review board at each university affiliated with the study.

Of the 1,520 physician organizations originally identified, 538 completed the interview, 144 refused to participate, 480 were identified as ineligible to participate because they were no longer in business or did not meet study criteria, and the status of 358 could not be determined despite exhaustive searching. Based on the proportion of known eligible organizations (682 completes and refusals) to known ineligible (480 organizations), 148 of the 358 organizations with unknown status were classified as ineligible and 210 of the unknown status were classified as eligible. Thus, the total estimated number of known and estimated eligible organizations was 892 (682 + 210), or 58.7% (892/1,520) and the total estimated number of ineligible organizations was

**Table 1.** Care Management Processes for Chronic Illness

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For each illness, participants were asked whether or not the physician organization

1. Maintained an electronic registry or a list of patients
2. Provided the majority of physicians with guideline-based reminders for services the patient should receive for use at the time of seeing the patient
3. Provided data to their physicians on the quality of their care for patients
4. Sent reminders for preventive or follow-up care directly to a majority of patients
5. Made available nonphysician staff (e.g., health educators and nurses) who were specially trained and designated to educate patients in managing their illness
6. Provided nurse care managers whose primary job was to coordinate and improve the quality of care for patients with chronic illnesses (as distinct from utilization management)

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628 (480 + 148). Based on these estimated numbers, the response rate was 60.3% (538/892; American Association for Public Opinion Research, 2007). There were no statistically significant differences in the response rates for medical groups and IPAs, and response rates did not vary across states and regions.

### *Outcome Measures*

Six CMPs (Table 1) were measured for each of the four chronic illnesses: diabetes, asthma, CHF, and depression. Organizations were given credit for each CMP whether it was implemented by their organization or by a physician hospital organization (PHO) or integrated delivery system with which they had a significant relationship. Five indices were created for each organization: four illness-specific indices (range 0-6), and one combined measure of overall CMP use (range 0-24).

### *Organizational Capabilities*

In addition to structural characteristics such as organizational size, structure (medical group vs. IPA), specialty composition, and ownership, we measured several other organizational capabilities potentially associated with CMP use, including an emphasis on patient-centered care, participation in collaborative quality improvement programs, and the use of rapid cycle improvement strategies.

Because organizations that emphasize service excellence may be more likely to use CMPs to improve care (Institute of Medicine, Committee on Quality of Health Care in America, 2001), we included a measure of “patient-centered care,” drawing on five measures of “consumer-focused organizations” adapted from the National Malcolm Baldrige Quality Award criteria. These criteria have been used to differentiate high-performing from low-performing organizations in many sectors (Department of Commerce, National Institute of Standards and Technology, 2007; Shortell et al., 2004). Participants were asked to what extent they believed the majority of physicians in their organization agreed or disagreed with the following statements: (a) The organization

does a good job of assessing patient needs and expectations, (b) staff promptly resolve patient complaints, (c) patients' complaints are studied to identify patterns and prevent the same problems from recurring, (d) the organization uses data from patients to improve care, and (e) the organization uses data on patient expectations and/or satisfaction when developing new services. Responses were recorded using a 5-point Likert-type scale ranging from *strongly disagree* (1 point) to *strongly agree* (5 points). A patient-centered care index was created for each organization, equal to the average response to the five questions listed above for that organization.

As a measure of quality improvement capacity, we asked respondents if they participated in any collaborative quality improvement demonstration programs, including but not limited to Bridges to Excellence (n.d.), Pursuing Perfection, Institute for Healthcare Improvement (n.d.-b), Improving Chronic Illness Care (n.d.), and the Quality Collaboratives sponsored by the Institute for Healthcare Improvement. An organization was scored 1 if it participated in at least one quality improvement demonstration program, 0 if it did not participate in any such program. We also asked if they used the rapid cycle quality improvement strategy (plan-do-study-act cycle), a common feature of quality improvement programs, to manage change within the organization (Lin et al., 2005). An organization was scored 1 if it used a rapid cycle quality improvement strategy and scored 0 if it did not use such a strategy.

