

# Organizational Factors Affecting the Adoption of Diabetes Care Management Processes in Physician Organizations

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**OBJECTIVE** — To describe the extent of adoption of diabetes care management processes in physician organizations in the U.S. and to investigate the organizational factors that affect the adoption of diabetes care management processes.

**RESEARCH DESIGN AND METHODS** — Data are derived from the National Survey of Physician Organizations and the Management of Chronic Illness, conducted in 2000–2001. A total of 1,104 of the 1,590 physician organizations identified responded to the survey. The extent of adoption of four diabetes care management processes is measured by an index consisting of the organization's use of diabetic patient registries, clinical practice guidelines, case management, and physician feedback. The ordinary least-squares model is used to determine the association of organizational characteristics with the adoption of diabetes care management processes in physician organizations. A logistic regression model is used to determine the association of organizational characteristics with the adoption of individual diabetes care management processes.

**RESULTS** — Of the 987 physician organizations studied that treat patients with diabetes, 48% either do not use any or use only one of the four diabetes care management processes. A total of 20% use two care management processes, and 32% use three or four processes. External incentives to improve quality, computerized clinical information systems, and ownership by hospitals or health maintenance organizations are strongly associated with the diabetes care management index and the adoption of individual diabetes care management processes.

**CONCLUSIONS** — Policies to encourage external incentives to improve quality and to facilitate the adoption of computerized clinical information technology may promote greater use of diabetes care management processes.

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A large body of evidence suggests that diabetes is inadequately managed in the U.S. In a 1999–2000 randomly sampled survey of 488 adults with diabetes living in 12 metropolitan areas in the U.S., followed by a review of many of their medical charts, only 45% of recommended processes of diabetes care

were delivered. Only 24% of adults with diabetes underwent three or more HbA<sub>1c</sub> tests over a 2-year period (1).

Data from the 1999–2000 National Health and Nutrition Examination Survey (NHANES) show that 37% of patients with diabetes achieved the target goal of HbA<sub>1c</sub> level <7.0% and 37% had HbA<sub>1c</sub> levels >8.0%, percentages that did not change significantly from a similar 1988–1994 national survey. A total of 36% of patients with diabetes had normal blood pressure (<130/80 mmHg), whereas 40% had elevated blood pressure (≥140/90 mmHg). Of the study subjects, 52% had total cholesterol levels ≥200 mg/dl. Only 7% of adults with diabetes in 1999–2000 attained recommended goals of HbA<sub>1c</sub>, blood pressure, and total cholesterol (2).

The locus of actual care delivery for much of diabetes management is the physician organization. No large-scale surveys have previously been conducted to determine the extent to which physician organizations have adopted innovations known to improve the care of diabetes. It is also not known which organizational and market characteristics are associated with implementation of diabetes care improvements. This study presents data from the first major physician organization survey ever conducted in the U.S. to address these two questions. The National Study of Physician Organizations and the Management of Chronic Illness (NSPO) was a national telephone survey of medical groups and independent practice associations (IPAs) with 20 or more physicians (3). The NSPO collected data that can determine the prevalence of diabetes care improvements and can explore which characteristics of physician organizations associate with their greater adoption. To address deficiencies in the management of diabetes and other chronic conditions, Wagner et al. (4) developed the Chronic Care Model (5,6). The Chronic Care Model includes six components, two (health care organization and community resources) that in-

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**Abbreviations:** CMP, care management process; HEDIS, Health Plan Employer Data and Information Set; HMO, health maintenance organization; IOM, Institute of Medicine; IPA, independent practice association; IT, information technology; NSPO, National Study of Physician Organizations and the Management of Chronic Illness.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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volve the larger health care system surrounding the physician organization and four internal components (decision support, delivery system redesign, clinical information systems, and self-management support) that take place within the physician organization.

