External Incentives, Information Technology, and Organized Processes to Improve Health Care Quality for Patients With Chronic Diseases

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Context Organized care management processes (CMPs) can improve health care quality for patients with chronic diseases. The Institute of Medicine of the National Academy of Sciences has called for public and private purchasers of health care to create incentives for physician organizations (POs) to use CMPs and for the government to assist POs in implementing information technology (IT) to facilitate CMP use. Research is lacking about the extent to which POs use CMPs or about the degree to which incentives, IT, or other factors are associated with their use.

Objectives To determine the extent to which POs with 20 or more physicians use CMPs and to identify key factors associated with CMP use for 4 chronic diseases (asthma, congestive heart failure, depression, and diabetes).

Design, Setting, and Participants One thousand five hundred eighty-seven US POs (medical groups and independent practice associations) with 20 or more physicians were identified using 5 large databases. One thousand one hundred four of these POs (70%) agreed to participate in a telephone survey conducted between September 2000 and September 2001. Sixty-four responding POs were excluded because they did not treat any of the 4 diseases, leaving 1040 POs.

Main Outcome Measures Extent of use of CMPs as calculated on the basis of a summary measure, a PO care management index (POCMI; range, 0-6) and factors associated with CMP use.

Results Physician organizations' mean use of CMPs was 5.1 of a possible 16; 50% used 4 or fewer. External incentives and clinical IT were most strongly associated with CMP use. Controlling for other factors, use of the 2 most strongly associated incentives—public recognition and better contracts for health care quality—was associated with use of 1.3 and 0.7 additional CMPs, respectively ($P<.001$ and $P=.007$). Each additional IT capability was associated with 0.37 additional CMPs ($P<.001$). However, 33% of POs reported no external incentives and 50% reported no clinical IT capability.

Conclusions The use of CMPs varies greatly among POs, but it is low on average. Government and private purchasers of health care may increase CMP use by providing external incentives for improvement of health care quality to POs and by assisting them in improving their clinical IT capability.

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RECENT REPORTS, INCLUDING 2 by the Institute of Medicine (IOM) of the National Academy of Sciences, argue that the quality of health care in the United States falls far short of biomedical knowledge and that this gap in quality is primarily a failure of organization, rather than of individual physicians.[1-7] The IOM and others have called for the implementation of organized processes to improve quality and have argued that government and large private purchasers of health care should provide physician organizations (POs) with incentives to implement such processes.[8-14] The IOM also has advocated government financial assistance to POs to improve their clinical information technology (IT), which is considered fundamental to organized attempts to improve quality of care.[2,15,16]

Despite this attention and despite a growing body of research supporting the effectiveness of organized processes in improving quality of care,[17] little information is available to answer 4 fundamental questions: (1) To what extent do POs—medical groups and independent practice associations (IPAs)—currently use organized processes to improve quality?[18] (2) Do POs have external incentives to improve quality? (3) What clinical IT capabilities do POs have? and (4) Are external incentives and clinical IT capabilities associated with in-

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creased use of organized processes by POs to improve the quality of care?

To address these questions, we conducted a National Survey of Physician Organizations and the Management of Chronic Illness (NSPO). We used 5 separate databases to develop the most extensive census available to date of medical groups and IPAs with 20 or more physicians, and we conducted a telephone survey with 1040 of these POs. We focused on POs with 20 or more physicians because, compared with individual and small group practices, these larger organizations should have more capacity to invest in the management time and expertise, clinical IT systems, and skilled nonphysician staff that are thought to be necessary for the creation and maintenance of organized processes to improve the quality of care.[19-22] We called these organized processes *care management processes* (CMPs) and hypothesized that the extent to which a PO uses CMPs will vary with its IT capability and with the incentives for improvement of quality provided by health insurance plans and health care purchasers.

The NSPO survey focused on 4 types of CMPs—case management, performance feedback to individual physicians, use of disease registries, that is, lists of a PO's patients with a particular chronic illness that make it possible for the PO to organize care for patients with that particular illness, and use of clinical practice guidelines in conjunction with physician education and electronic or chart-based reminder systems. Support for self-management skills for chronically ill patients was not assessed for the 4 individual chronic diseases surveyed but only for managing their disease in general (BOX).

We chose these CMPs because evidence is growing that they are effective, individually and especially in combination, in improving quality of care.[17,23-27]

Case management programs repeatedly have been shown to improve outcomes for patients with congestive heart failure (CHF), diabetes, and mixed comorbidities.[28] While clinical practice guidelines alone have not been demonstrated to change physician performance,[29] a Cochrane review and recently published studies, including a meta-analysis, have found that guidelines in conjunction with physician education or reminder systems do improve physician management of several chronic conditions and may improve clinical outcomes.[17,30,31] Performance feedback to physicians has been shown to improve medical practice in both a Cochrane review and a separate meta-analysis, although the effect was small.[17,32] Disease registries have been shown to be important components of health care management.[33] Patient self-management education can succeed in improving clinical outcomes according to a Cochrane review of use of this technique for patients with asthma[34] and according to randomized controlled trials of patients with diabetes[35,36] and with a variety of other chronic diseases.[37,38]

The NSPO survey focused on POs' use of CMPs for asthma,[39,40] CHF,[41-43] depression,[44-48] and diabetes.[26,49,50] These 4 diseases are directly responsible for approximately 140 000 deaths each year in the United States,[51] generate at least $173 billion in annual costs,[52-55] and are conditions for which evidence suggests that CMPs can improve the quality of health care.[17,23,56]

Box. Care Management Processes Surveyed*

Case Management

Case management is available at the request of the physician and/or assigned to all severely ill patients with the disease.