Organizational size was measured according to number of physicians. Size was considered separately for medical groups and IPAs, because IPAs contract with, rather than employ, physicians and typically have many more physician members. We divided the data on number of physicians into deciles and examined the association between size and CMP use. Based on the finding that the association was not linear, we created four size categories (deciles 1-3, 4-6, 7-9, and 10) for each type of organization for inclusion in the analysis. Other organizational capabilities included ownership (owned by physicians, or by a larger entity such as a hospital or HMO), and specialty composition—"mainly primary care physicians," "multispecialty," or "mainly non-primary care specialists." Information technology (IT) capability was measured using a 0 to 5 point "IT index." One point was assigned for use of an electronic medical record by a majority of physicians for (a) ambulatory care progress notes, (b) automatic alerts of potential drug interactions, (c) point-of-care decision support, and (d) alerts about abnormal test results. A fifth point was assigned if the organization provided electronic prescribing capability for its physicians.

### *External (Marketplace) Influences*

External influences hypothesized to increase CMP use by physician organizations included external evaluation on quality of care, payer mix, capitated payment for physician and hospital expenses, and CMPs provided by health insurance plans. An external evaluation index was created by awarding an organization one point if it was evaluated by external entities such as health insurance plans for clinical quality and one point if it was evaluated by external entities for patient satisfaction. Payer mix was



measured as the percent of annual revenues for patient care from commercial health insurance, Medicare, Medicaid, and no insurance/self-pay. Capitation for physician and hospital expenses was measured by multiplying the percent of annual revenue from HMO insurance products (including point of service [POS], Medicaid managed care, and Medicare managed care) times the percentage of these patients for which the organization accepted capitation payment for physician and hospital costs.

CMPs can be implemented by both physician organizations and health plans, but little is known about whether these efforts complement or substitute for one another. We asked participants whether the major health plans that insured their patients provided their organization with any of the following CMPs: a list of patients, performance data, patient reminders, patient educators, and/or care managers. These questions matched the questions for CMP use by physician organizations listed in Table 1, except they were not illness-specific and we did not ask if health plans provided point of care reminders. A single "health plan activities index" was created for each organization (1 point for each CMP used by health plans; range 0-5).

### *Statistical Analysis*

We used linear regression to examine the association between organizational capabilities and external influences and CMP use. Five multivariate models were run. Four models used the illness-specific CMP indices (range 0-6) as the dependent variables. A fifth model used the overall CMP index (range 0-24). Because of the discrete nature of our outcomes, we also investigated Poisson and negative binomial regression models but found that a linear model provided the best fit to the data based on generalized linear model diagnostics (McCullagh & Nelder, 1989).

For overall CMP use (all four illnesses combined), an organization was included if it treated patients for three or more of the illnesses studied. For the 25 organizations (4.6% of cases) that treated only three illnesses, CMP use by that organization was imputed for the fourth illness. For illness-specific analyses, an organization was included only if it treated patients for that illness. Data were imputed for 25 cases (4.6%) that were missing data for three covariates: percentage annual revenue from Medicare, Medicaid, and no insurance (self-pay). Data were also imputed for 6.3% of cases for the percentage risks for hospital costs. All missing data were multiply imputed using a multivariate normal model with five imputations for each missing value (Schafer, 1997). The imputation model included all variables used in the regressions as well as the four illness-specific CMP indices to preserve associations among the variables. In particular, this approach preserves the relationships between the illness-specific CMPs so that imputed depression CMP scores will tend to be lower than the other three observed CMP scores within the same organization. Imputations and postimputation analyses were performed using SAS/STAT Version 9.1 (SAS Institute Inc., 2003). Because the model predicting overall CMP use included only organizations that treated three or more illnesses, nearly all organizations were multispecialty; therefore, specialty composition was not included as an independent variable.