The NSPO gathered data from physician organizations on four care management processes (CMPs) derived from the internal Chronic Care Model components. These four CMPs are 1) use of clinical practice guidelines in conjunction with physician reminder systems (decision support and clinical information systems), 2) case management (delivery system redesign), 3) performance feedback to individual physicians (clinical information systems), and 4) disease registries (clinical information systems). These four CMPs were chosen because a number of studies have demonstrated that they improve clinical outcomes for patients with diabetes. A meta-analysis and a Cochrane review found that reminder systems (placing practice guidelines at the point of care) improved diabetes control (7,8). Compared with control subjects, those undergoing case management, in planned nurse-run diabetes clinics or by telephone, had improved glycemic control in several studies (9–12). Pooled data from three studies showed that performance feedback to physicians was associated with a slight improvement in diabetes control (8). Diabetes registries, if used to bring patients at risk into care, have been shown in a Mayo Clinic study to reduce HbA<sub>1c</sub> levels compared with control groups (13). Particularly for diabetes, the introduction of several of these care management interventions is more effective than the use of only one intervention (6,14,15). The survey asked physician organizations about their use of patient self-management programs (3), but not in specific relation to diabetes; therefore, data about this CMP are not reported here.

## RESEARCH DESIGN AND METHODS

The NSPO was conducted from September 2000 to September 2001 (3). A medical group was defined as an organization composed of physicians belonging to one practice, operating in either one office or at many locations. An IPA was defined as an organization through which physicians contract with managed care plans and in

which physicians work solo or in small practices that are independent of each other.

A number of strategies were used to increase the response rate, including making up to 25 phone calls to the physician organization. In addition, information about support for the project from various professional groups and leaders were faxed or mailed to certain groups. Participants were paid \$150 and sent a summary feedback report to use for benchmarking with other physician organizations around the country.

## Population studied

Of the 1,590 physician organizations identified, 1,104 (69.6%) responded to the telephone survey. Information on nonrespondents is limited. Nonrespondents did not differ from respondents by size or by state, but IPAs had a significantly higher response rate than medical groups (79 and 66%, respectively) (3). Of these 1,104 respondents, we excluded 117 organizations stating that they did not treat patients with diabetes, leaving 987 physician organizations included in our study. Among these were 645 medical groups and 342 IPAs. The NSPO was designed to measure the organizational characteristics and extent of adoption of CMPs for physician organizations with at least 20 physicians. A number of questions in the survey attempted to determine the use of these CMPs for the care of patients with diabetes. Further information about the development, administration, and content of the survey is available from other sources (3,16).

## Dependent variable

To assess physician organizations' use of diabetes CMPs, the survey asked whether the organization had implemented the four diabetes CMPs discussed above: clinical practice guidelines in conjunction with physician reminder systems, case management, performance feedback to individual physicians, and disease registries. All four diabetes CMPs are significantly correlated with each other ( $P < 0.001$ ). We created a diabetes care management index using these four diabetes CMPs to measure the extent of adoption of diabetes CMPs in each physician organization. The index range is 0–4; an organization received one point for each of the four CMPs adopted. The internal con-

sistency reliability (Cronbach  $\alpha$ ) of the diabetes care management index was 0.64.

## Independent variables

We used four groups of independent variables: external incentives for a physician organization to improve quality, computerized clinical information technology infrastructure, relationship with health maintenance organizations (HMOs), and ownership of the physician organizations.

To assess external incentives, the survey asked seven questions: whether the physician organization received additional income from health plans for scoring well on quality measures; whether the physician organization got public recognition for quality; whether it received better contracts from health plans for quality; and whether physician organizations were required to report Health Plan Employer Data and Information Set (HEDIS) data, outcomes data, results of quality projects, or patient satisfaction data to an outside organization. The first three of the external incentive questions were defined as categorical variables, coded as 1 or 0. For the last four questions, we created a composite measure with the organization receiving one point for each kind of reporting to an outside organization. The range of this composite measure is 0–4. Altogether, we had four independent variables for the external incentives.