Physician Feedback

Physicians receive feedback on specific practices (eg, use of anti-inflammatory medication in asthma, angiotensin-converting enzyme inhibitors in congestive heart failure, retinal screening in diabetes). Depression was omitted for this category.

Disease Registry

This is maintained for patients with the disease.

Clinical Practice Guidelines

These are (1) adopted and (2) physicians are trained in the guidelines, and (3) the guidelines must be present in patient charts or in reminder systems or in order-entry systems. An answer of yes for use of all 3 is required.

Self-management Skills

Programs to teach chronically ill patients skills for better managing their illness in general, not for each of the 4 chronic diseases surveyed.

*For each care management process, the organization receives 1 point for each disease for each affirmative answer (except for feedback to physicians for depression) and 1 point for use of programs to teach patients self-management skills.

METHODS

Development of a National Census of Medical Groups and IPAs

To generate as complete a national census as possible of medical groups and IPAs with 20 or more physicians, we combined databases from the Medical Group Management Association, Englewood, Colo; Dorland Healthcare Information, Philadelphia, Pa; National IPA Coalition, Oakland, Calif; American Hospital Association, Chicago, Ill; and Virginia Commonwealth University Study of Physician Organizations, Richmond (this database merges data from 6 sources, including a survey of medical groups by the American Medical Association, Chicago, Ill) (R.R.G., unpublished data, 2002). The National Opinion Research Center at the University of Chicago made preliminary telephone calls to all 3233 organizations identified to verify their type and size and to arrange an appointment for a telephone survey. On the basis of these calls, 1646 organizations (51%) were excluded because they were out of business or could not be located (21%),

were not a medical group or IPA (20%), had fewer than 20 physicians (17%), were duplicates (20%), or were excluded for miscellaneous reasons (11%). In addition, we excluded the 10% of POs that were composed of radiologists, pathologists, chiropractors, podiatrists, ophthalmologists, anesthesiologists, or emergency department physicians.

Study Population

Of the 1587 organizations remaining, 1104 (70%) responded to the survey. Information on nonrespondents is limited: they did not differ from respondents by size or by state where they were located, but response rates were significantly higher for IPAs (79%) than for medical groups (66%; $P<.001$). Of the 1104 respondents, we excluded 64 organizations that stated that they did not treat any of the 4 chronic diseases we surveyed, leaving 1040 POs (693 medical groups and 347 IPAs) included in our study.

Survey Development and Administration

The NSPO survey was developed based on review of the literature on health care quality improvement, on dimensions of the Assessment of Chronic Illness Care model,[57] on feedback from the NSPO's national advisory committee, and on input from a focus group of 9 medical directors from POs. The survey was revised after a pilot test was conducted with 36 medical groups and 10 IPAs. The survey instrument is available from the corresponding author.

Organizations that agreed to participate were sent in advance a packet with a worksheet to be completed prior to the interview. Specially trained NORC interviewers then conducted 60-minute telephone surveys between September 2000 and September 2001 with each organization's president, chief executive officer, or medical director, using Computer Assisted Telephone Interviewing.

Outcome Measures

To assess POs' use of CMPs, interviewers asked, for each of the 4 chronic diseases, whether the PO used case management, a disease registry, clinical guidelines, and feedback to physicians (feedback was not asked for depression) (Box). Organizations also were asked whether they have general programs to teach patients self-management skills for chronic diseases. To avoid positive but overly general answers that might not accurately reflect an organization's use of CMPs (eg, "Yes, we have guidelines"), survey questions were designed to probe for more specific answers (eg, "Are the guidelines placed in patient charts, reminder systems, or order entry systems?" and "Do you feed back data to physicians on appropriate use of ACE [angiotensin-converting enzyme] inhibitors for patients with CHF?").

To assess the external incentives for a PO to improve quality of care, the survey asked about a range of 7 incentives: whether the PO received a bonus from health plans (ie, additional income from health plans for scoring well on quality measures), public recognition (eg, through report cards), or better contracts with health plans for quality and whether it was required to report Health Plan Employer Data and Information Set data,[58] outcomes data, results of quality improvement projects, or patient satisfaction data to an outside organization (TABLE 1).

The use of clinical IT systems[59] was assessed by asking POs whether they use an electronic data system and, if so, whether the IT system includes a standardized problem list, the majority of physician progress notes, medications prescribed, medication decision support (ie, reminders and/or drug interactions information), laboratory results, and radiology results (TABLE 2).