**Table 2.** Use of Care Management Processes (CMPs) by Physician Organizations

Type of CMPs	Number (%) Using Each CMP for	
	Each of the 4 Chronic Illnesses It Treats (n = 491) <sup>a</sup>	At Least 1 Chronic Illness (n = 538)
Patient list or registry	192 (39.1)	386 (71.7)
Provide patient educators	150 (30.5)	411 (76.4)
Physician feedback on quality	152 (30.9)	369 (68.6)
Nurse care managers	117 (23.8)	312 (58.0)
Patient reminders	94 (19.1)	288 (53.5)
Point-of-care reminders	96 (19.5)	266 (49.4)
No. (%) using all 24 CMPs	18 (3.7)	Not applicable
Mean CMP use (out of 24)	11.1	Not applicable

Source: National Survey of Physician Organizations and the Management of Chronic Illness II (2007).

a. The number of physician organizations treating all four diseases.

## Results

As shown in Table 2, physician organizations used an average of 11.1 CMPs out of a possible 24. The most commonly used CMPs were lists or electronic registries of patients, specially trained and designated patient educators, and feedback to physicians on the quality of their care. More than two thirds of organizations used each of these CMPs for at least one illness, and roughly one third used each of these CMPs for all four illnesses. Only 18 organizations (3.7%) used all measured CMPs across all illnesses (24 CMPs).

As shown in Table 3, there was significant variation in prevalence of care management processes by illness. For each CMP, use was highest for diabetes and lowest for depression. Out of the possible 6 CMPs for each condition, organizations used an average of 3.7 for diabetes, 2.9 for asthma, 2.8 for CHF, and 1.8 for depression.

Capabilities of physician organizations and external (market) influences on quality improvement are displayed in Table 4. The mean value for the patient-centered care index was 3.8 out of a possible 5. A total of 53.9% of physician organizations participated in quality improvement demonstration programs and 27.0% reported using the rapid cycle improvement strategy. Roughly one-quarter of organizations were owned by a hospital, hospital system, or HMO. Evaluation by external entities on measures of patient satisfaction or clinical quality was common, the mean value of the external evaluation index was 1.6 out of 2. Participants reported that health plans were using 3.1 CMPs out of a possible 5.

Regression analyses examining the association between organizational capabilities and external influences on the use of care management processes are presented in Table 5. Several organizational capabilities were associated with overall CMP use for the four chronic illnesses (column 1). A patient-centered care focus was positively associated with CMP use. A one-unit increase in this index was associated with an increase of nearly three CMPs ( $p < .001$ ). Organizations participating in quality

**Table 3.** Use of Care Management Processes (CMPs) by Physician Organizations, According to Type of Chronic Illness

Type of CMPs	Number (%) Using the CMP for Each Chronic Illness			
	Diabetes (n = 523) <sup>a</sup>	Asthma (n = 522) <sup>a</sup>	Congestive Heart Failure (n = 526) <sup>a</sup>	Depression (n = 497) <sup>a</sup>
Patient list or registry	367 (70.2)	326 (62.4)	308 (58.5)	203 (40.8)
Provide patient educators	387 (73.9)	281 (53.8)	282 (53.6)	176 (35.4)
Physician feedback on quality	346 (66.1)	293 (56.1)	267 (50.8)	163 (32.8)
Nurse care managers	286 (54.7)	223 (42.7)	250 (47.5)	125 (25.1)
Patient reminders	269 (51.4)	184 (35.2)	184 (35.0)	98 (19.7)
Point-of-care reminders	268 (51.2)	190 (36.4)	174 (33.1)	114 (22.9)
No. (%) using all 6 CMPs	113 (21.6)	55 (10.5)	53 (10.1)	22 (4.4)
Mean CMP Use (out of 6)	3.7	2.9	2.8	1.8

Source: National Survey of Physician Organizations and the Management of Chronic Illness II (2007).

a. The number of physician organizations treating each disease

improvement demonstration programs used, on average, 2.6 more CMPs than organizations that did not engage with these programs ( $p < .001$ ). Organizations owned by a hospital or HMO used 1.6 more CMPs compared with other organizations ( $p < .01$ ). Controlling for other factors, very large medical groups (more than 440 physicians) used 3.0 more CMPs than medical groups in the smallest medical groups (20–40 physicians;  $p < .02$ ). IPAs of all size categories used between 2.5 and 4.0 more CMPs than the smallest medical groups.