Clinical information technology was measured by a single clinical information technology (IT) index. The components of this index included whether the physician organization had a computerized problem list, physician progress notes, list of medications prescribed, medication ordering reminders and/or drug interaction information, laboratory results, and radiology results. We assigned one score for each of the six IT components; the resulting index measure ranges from 0 to 6.

The relationship of a physician organization with HMOs was assessed by two measures: the percentage of revenue from capitation and the percentage of risk delegation to the physician organization for hospital admission of HMO and point-of-services patients.

Ownership of physician organizations was categorized as ownership by an HMO or hospital system, ownership by physicians in the organization, or ownership by nonphysician managers and others.

Table 1—Descriptive statistics for dependent and independent variables

	Physician organizations
<i>n</i>	987
Dependent variable	
Diabetes care management index (range 0–4)	1.7 ± 1.4
Independent variables	
External incentives for quality	
Reporting of quality data to outside organizations (range 0–4)	0.83 ± 1.4*
Receiving income for quality (%)	42
Receiving public recognition for quality (%)	27
Receiving better contracts for quality (%)	24
Clinical IT index (range 0–6)	1.3 ± 1.7
Relationship with HMOs	
Percentage of revenue from capitation	34 ± 40
Percentage of HMO and point-of-service patients for whom hospital utilization management is delegated to the group	34 ± 44
Ownership	
Owned by HMO or hospital systems (%)	39
Owned by physicians (%)	48
Owned by nonphysician managers and others (%)	13
Control variables	
Percentage of physician organizations that are medical groups (%)	65
Percentage of physician organizations that are IPAs (%)	35
Specialty type	
Primary care only (%)	12
Specialty care only (%)	4
Multispecialty (%)	84
Number of MDs in the physician organization	236 ± 419
Age of physician organization (years)	26 ± 22
Percentage of HMO penetration at the county level	33 ± 17

Data are *n* or means ±SD. \*Whether physician organizations are required to report HEDIS data, outcomes data, results of quality projects, or patient satisfaction data to an outside organization.

**Control variables**

Control variables included the type of physician organization (medical group or IPA), the practice type (primary care only, specialty care only, or multispecialty group with both primary and specialty care), organization age, size of the organization, and the degree of HMO penetration at the county level.

**Model specification**

We used a multivariate ordinary least-squares regression model to predict the effects of organizational characteristics on the extent of adoption of diabetes CMP in physician organizations. We also used a logistic model to explore each of the four CMPs separately because the answers for adoption of individual diabetes CMPs are categorical yes/no variables.

**RESULTS**— The descriptive statistics on the extent of adoption of diabetes

CMPs in physician organizations are reported in Table 1. Of the 987 medical groups and IPAs surveyed that treat patients with diabetes, the average score on the diabetes care management index was 1.7. In other words, physician organizations on average used fewer than two of the four components of the diabetes care management index. A total of 26% of physician organizations used none of the four diabetes care management processes,

22% used only one process, 20% used two processes, 19% used three processes, and 13% used all four processes. Physician performance feedback was the most commonly reported CMP for diabetes, used by 48% of physician organizations, followed by 43% using diabetes case managers, 40% having a diabetes registry, and 39% using physician guidelines and tied to reminder systems (Table 2). Interestingly, the physician organizations that used more of the diabetes CMP also used more CMP for congestive heart failure, asthma, and depression.

Table 3 shows the results of the ordinary least-squares regression for factors affecting adoption of diabetes CMPs. All four external incentives to improve quality are strongly associated with a physician organization's use of diabetes CMPs. Requiring physician organizations to report HEDIS and other quality data to outside organizations is strongly associated with increasing the diabetes care management index score. Reporting one additional kind of quality data to an outside organization is associated with increasing the diabetes care management index score by 0.18, an 11% increase from the 1.7 average diabetes care management index score (*P* < 0.001). Organizations reporting all four kinds of quality data to an outside organization use 2.2 diabetes CMPs, whereas physician organizations that did not report quality data to an outside organization use only 1.5 diabetes CMPs on average. Compared with physician organizations that did not receive the indicated incentive for quality, physician organizations that received outside income for quality improvement use 0.20 more diabetes CMPs (12% increase from the mean, *P* < 0.05). Physician organizations that received public recognition for scoring well on quality-of-care measures use 0.35 more diabetes CMPs (21% increase from the mean, *P* < 0.001), and physician organizations that received bet-