Table 1. External Incentives for Physician Organizations to Improve the Quality of Health Care*

Incentives for Quality of Health Care	All Physician Organizations (N = 1040)	Medical Groups (n = 693)	Independent Practice Associations (n = 347)
Rewards for scoring well on quality measures			
Bonus from health plans	422 (40.6)	298 (43.0)	124 (35.7)
Public recognition (eg, through report cards)	272 (26.1)	178 (25.7)	94 (27.1)
Better contracts with health plans	244 (23.5)	161 (23.2)	83 (23.9)
Quality reporting to an outside organization mandated for			
HEDIS data	186 (17.9)	108 (15.6)	78 (22.5)
Clinical outcome data	197 (18.9)	130 (18.8)	67 (19.3)
Results of quality improvement projects	234 (22.5)	156 (22.5)	78 (22.5)
Patient satisfaction data	233 (22.4)	150 (21.7)	83 (23.9)
Mean (SD) No. of incentives present; range, 0-7	1.7 (1.8)	1.7 (1.8)	1.7 (1.9)

Abbreviation: HEDIS, The Health Plan Employer Data and Information Set.
*Data presented as No. (%), unless otherwise specified.

Table 2. Clinical Information Technology System Use by Physician Organizations*

	All Physician Organizations (N = 1040)	Medical Groups (n = 693)	Independent Practice Associations (n = 347)
Electronic data system includes			
Standardized problem list	184 (17.7)	146 (21.1)	38 (11.0)
Progress notes	98 (9.4)	90 (13.0)	8 (2.3)
Medications prescribed	249 (23.9)	182 (26.3)	67 (19.3)
Medication ordering reminders and/or drug interactions information	151 (14.5)	132 (19.1)	19 (5.5)
Laboratory results	420 (40.4)	370 (53.4)	50 (14.4)
Radiology results	313 (30.1)	278 (40.1)	35 (10.1)
Mean (SD) No. of clinical information technology processes used; range, 0-6	1.4 (1.8)	1.7 (1.9)	0.63 (1.1)

*Data presented as No. (%), unless otherwise specified.

We also assessed other organizational characteristics of POs that may affect the use of CMPs: the survey provided demographic information on the type of PO (medical group or IPA), number of physicians, practice type, practice ownership, and US location (divided by the American Medical Association census regions) (TABLE 3).

Health maintenance organizations (HMOs) also might affect POs' use of CMPs. We used InterStudy data to define *HMO penetration* as the number of people enrolled in HMOs in a PO's county divided by the county population.[60] The survey asked whether a PO took at least some risk for hospitalized HMO patients (964 POs answered this question) and whether HMOs delegate utilization management responsibility for hospitalized HMO patients to the PO (965 POs answered this question) (Table 3).[61]

Statistical Analysis

We used multivariate linear regression to measure the association of external incentives, IT capability, characteristics of POs, HMO penetration, and physician group health plan contracting characteristics with POs' use of CMPs. The outcome variable in our main model is a summary measure—a Physician Organization Care Management Index (POCMI)—with a range of 0 to 16. An organization's POCMI score is the number of CMPs used by the PO for the 4 chronic diseases: 1 point for each of the 4 CMPs for each disease (with the exception of feedback to physicians for depression, which was not asked) plus 1 point for use of programs to teach patient self-management support skills for chronic illnesses in general (Box). Omission of the feedback question for depression meant that depression was not weighted as heavily (3 possible points for CMP use for depression) as the other diseases (each of which has 4 possible points for CMP use). Regression results did not change significantly when depression was excluded from the model nor when depression was weighted equally to the other diseases.

The POCMI scores were normally distributed. The POCMI index exhibited a high level of internal consistency reliability with a Cronbach α of 0.86. Analyses were performed using SAS version 8.2 (SAS Institute Inc, Cary, NC).

The POCMI index treats the use of each type of CMP as equally important. Some CMPs may be more effective in improving quality of health care than others, but we did not believe that sufficient evidence existed to weight them differentially in our analysis.[17] We did, however, run regression analyses using a variety of different weightings; the results of these analyses did not differ significantly from our main model.

The 4 external incentives concerning reports to an outside organization (of Health Plan Employer Data and Information Set data, outcomes data, results of quality improvement projects, and patient satisfaction data) are highly correlated with each other and are included in our main regression analysis as a single summary variable with a range of 0 to 4. The 3 other incentives are included individually. Results did not change when all 7 external incen-

Table 3. Characteristics of Physician Organizations

	All Physician Organizations (N = 1040)	Medical Groups (n = 693)	Independent Practice Associations (n = 347)
No. of physicians			
Mean (SD)	227.0 (411.0)	136.2 (275.8)	408.4 (552.9)
Median	85	52	250
Practice type, No. (%)			
Primary care only	123 (11.8)	103 (14.9)	20 (5.8)
Specialty only, no primary care	83 (8.0)	72 (10.4)	11 (3.2)
Multispecialty including primary care	834 (80.2)	518 (74.7)	316 (91.1)
Practice ownership, No. (%)			
Physician-owned	514 (49.4)	295 (42.6)	219 (63.1)
Hospital and/or health system	334 (32.1)	294 (42.4)	40 (11.5)
Nonphysician managers	96 (9.2)	35 (5.1)	61 (17.6)
HMO and/or health plan	17 (1.6)	14 (2.0)	3 (0.9)
Joint physician and hospital and/or HMO	43 (4.1)	28 (4.0)	15 (4.3)
Manager, government, community clinic owned	36 (3.5)	27 (3.9)	9 (2.6)
HMO contracting			
HMO penetration, mean % (SD)	33.1 (17.1)	31.7 (16.5)	36.5 (17.7)
HMO patients for whom physician organizations share some hospital risk, mean % (SD)	22.0 (36.3)	16.1 (32.6)	34.0 (40.3)
Physician organizations that share any hospital risk, No. (%)	341 (35.4)*	175 (27.1)	166 (52.0)
HMO patients for which hospital utilization management was delegated to physician organizations, mean % (SD)	32.9 (44.2)	21.7 (38.1)	55.1 (47.0)
Physician organizations that have any hospital utilization management delegated, No. (%)	405 (42.0)†	204 (31.7)	201 (62.4)
US region, No. (%)	192 (18.4)	144 (20.8)	48 (13.8)
East northcentral	49 (4.7)	40 (5.8)	9 (2.6)
Mountain	62 (6.0)	36 (5.2)	26 (7.5)
Middle Atlantic	106 (10.2)	74 (10.7)	32 (9.2)
New England	61 (5.9)	39 (5.6)	22 (6.4)
Pacific	257 (24.7)	115 (16.6)	142 (40.9)
South Atlantic	136 (13.1)	111 (16.0)	25 (7.2)
West northcentral	90 (8.6)	72 (10.4)	18 (5.2)
West southcentral	87 (8.4)	62 (8.9)	25 (7.2)