Health plans and purchasers influenced the use of CMPs by physician organizations. Organizations that were evaluated by health plans or other external entities on both quality of care and patient satisfaction used 1.2 more CMPs than organizations that were not externally evaluated ( $p < .05$ ). The use of CMPs by health plans, and greater capitation for hospital costs, were both associated with more CMP use by physician organizations.

Organizational capabilities and external influences associated with CMP use were similar across each of the four illnesses, as indicated in the remaining columns in Table 5.

## Discussion

Performance of physician organizations is driven by factors internal and external to the organization. This study used data from a national study of large medical groups and IPAs to determine the level of adoption of evidence-based chronic care management processes, and the association between adoption of these processes and external (market) influences and organizational capabilities.

**Table 4.** Organizational Capabilities and External Influences of Physician Organizations

Organizational Capabilities	
Patient-Centered Management Index, mean value (SD)	3.8 (0.63)
Participates in at least one quality demonstration project, no. of organizations (%)	290 (53.9)
Uses rapid cycle quality improvement strategy, no. of organizations (%)	145 (27.0)
Clinical Information Technology Index, mean no. of information technology components used (SD)	1.4 (1.8)
Ownership, no. of organizations (%)	
Owned by hospital, hospital system, or HMO	127 (23.6)
Owned by physicians or other entities	411 (76.4)
Specialty composition, no. of organizations (%)	
Mainly primary care physicians	115 (21.4)
Mainly non–primary care physicians	28 (5.2)
Mainly multispecialty physicians	395 (73.4)
Organizational structure, no. of organizations (%)	
Medical group	339 (63.0)
Independent practice association	199 (37.0)
Number of physicians	
Mean value (SD)	288.3 (744.8)
Median	100
External Influences	
External Evaluation Index, mean value (SD)	1.6 (0.67)
Health Plan Activity Index, mean value (SD)	3.1 (1.6)
Percentage risk for hospital cost (capitation), mean % (SD)	13.5 (28.1)
Payer mix: mean % (SD) of annual revenue	
Commercial insurance	53.6 (26.6)
Medicare	25.3 (18.9)
Medicaid	16.6 (24.5)
No insurance/self-pay	4.5 (7.8)

Note:  $n = 538$ .

We found that, on average, large physician organizations are using 46% of the evidence-based CMPs assessed in this study to improve care for patients with chronic illness. This is an increase from 32% in 2000–2001 (Casalino et al., 2003). Despite this increase, our findings indicate that there is much work to be done to achieve widespread adoption of these important components of delivery system redesign to improve chronic illness care.

Several organizational capabilities were associated with increased adoption of CMPs. We found a strong association between an independent measure of patient-centered care and greater CMP use. The association was robust in all multivariate models, controlling for other organizational capabilities and external influences. Given that this is the first study examining this association, the finding is of particular interest. There are three possible interpretations, which are not necessarily mutually exclusive. First,

**Table 5.** Organizational Capabilities and External Influences Associated With the Use of Care Management Processes (CMPs) by Physician Organizations