Table 2—Descriptive statistics for utilization of diabetes CMPs

	All physician organizations	Medical groups only	IPAs only
<i>n</i>	987	645	342
Guidelines with physician reminder systems (%)	39	43	30
Case management (%)	43	40	48
Performance feedback to physicians (%)	48	50	45
Disease registries (%)	40	40	40

**Table 3—Ordinary least-squares regression results for organizational factors that affect the adoption of overall diabetes CMPs in physician organizations**

	Regression coefficient	Standardized regression coefficient
External incentives for quality		
Reporting of quality data to outside organizations	0.18 ± 0.03‡	0.19
Receiving income for quality	0.20 ± 0.08*	0.07
Receiving public recognition for quality	0.35 ± 0.10†	0.11
Receiving better contracts for quality	0.23 ± 0.09*	0.07
Clinical IT index	0.11 ± 0.02‡	0.14
Relationship with HMOs		
Percentage of revenue from capitation	0.003 ± 0.002*	0.04
Percentage of HMO and point-of-service patients for whom hospital utilization management is delegated to the group	0.005 ± 0.001‡	0.18
Ownership (comparison group is physician-owned groups)		
Owned by HMO or hospital systems	0.22 ± 0.09†	0.08
Owned by nonphysician managers and others	0.24 ± 0.12	0.06
Control variables		
•Medical groups (versus IPAs)	0.20 ± 0.12	0.07
•Specialty type (comparison group is multispecialty groups)		
•Primary care only	0.17 ± 0.12	0.04
•Specialty care only	−0.27 ± 0.21	−0.04
•Number of MDs in the physician organization	0.0003 ± 0.000†	0.10
•Age of physician organization (years)	0.002 ± 0.002	0.02
•Percentage of HMO penetration at the county level	0.002 ± 0.003	0.04

Data are means ± SE. \* $P \leq 0.05$ ; † $P \leq 0.01$ ; ‡ $P \leq 0.001$ .

ter contracts for quality use 0.23 more diabetes CMPs (14% increase from the mean,  $P < 0.05$ ).

IT infrastructure is also significantly related to adoption of diabetes care management. A one-point increase in the IT index is associated with an increase of 0.11 (6% increase from the mean,  $P < 0.001$ ) in the diabetes care management index. That is, organizations that score 0 on the clinical IT index use only 1.5 diabetes CMPs, whereas an organization that scores 6 on the IT index uses 2.2 diabetes CMPs.

Among the variables that assess the relationship between physician organizations and health plans, the percentage of revenue from capitation has a very small positive influence of 0.002 on the diabetes care management index ( $P < 0.05$ ). In other words, a physician organization that is fully capitated uses 0.3 more diabetes CMPs than a physician organization that is reimbursed only on a fee-for-service basis. The percentage of delegation of utilization management for hospital admissions to the physician or-

ganization also has a small effect of 0.005 ( $P < 0.001$ ). Increasing the delegation from 0 to 100% in an organization increases the number of diabetes CMPs by 0.5.

Physician organizations owned by HMOs or hospital systems score 0.22 higher on the diabetes care management index than those owned by physicians, a 13% increase from the average index score ( $P < 0.01$ ).

Among control variables, only size is positively correlated with more diabetes CMPs ( $P < 0.01$ ), but the effect is very small (only 0.0003). Medical groups use more diabetes CMPs than IPAs, but the difference is not significant.