Abbreviation: HMO, health maintenance organziation.
*Percentages are calculated from the physician organizations who answered the question (n = 964).
†Percentages are calculated from the physician organizations who answered the question (n = 965).

tives were included individually, except that the reporting requirements variables, which are significant as a group, are not significant individually. We included the 6 IT measures as a single index variable, with a range of 0 to 6, in our main model. Results did not differ when the IT measures were examined individually rather than as an index in a regression analysis.

Ninety-three POs (9%) stated that they treated only 3 of the 4 diseases, and 83 (8%) stated that they treated 2 or fewer diseases. In our main model, we included these POs and assigned them scores for each disease they did not treat equal to the mean score for that disease for all POs that treated that disease. We also conducted regression analyses that included only the 947 POs that treated at least 3 of the 4 diseases. Results from these analyses did not differ significantly from our main model.

RESULTS

The mean POCMI score was 5.1, indicating that the average PO used 32% of the 16 CMPs (TABLE 4); 15.2% used none, 49.6% used 4 or fewer, and 5.3% used 13 or more CMPs. Case management was the most commonly used CMP: that is, the mean percentage of POs using case management across all 4 diseases was 37.6% (TABLE 5). Clinical guidelines used in conjunction with reminders placed in charts or in the electronic medical record were least commonly used (28.5%) (Table 5). Care management processes were implemented most often for diabetes (42.5% of POs) and least often for depression (17.1% of POs). Few POs used any one type of CMP across all 4 illnesses (range, 10.5%-18.5%, for clinical guidelines, disease registry, physician feedback, and case management), and fewer (3.2%-12.7%, for depression, asthma, CHF, and diabetes) used all 4 types of CMP to focus on any 1 illness (Table 5). Self-management programs for chronically ill patients were provided by 589 (56.6%) of POs (not included in Table 5 because the survey asked about self-management programs in general, not for each of the 4 diseases).

The results of multivariate analysis showed that the presence of external incentives to improve quality of care was most strongly associated with use of CMPs (TABLE 6). When all other variables, including other external incentives, are held constant, POs that received public recognition for scoring well on quality of care measures used 1.3 more CMPs ($P<.001$). Physician organizations that reported receiving better contracts for scoring well used 0.74 more CMPs ($P=.007$). Requiring POs to report quality of care data and activities to outside organizations also was significantly associated with increased CMP use ($P<.001$). Receiving a bonus for scoring well on quality of care measures was not significantly associated with CMP use ($P=.08$), possibly because POs generally reported that the amounts received were very small.

The mean number of external incentives reported by POs was only 1.7 of the 7 external incentives surveyed (Table 1). Three hundred forty-one (32.8%) POs had no incentives, 776 (73.6%) had 2 or fewer incentives, while only 177 (17.0%) had 4 or more incentives to improve quality (data not shown).

Clinical IT also is significantly associated with CMP use: each additional capability is associated with the use of 0.37 additional CMPs ($P<.001$) (Table 6). However, the average PO had only 1.4 (23%) of the 6 clinical IT capabilities surveyed (Table 2). Five hundred

Table 4. Use of Care Management Processes by Physician Organizations*

No. of Care Management Processes Used	All Physician Organizations (N = 1040)	Medical Groups (n = 693)	Independent Practice Associations (n = 347)
0	158 (15.2)	70 (10.1)	88 (25.4)
1-4	358 (34.4)	283 (40.8)	75 (21.6)
5-8	291 (28.0)	203 (29.3)	88 (25.4)
9-12	178 (17.1)	102 (14.7)	76 (21.9)
13-16	55 (5.3)	35 (5.1)	20 (5.7)
Mean (SD)	5.1 (4.1)	5.0 (4.0)	5.4 (4.5)

*Data presented as No. (%), unless otherwise specified.