Independent Variables	CMPs for 4 Chronic Diseases (Range 0-24)		Diabetes (Range 0-6)		Asthma (Range 0-6)		Congestive Heart Failure (Range 0-6)		Depression (Range 0-6)	
	Coefficient (SE)	p	Coefficient (SE)	p	Coefficient (SE)	p	Coefficient (SE)	p	Coefficient (SE)	p
Organizational capabilities										
Patient-Centered Management Index	-8.45 (1.78)	<.0001	-1.14 (0.52)	0.03	-2.33 (0.54)	<.0001	-2.91 (0.54)	<.0001	-2.30 (0.56)	<.0001
Participates in a quality demonstration project	2.96 (0.41)	<.0001	0.65 (0.12)	<.0001	0.79 (0.12)	<.0001	0.84 (0.13)	<.0001	0.68 (0.13)	<.0001
Uses rapid cycle quality improvement strategy	2.55 (0.54)	<.0001	0.86 (0.16)	<.0001	0.66 (0.16)	<.0001	0.61 (0.16)	0.0002	0.41 (0.17)	0.01
Clinical Information Technology Index	1.04 (0.61)	0.09	0.54 (0.18)	0.003	0.30 (0.18)	0.10	0.23 (0.18)	0.21	0.03 (0.19)	0.87
Owned by hospital, hospital system, or HMO <sup>a</sup>	0.20 (0.15)	0.16	0.03 (0.04)	0.44	0.02 (0.04)	0.64	0.03 (0.04)	0.54	0.11 (0.05)	0.01
Mainly primary care practice <sup>b</sup>	1.61 (0.61)	0.01	0.24 (0.18)	0.17	0.33 (0.18)	0.07	0.63 (0.18)	.001	0.47 (0.19)	0.01
Mainly specialty care practice <sup>b</sup>	—	—	-0.05 (0.19)	0.80	-0.04 (0.19)	0.85	-0.13 (0.20)	0.52	0.08 (0.20)	0.68
Medical group: Medium (deciles 4-6) <sup>c</sup>	—	—	0.003 (0.44)	0.99	0.36 (0.49)	0.47	1.24 (0.35)	0.004	0.72 (0.55)	0.19
Medical group: Large (deciles 7-9) <sup>c</sup>	0.66 (0.79)	0.41	0.15 (0.23)	0.52	0.16 (0.24)	0.51	0.19 (0.24)	0.42	0.14 (0.25)	0.58
Medical group: Very large (decile 10) <sup>c</sup>	0.42 (0.82)	0.61	0.21 (0.25)	0.40	-0.04 (0.26)	0.88	0.26 (0.25)	0.31	-0.09 (0.27)	0.74
IPA: Small (deciles 1-3) <sup>c</sup>	3.00 (1.27)	0.02	0.87 (0.38)	0.02	0.73 (0.39)	0.06	0.97 (0.39)	0.0004	0.34 (0.40)	0.39
IPA: Medium (deciles 4-6) <sup>c</sup>	2.45 (0.97)	0.01	0.53 (0.29)	0.07	0.85 (0.30)	0.005	0.66 (0.30)	0.03	0.37 (0.31)	0.23
IPA: Large (deciles 7-9) <sup>c</sup>	3.68 (0.97)	0.0001	0.76 (0.29)	0.01	1.20 (0.30)	<.0001	0.90 (0.30)	0.003	0.70 (0.31)	0.02
IPA: Very large (decile 10) <sup>c</sup>	2.45 (0.97)	0.01	0.61 (0.30)	0.04	0.75 (0.31)	0.01	0.89 (0.31)	0.004	0.17 (0.32)	0.60
	4.04 (1.4)	0.004	0.77 (0.43)	0.07	1.34 (0.43)	0.002	1.25 (0.44)	0.004	0.48 (0.45)	0.28

(continued)

**Table 5. (continued)**

Independent Variables	CMPs for 4 Chronic Diseases (Range 0-24)		Diabetes (Range 0-6)		Asthma (Range 0-6)		Congestive Heart Failure (Range 0-6)		Depression (Range 0-6)	
	Coefficient (SE)	p	Coefficient (SE)	p	Coefficient (SE)	p	Coefficient (SE)	p	Coefficient (SE)	p
External influences										
External Evaluation Index	1.16 (0.41)	0.005	0.47 (0.12)	<.0001	0.36 (0.12)	0.003	0.31 (0.12)	0.01	0.11 (0.13)	0.39
Health Plan Activity Index	0.48 (0.16)	.003	0.11 (0.05)	0.03	0.10 (0.05)	0.04	0.18 (0.05)	0.0003	0.13 (0.05)	0.01
Percentage risk for hospital costs (capitation)	0.03 (0.01)	0.001	0.01 (0.003)	0.03	0.01 (0.003)	.0002	0.008 (.003)	0.004	0.006 (0.003)	0.03
Percentage annual revenue: Medicare <sup>d</sup>	0.01 (0.01)	0.29	0.002 (0.004)	0.65	-0.001 (0.004)	0.82	0.01 (0.004)	0.01	0.001 (0.005)	0.82
Percentage annual revenue: Medicaid <sup>d</sup>	-0.01 (0.01)	0.47	-0.01 (0.003)	0.08	0.002 (0.003)	0.51	-0.003 (0.003)	0.37	-0.002 (0.003)	0.58
Percentage annual revenue: No insurance/self-pay <sup>d</sup>	0.05 (0.03)	0.14	0.02 (0.01)	0.04	0.02 (0.01)	0.05	-0.003 (0.01)	0.79	0.01 (0.01)	0.16
Adjusted R <sup>2</sup>	.31		.29		.27		.28		.15	
n	516		523		522		526		497	