We also explored each of the four CMPs separately, using logistic regression models, because the answers for adoption of individual diabetes CMPs are categorical yes/no variables. The results of the logistic regressions of use of individual diabetes CMPs are similar to the results for the overall diabetes care management index and are not presented.

**CONCLUSIONS**— Our study is the first to provide national data on the use of diabetes CMPs among physician organizations. Our results demonstrate that external incentives for quality, clinical IT capability, and group ownership by an HMO or hospital system are associated with increased use of diabetes CMPs.

On average, physician organizations have adopted fewer than two of the four components of the diabetes care management index. More than 25% of the physician organizations studied that treat patients with diabetes do not use any diabetes CMPs at all, and an additional 22% use only one of these CMPs. This is unfortunate, because the CMPs have been shown, in most studies, to be associated with improved diabetes outcomes (7–13,15). These findings are consistent with the conclusion of the report Crossing the Quality Chasm by the Institute of Medicine (IOM) (17), in that the gap between scientific knowledge and routine practice in diabetes treatment remains large. The IOM report also argued that low quality is primarily the result of a failure at the organizational level rather than that of individual physicians. The IOM proposed the implementation of organizational processes for quality and emphasized the importance of providing physician organizations with incentives for quality-enhancing processes.

Our regression results support the conclusions of the IOM report. They demonstrate that incentives for physician organizations to improve quality are associated with greater adoption of diabetes CMPs. Physician organizations being required to report on quality to outside organizations, receiving income, gaining public recognition for high quality care, or getting better contracts for quality are more likely to adopt diabetes CMPs. These incentives result in 11, 12, 21, and 14% increases, respectively, in the use of diabetes CMPs in physician organizations.

Our findings also support the role played by clinical IT infrastructure. IT facilitates better chronic illness care by giving physicians access to patient information, enabling identification of at-risk populations, and providing decision support at the point of care. Without IT infrastructure, it is difficult to generate a registry of diabetic patients and to provide tools for patient tracking and follow-up. Despite these benefits, few physician orga-

nizations studied had robust IT capabilities. Using an IT index with a range from 0 to 6, the mean IT index score for physician organizations surveyed is only 1.33. Resources and tools to create greater IT infrastructure in physician organizations may stimulate increased adoption of diabetes CMPs.

We also found that physician organizations owned by HMOs or hospital systems used more diabetes CMPs than physician-owned physician organizations. This result may be explained by the fact that HMO- and hospital-owned physician organizations have more resources available to implement CMPs.

Our study has several limitations. First, the study relied on physician organization leaders (almost always the medical directors or president) to report on the adoption of diabetes CMPs. There may have been a tendency to overreport the adoption of CMPs, in which case the actual extent of use of these CMPs may be lower than what we have reported. Second, we asked organizations yes/no questions regarding use of a particular CMP. We have no information on how many patients are affected by a CMP, or the clinical outcomes associated with the use of that process. Third, the cross-sectional nature of the data leads to an inability to draw conclusions about cause and effect. For example, if a physician organization could get better contracts for quality, it may be more likely to implement CMPs in the organization. On the other hand, it is also likely that a physician organization that has implemented CMPs is more likely to obtain better contracts that include incentive bonuses for quality. A fourth limitation is that the NSPO only surveyed organizations of 20 or more physicians. We have no information on organizations with fewer than 20 physicians.

CMPs—the institution of physician reminder systems based on clinical practice guidelines, case management, performance feedback to individual physicians, and use of disease registries—have been associated with improved glycemic control in patients with diabetes.

The survey reported here demonstrates that few medium- and large-sized

physician organizations have adopted all these processes and that 48% of these physician organizations have instituted none or only one of these processes. This study identifies some factors that seem to increase the likelihood of physician organizations adopting CMPs for diabetes. Some of these factors are external quality reporting, additional payment for better quality, sophisticated clinical information systems, organizational size, and ownership of the physician organization by an HMO or hospital system. Policies and practices that promote these characteristics may help spread improvement in diabetes care.

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