Table 5. Use of Care Management Processes (CMPs) by Type of Chronic Disease for 1040 Physician Organizations*

	Physician Organizations Using the CMP for Each Disease, No. (%)†					No. (%) Using CMPs for	
Type of CMPs	Diabetes	Asthma	Congestive Heart Failure	Depression	Overall Mean‡	Each of the 4 Diseases It Treats	At Least 1 Disease
Case management	425 (43.1)	386 (39.7)	423 (43.4)	209 (23.0)	364 (37.6)	192 (18.5)	550 (52.9)
Feedback to physicians§	474 (48.0)	234 (24.1)	297 (30.5)	N/A	336 (34.3)	169 (16.5)	554 (53.3)
Disease registry	398 (40.3)	304 (31.2)	339 (34.8)	143 (15.7)	299 (30.8)	153 (14.7)	493 (47.4)
Clinical guidelines with reminders	380 (38.5)	330 (33.9)	270 (27.7)	114 (12.5)	277 (28.5)	109 (10.5)	522 (50.2)
Mean	419 (42.5)	314 (32.2)	332 (34.1)	155 (17.1)	NA	NA	NA
Using all 4 CMPs	125 (12.7)	74 (7.6)	86 (8.8)	29 (3.2)	NA	9.4 (0.9)	NA

Abbreviation: NA, not applicable.
*Note that 589 (56.6%) of physician organizations provided programs to teach chronically ill patients self-management skills in general, that is, not for an individual disease.
†The number of physician organizations treating each disease.
‡Means weighted by number of physician organizations treating each disease.
§This question was not asked for depression.

nineteen (49.9%) of POs had none and 816 (78.5%) had 2 or fewer (data not shown) of the 6 clinical IT capabilities surveyed.

The strong association of external incentives and IT with the use of CMPs was found in every model we tested, including the POCMI model presented in this article, which evaluates the association with all types of CMPs surveyed as a group, the POCMI model presented in this article with depression excluded, the POCMI model with a variety of weights assigned to individual types of CMPs (data not shown), the POCMI model run for each of the 4 chronic diseases individually (data not shown), and models in which the association is tested for each type of CMP separately (data not shown).

Health maintenance organization penetration, PO size, hospital or health plan ownership of a PO, and the percentage of patients for which a PO is delegated utilization management also are statistically significantly associated ($P<.05$) with the use of CMPs by POs, but their impact is small (Table 6). For example, an increase of 100 physicians in a medical group is associated with use of only one fifth of an additional CMP, and an increase from 0 to 50% in the percentage of patients for whom the PO is delegated utilization management is associated with use of only 1 additional CMP.

Table 6. Factors Associated with Physician Organization Use of Care Management Processes for Improving Quality of Health Care*

	Regression Coefficients (SE)	*P* Value
Constant	1.6 (0.50)	.001
External incentives		
Report quality of care data and activities to an outside organization	0.63 (0.08)	<.001
Bonus from health plans	0.43 (0.25)	.08
Public recognition	1.3 (0.28)	<.001
Better contracts with health plans	0.74 (0.27)	.007
Clinical information technology	0.37 (0.07)	<.001
Medical group†	0.31 (0.32)	.33
Primary care only‡	0.05 (0.36)	.88
Specialty only‡	0.76 (0.44)	.09
Size of medical group	0.001 (0.0005)	.006
Size of independent practice association	0.001 (0.0004)	<.001
Delegated hospital utilization management for HMO patients, %	0.02 (0.003)	<.001
At-risk hospital costs, %	0.005 (0.004)	.16
HMO penetration	0.02 (0.008)	.03
Hospital, HMO, and/or joint owned§	0.59 (0.26)	.02
Manager, government, community clinic owned§	0.63 (0.36)	.08
Adjusted *R*‡	0.28	

Abbreviation: HMO, health maintenance organization.
*Regional dummy variables were included in analysis but none was significant
†Reference group is independent practice associations.
‡Reference group is multispecialty practice type with primary care.
§Reference group is physician owned.

COMMENT

Many medical groups and IPAs have implemented CMPs to improve the quality of care for their patients. But on average, POs use 5.1 CMPs, which is less than one third of the 16 CMPs surveyed. These findings can be interpreted as encouraging that POs are using any CMPs at all. However, the fact that 50% of POs use 4 or fewer of the 16 CMPs and that POs lacked registries of patients with a chronic disease 69% of the time suggests that organized processes to improve the quality of health care remain relatively uncommon in POs. It is difficult for an organization to provide proactive health care for a specific group of patients if the organization lacks these registries, that is, it does not know who these patients are.

Our findings support the IOM and others[8-14] who argue that rewarding POs for improving quality of care is important. Giving POs public recognition and better contracts for scoring well on quality measures is associated with the use of 2.0 additional CMPs—a substantial increase, given that the average PO uses only a total of 5.1 CMPs. However, our data also confirm the widespread perception that incentives for POs to improve quality are uncommon[10,20,62]: 32% of organizations reported having no incentives and 74% had 2 or fewer of 7 incentives surveyed to improve quality of care.

Our findings also support the belief that clinical IT is important, but that most POs lack clinical IT capabilities.[10,20] Each additional IT capability was associated with the use of 0.37 more CMPs, but 50% of POs had none of and more than 78% had 2 or fewer of the 6 IT capabilities surveyed.

The NSPO is the first study, to our knowledge, to provide national data on the use of CMPs by POs to improve the quality of health care and to show that clinical IT capabilities and external incentives to improve quality are each strongly associated with POs' use of CMPs. This strong association was present in every model for which we conducted statistical analyses, including models using a variety of weights for individual types of CMP, models testing the association for individual types of CMP, and models testing the association for individual diseases.