Note: HMO = health maintenance organization; IPA = independent practice association.

a. Reference category is physician or other owned.

b. Reference category is multispecialty practice.

c. Reference category is small medical groups (decile 1-3).

d. Reference category is commercial insurance.

social-desirability bias could explain the association. Because we are interviewing only a single organizational leader, it is possible that this person overstated both the level of CMP use (across all illnesses) and the extent to which their organization is perceived to be patient-focused. To fully explain the association, however, some leaders would have to have *understated* both the level of CMP use and the extent to which the management of their organization is perceived to be patient-focused. A second possible explanation is that a patient-centered focus might not lead an organization to use more CMPs. Instead, it might be a marker for other unmeasured capabilities of the organization that result in increased use of CMPs. For example, use of chronic care management processes and having a patient-centered focus are both delivery-system innovations that could be markers for an underlying organizational culture such as openness to the early adoption of new evidence in multiple arenas, including both clinical care processes and adopting a “customer service” or patient focus. As evidence accumulates to support the importance of both of these factors in the improving of health care quality, certain “early adopter” organizations may well be poised to adopt both factors, while others struggle or lag in both arenas. Finally, one must consider the possibility that a patient-centered focus works independently of multiple other measures of organizational capabilities and external influences, driving an organization to adopt evidence-based CMPS for chronic illness. That is, organizations that understand the centrality of the patient are much quicker to move toward implementation of innovative processes of care. For example, if an organization is patient focused, it is looking for tools that will help it address patient complaints, use data to identify opportunities for improvement and to develop new services. These tools include CMPs such as physician feedback on the quality of care provided, use of guideline-based reminders and knowledge and coordination that can be provided by using nurse care managers.

We also found a strong positive independent association between CMP use and participation in collaborative quality improvement demonstration programs. In our study, more than half (53.8%) of the organizations participated in a quality improvement demonstration program, and those that participated used significantly more CMPs than other organizations. These national data support the positive findings of a number of smaller program evaluations (Asch et al., 2005; Baker et al., 2005; Bonomi, Wagner, Glasgow, & VonKorff, 2002; Daniel et al., 2004; Institute for Healthcare Improvement, n.d.-a; Pearson et al., 2005; Schonlau et al., 2005; Vargas et al., 2007; Wagner et al., 2001).

Structural characteristics of physician organizations (i.e., IPA vs. medical group; size) were also associated with CMP use in multivariate analysis. Very large medical groups (more than 440 physicians) demonstrated significantly more CMP use compared with smaller medical groups with 20 to 40 physicians. IPAs of all sizes also used significantly more CMPs than did small medical groups, demonstrating that CMPs can be implemented in these less fully integrated practice environments. This is an important finding because most U.S. physicians practice in much smaller settings than studied here, and IPAs provide one example of how these practices can be linked together for quality improvement activities (Friedberg et al., 2007; Rittenhouse, Grumbach, O’Neil, Dower, & Bindman, 2004).

Our study did not find an association between implementation of clinical information technology and CMP use. This result differs from the 2000-2001 National Study of Physician Organizations, which found a small but significant association (Casalino et al., 2003). The lack of association has been found in recent smaller studies (Green, Fortin, Maclure, Macgregor, & Robinson, 2006; Mehrotra, Epstein, & Rosenthal, 2006; Nutting et al., 2007; Rittenhouse & Robinson, 2006; Solberg et al., 2005; Sperl-Hillen et al., 2004). This suggests that care management is not entirely dependent on IT implementation.