Our study has limitations, each of which suggests areas for future research. First, although respondents were assured that neither they nor their organizations would be identified, some may have overstated their organization's CMP use, even though the survey questions were designed to minimize this possibility. Also, it is possible that there may have been a response bias, such that organizations that use few or no CMPs were less likely to agree to be surveyed. For both these reasons, our data may somewhat overestimate the extent of CMP use among POs in the

United States. Second, even though POs were asked what CMPs were used by their organization as a whole, we do not know whether each individual practice site within a PO was in fact using the CMPs claimed for the organization. It is possible that some sites may have been using less and some using more CMPs. Third, in this cross-sectional study we demonstrate strong associations between certain variables and CMP use, but we cannot show the direction of causality, which may work to varying extents in both directions. For example, we suggest that it is plausible that the presence of external incentives to improve quality would induce POs to implement CMPs, but we cannot exclude the possibility that health plans and purchasers are more likely to provide such incentives to POs that already have some CMPs in place, that is, that have shown some capability to manage health care. Analogously, clinical IT increases organizations' ability to implement CMPs, but organizations planning to implement CMPs may be more likely to invest in clinical IT. Simply providing clinical IT systems (eg, through government financial support) to POs that lack both interest and incentives to improve quality may be unlikely to have much effect.

Underlying our study is the hypothesis that CMPs improve the quality of health care. Although evidence to support this hypothesis is accumulating, more research is needed to further explore the relationship between CMP use and clinical outcomes, specifically whether certain individual CMPs and combinations of CMPs are more effective than others for specific chronic diseases. This research will be difficult.[61,63] Our study also assumes that organizations of 20 or more physicians are more likely to implement CMPs than smaller organizations, but the extent to which physicians who work in smaller practices use CMPs is unknown. Further research is needed to identify the extent of CMP use and its relationship to clinical outcomes as well as the factors associated with CMP use in these practices. Finally, we are able to explain 28% of the variance in CMP use among POs, but the literature suggests that factors not evaluated in this study, particularly an organization's leadership and culture, also are important and should be a subject for further research.[64-68]

The findings from the NSPO have a number of important implications. For medicine as a profession, the fact that the use of CMPs is relatively uncommon in POs raises the question of whether such processes will be developed primarily by other entities, such as health plans and pharmaceutical companies, without adequate coordination with physicians. For government and large private purchasers of health care, this study provides strong confirmation for the IOM's assertions that organized processes to improve quality of care are not common in POs and that many physicians work in practices that have neither incentives nor IT capabilities to improve quality. Our data support policy recommendations by the IOM and others that POs should be given incentives to improve quality and support for developing clinical IT systems. Attempts to provide incentives for quality of care, though still exceptional, are becoming more common.[69-71] Such incentives can complement the efforts of organizations, such as the Institute for Healthcare Improvement, Boston, Mass,[72,73] and the MacColl Institute for Healthcare Innovation, Seattle, Wash,[74,75] that are working to help POs develop organized processes to improve the quality of health care.

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REFERENCES

1. Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: National Academy Press; 2001.
2. Institute of Medicine. *Leadership By Example: Coordinating Government Roles in Improving Health Care Policy*. Washington, DC: National Academy Press; 2002.
3. Beckles GL, Engelgau MM, Venkat Narayan KM, Herman WH, Aubert RE, Williamson DF. Population-based assessment of the level of care among adults with diabetes in the US. *Diabetes Care*. 1998;21:1432-1438.
4. Chassin MR, Galvin RW. The urgent need to improve health care quality: Institute of Medicine national roundtable on health care quality. *JAMA*. 1998;280:1000-1005.
5. Leatherman S, McCarthy D. *Quality of Health Care in the United States: A Chartbook*. New York, NY: Commonwealth Fund; 2002.
6. Schuster MA, McGlynn EA, Brook RH. How good is the quality of health care in the United States? *Milbank Q*. 1998;76:517-563.
7. Saaddine JB, Engelgau MM, Beckles GL, Gregg EW, Thompson TJ, Narayan KV. A diabetes report card for the United States: quality of care in the 1990s. *Ann Intern Med*. 2002;136:565-574.
8. Becher EC, Chassin MR. Improving quality, minimizing error: making it happen. *Health Aff (Millwood)*. 2001;20:68-82.
9. Newhouse JP. Why is there a quality chasm? *Health Aff (Millwood)*. 2002;21:13-25.
10. Lansky D. Improving quality through public disclosure of performance information. *Health Aff (Millwood)*. 2002;21:52-62.
11. Enthoven AC. The Fortune 500 model for health care: is now the time to change? *J Health Polit Policy Law*. 2002;27:37-48.
12. Ellrodt G, J CD, Lee J, Cho M, Hunt D, Weingarten S. Evidence-based disease management. *JAMA*. 1997;278:1687-1692.
13. McGlynn EA, Brook RH. Keeping quality on the policy agenda. *Health Aff (Millwood)*. 2001;20:82-90.
14. Grol R. Improving the quality of medical care: building bridges among professional pride, payer profit, and patient satisfaction. *JAMA*. 2001;286:2578-2585.
15. Bates DW, Leape LL, Cullen DJ, et al. Effect of computerized physician order entry and team intervention on prevention of serious medication errors. *JAMA*. 1998;280:1311-1316.
16. Balas EA, Weingarten S, Garb CT, Blumenthal D, Boren SA, Brown GD. Improving preventive care by prompting physicians. *Arch Intern Med*. 2000;160:301-308.

17. Weingarten S, Henning J, Badamgarav E, et al. Interventions used in disease management programmes for patients with chronic illness—which ones work? meta-analysis of published reports. *BMJ.* 2002; 325:925-942.
18. Kerr E, Mittman B, Hays R, Leake B, Brook R. Quality assurance in capitated physician groups: where is the emphasis? *JAMA.* 1996;276:1236-1239.
19. Robinson JC. *The Corporate Practice Of Medicine: Competition and Innovation in Health Care*. Berkeley: University of California Press; 1999.
20. Miller RH, Bovbjerg RR. Efforts to improve patient safety in large, capitated medical groups: description and conceptual model. *J Health Polit Policy Law.* 2002;27:401-440.
21. Burns LR. Medical organization structures that promote quality and efficiency: past research and future considerations. *Qual Manag Health Care.* 1995;3:10-18.
22. Burns LR, Wholey DR. Responding to a consolidating healthcare system: options for physician organizations. In: Blair JD, Fottler MD, Savage GT, eds. *Advances in Health Care Management*. Vol 1. New York, NY: Elsevier Science; 2000:261-323.
23. Bodenheimer T, Wagner EH, Grumbach K. Improving care for patients with chronic illness: the chronic care model, part 2. *JAMA.* 2002;288:1909-1914.
24. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. *Milbank Q.* 1996;74:511-543.
25. Olivarius N, Beck-Nielsen H, Andreasen AH, Hørder M, Pedersen PA. Randomised controlled trial of structured personal care of type 2 diabetes mellitus. *BMJ.* 2001;323:1-9.
26. Renders CM, Valk GD, Griffin SJ, Wagner EH, Eijk van JT, Assendelft WJ. Interventions to improve the management of diabetes in primary care, outpatient, and community settings: a systematic review. *Diabetes Care.* 2001;24:1821-1833.
27. Grimshaw J, Shirran L, Thomas R, et al. Changing provider behavior: an overview of systematic reviews of interventions. *Med Care.* 2001;39(8 suppl 2): II2-II45.
28. Ferguson JA, Weinberger M. Case management programs in primary care. *J Gen Intern Med.* 1998; 13:123-126.
29. Cabana MD, Rand CS, Powe NR, et al. Why don't physicians follow clinical practice guidelines? a framework for improvement. *JAMA.* 1999;282:1458-1465.
30. Thomson O'Brien MA, Freemantle N, Oxman AD, Wolf F, Davis D, Herrin J. *Continuing Education Meetings and Workshops: Effects on Professional Practice and Health Care Outcomes [Cochrane Review]*. Oxford, England: Cochrane Library, Update Software; 2002; issue 4.
31. Demakis JG, Beauchamp C, Cull WL, et al. Improving residents' compliance with standards of ambulatory care: results from the VA cooperative study on computerized reminders. *JAMA.* 2000;284:1411-1416.
32. Thomson O'Brien MA, Oxman AD, Davis DA, Haynes RB, Freemantle N, Harvey EL. Audit and feedback: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev.* 2000;2: CD000259.
33. Griffin S, Kinmouth A. *Systems for Routine Surveillance for People With Diabetes Mellitus* [*Cochrane Review*]. Oxford, England: Cochrane Library, Update Software; 2000; issue 3.
34. Gibson P, Coughlan J, Wilson A, et al. *Self-management Education and Regular Practitioner Review for Adults With Asthma.* [Cochrane Review on CD-ROM]. Oxford, England: Cochrane Library, Update Software; 2001; issue 4.
35. Anderson RM, Funnell MM, Butler PM, Arnold MS, Fitzgerald JT, Feste CC. Patient empowerment: results of a randomized controlled trial. *Diabetes Care.* 1995;18:943-949.
36. Norris SL, Engelgau MM, Narayan KM. Effectiveness of self-management training in type 2 diabetes: a systematic review of randomized controlled trials. *Diabetes Care.* 2001;24:561-587.
37. Lorig KR, Ritter P, Stewart A, et al. Chronic disease self-management program: 2-year health status and health care utilization outcomes. *Med Care.* 2001;39:1217-1223.
38. Bodenheimer T, Lorig K, Holman H, Grumbach K. Patient self-management of chronic disease in primary care. *JAMA.* 2002;288:2469-2475.
39. Rossiter LR, Whitehurst-Cook MY, Small RE, Shasky C, et al. The impact of disease management on outcomes and cost of care: a study of low-income asthma patients. *Inquiry.* 2000;37:188-202.
40. Jowers JR, Schwartz AL, Tinkelman DG, et al. Disease management program improves asthma outcomes. *Am J Manag Care.* 2000;6:585-592.
41. McAlister FA, Lawson F, Teo KK, Armstrong PW. A systematic review of randomized trials of disease management programs in heart failure. *Am J Med.* 2001;110:378-384.
42. Philbin EF. Comprehensive multidisciplinary programs for the management of patients with congestive heart failure. *J Gen Intern Med.* 1999;14:130-135.
43. Rich MW. Heart failure disease management programs: efficacy and limitations. *Am J Med.* 2001;110: 410-412.
44. Schoenbaum M, Unützer J, Sherbourne C, et al. Cost-effectiveness of practice-initiated quality improvement for depression: results of a randomized controlled trial. *JAMA.* 2001;286:1325-1330.