Several factors external to the physician organization were also associated with increased use of CMPs. This is the first national study to examine the association between CMP use by health plans and by physician organizations. We found a strong positive relationship between the two, suggesting that these quality improvement efforts are complements, not substitutes. The extent to which the physician organizations collaborate with health plans to improve quality of care is not known. It may be that health plan care management activities drive physician organizations to adopt CMPs, or conversely that physician organizations engaged in chronic care management seek out contracts with health plans that share their approach. Another possible explanation is that a "yes" response regarding CMP use by both the physician organization and the health plan reflects a heightened awareness of these activities by the interviewee, perhaps reflecting underlying organizational culture or leadership. It is also possible that the use of CMPs by both the health plan and the physician organization are driven by a third factor such as regional market forces, although we controlled for many of these external influences in our model. Other incentives, including being evaluated on patient satisfaction and/or quality, and capitation for hospital costs, were also independently associated with higher CMP use, consistent with prior studies (Casalino et al., 2003; Mehrotra et al., 2006; Mehrotra et al., 2007).

Our study identified significant variation in use of CMPs by type of illness. Use was highest for diabetes (mean of 3.9 out of 6) and lower for asthma and CHF. The major organizational capabilities and external influences predicting CMP use were similar for diabetes, asthma, and CHF. CMP use for depression (mean of 1.7 out of 6) lagged behind use for other chronic illnesses despite substantial evidence supporting its effectiveness (Kates & Mach, 2007; Schoenbaum et al., 2001; Tsai et al., 2005). The low use of CMPs for depression is consistent with findings from a study in Minnesota, and may be partially explained by the lack of integrated structure, culture, and financing of physical and mental health services (Kilbourne et al., 2004; Margolis, Solberg, Asche, & Whitebird, 2007). We did not find a strong association between external influences and CMP use for depression.

Our study has several limitations. First, the survey response rate was 60.3%, although this rate is consistent with other recently published surveys of physicians and health care executives and reflects the substantial response burden on professionals (Campbell et al., 2007). Response rates were similar across states and regions and there were no differences by medical group versus IPA structure. Second, we surveyed



either the medical director or administrative leader because this person is likely to be most knowledgeable about CMP use, organizational capabilities, and external influences. Although the respondent might have overestimated the use of CMPs, we structured questions to account for possible overestimation, asking for example whether “a majority of physicians” used the CMP, or whether the CMP was implemented at “a majority of sites.” Overestimation of CMP use would not systematically bias our regression results. Third, the cross-sectional study design does not allow us to draw causal conclusions. Fourth, we limited our study to large physician organizations because they are theorized to be well-positioned to support the implementation of CMPs (Enthoven & Tollen, 2004). The study results cannot be generalized to smaller practice settings. Studies of smaller practice settings currently underway include our own National Study of Small and Medium Sized Physician Practices, the American Academy of Family Physicians’ TransforMED initiative, and the American College of Physicians’ Center for Practice Improvement.

Health reform efforts emphasize the urgent need to redesign the health care delivery system to improve quality and decrease spending. This study provides the only national data on implementation of organized chronic care processes by large physician organizations and demonstrates that implementation continues to lag. These data complement important qualitative research efforts to better understand organizational dynamics that lead to the adoption of evidence-based care processes. Our quantitative data suggest that mutable external influences, such as external evaluation by health plans and other entities, capitated payments for hospital costs, and the provision of chronic illness CMPs to physician organizations by health plans may stimulate the use of CMPs by physician organizations. Organizational capabilities that are associated with CMP use include a patient-centered focus, participation in a collaborative quality demonstration project, and access to greater resources such as those available to very large organizations and to organizations owned by larger entities such as a hospital, health system, or HMO. Purchasers, health plans, and health policy makers have important roles in the fashioning of incentives. Physicians and organizational leaders play the central role in developing the organizational structures and cultures capable of translating those incentives into improved care for their patients.

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The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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