45. Von Korff M, Goldberg D. Improving outcomes in depression. *BMJ.* 2001;323:948-949.
46. Holloway F, Carson J. Case management: an update. *Int J Psychiatry*. 2001;47:21-31.
47. Simon GE, VonKorff M, Rutter C, Wagner EH. Randomised trial of monitoring, feedback, and management of care by telephone to improve treatment of depression in primary care. *BMJ.* 2000;320:550-554.
48. Wells K, Sherbourne C, Schoenbaum M, et al. Impact of disseminating quality improvement programs for depression in managed primary care: a randomized controlled trial. *JAMA.* 2000;283:212-220.
49. Wagner EH, Grothaus LC, Sandhu N, et al. Chronic care clinics for diabetes in primary care: a system-wide randomized trial. *Diabetes Care.* 2001;24:695-700.
50. Griffin SJ. The management of diabetes: moving beyond registration, recall, and regular review. *BMJ.* 2001;323:946-947.
51. Hoyert DL, Arias E, Smith BL, Murphy SL, Kochanek KD. Deaths: final data for 1999. *Natl Vital Stat Rep.* 2001;49:1-23.
52. National Heart, Lung, and Blood Institute. *Congestive Heart Failure Data Fact Sheet.* Washington, DC: National Institutes of Health; 1996.
53. Jessup M. Mechanical cardiac support devices—dreams and devilish details. *N Engl J Med.* 2001;345: 1490-1492.
54. Songer TJ, Ettaro L. *Studies on the Cost of Diabetes.* Atlanta, Ga: Centers for Disease Control and Prevention; 1998.
55. Weiss K, Sullivan S. The health economics of asthma and rhinits: assessing the economic impact. *J Allergy Clin Immunol.* 2001;107:3-8.
56. Renders CM, Valk GD, Franse LV, Schellevis FG, van Eijk J, van der Wal G. Long-term effectiveness of a quality improvement program for patients with type 2 diabetes in general practice. *Diabetes Care.* 2001; 24:1365-1370.
57. Bonomi AE, Wagner EH, Glasgow RE, Von Korff M. Assessment of chronic illness care (ACIC): a practical tool to measure quality improvement. *Health Serv Res.* 2002;37:791-820.
58. The National Committee for Quality Assurance. The Health Plan Employer Data and Information Set (HEDIS). Available at: http://www.nqca.org/Programs/HEDIS. Accessed December 17, 2002.
59. Hersh WR. Medical informatics: improving health care through information. *JAMA.* 2002;288:1955-1958.
60. Wholey D, Christianson JB, Engberg J, Bryce C. HMO market structure and performance 1985-1995. *Health Aff (Millwood).* 1997;16:75-84.
61. Dudley RA, Landon BE, Rubin HR, Keating NL, Medlin CA, Luft, HS. Assessing the relationship between quality of care and the characteristics of health care organizations. *Med Care Res Rev*. 2000;57 (suppl 2):116-135.
62. Maxwell J, Temin P. Managed competition versus industrial purchasing of health care among the fortune 500. *J Health Polit Policy Law.* 2002;27:5-30.
63. Campbell M, Fitzpatrick R, Haines A, et al. Framework for design and evaluation of complex interventions to improve health. *BMJ.* 2000;321:694-696.
64. Rundall TG, Shortell SM, Wang MC, et al. As good as it gets? chronic care management in nine leading US physician organizations. *BMJ.* 2002;325:958-961.
65. Kohn LT, Corrigan JM, Donaldson MS, eds. *To Err Is Human: Building A Safer Health System*. Washington, DC: National Academy Press; 2000.
66. Solberg LI, Brekke ML, Fazio CJ, et al. Lessons from experienced guideline implementers: attend to many factors and use multiple strategies. *Jt Comm J Qual Improv.* 2000;26:171-188.
67. Landon BE, Wilson IB, Cleary PD. A conceptual model of the effects of health care organizations on the quality of medical care. *JAMA.* 1998;279:1377-1382.
68. Shortell S, Zazzali J, Burns L, et al. Implementing evidence-based medicine: the role of market pressures, compensation incentives, and culture in physician organizations. *Med Care.* 2001;39:I62-I78.
69. Christianson JB, Feldman R. Evolution in the Buyers Health Care Action Group. *Health Aff (Millwood).* 2002;21:76-88.
70. Robert Wood Johnson Foundation. Rewarding Results: Aligning Incentives With High Quality Care. Available at: http://www.nhcpi.net/rewardingresults. Accessed December 3, 2002.
71. Agency for Healthcare Research and Quality. Partnerships For Quality. Available at: http://www.ahrq.gov. Accessed December 3, 2002.
72. Berwick DM. Developing and testing changes in delivery of care. *Ann Intern Med.* 1998;128:651-656.
73. Kilo CM. A framework for collaborative improvement: lessons from the Institute for Healthcare Improvement's Breakthrough Series. *Qual Manag Health Care.* 1998;6:1-13.
74. Wagner EH, Glasgow RE, Davis C, et al. Quality improvement in chronic illness care: a collaborative approach. *Jt Comm J Qual Improv.* 2001;27:63-80.
75. Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A. Improving chronic illness care: translating evidence into action. *Health Aff (Millwood).* 2001;20:64-78.