

# The Relationship Between Organizational Systems and Clinical Quality in Diabetes Care

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**Objective:** To assess the clinical quality of diabetes care and the systems of care in place in Medicare managed care organizations (MCOs) to determine which systems are associated with the quality of care.

**Study Design:** Cross-sectional, observational study that included a retrospective review of 2001 diabetes Health Plan Employer and Data Information Set (HEDIS) measures and a mailed survey to MCOs.

**Methods:** One hundred and thirty-four plans received systems surveys. Data on clinical quality were obtained from HEDIS reports of diabetes measures.

**Results:** Ninety plans returned the survey. Composite diabetes quality scores (CDSs) were based on averaging scores for the 6 HEDIS diabetes measures. For the upper quartile of responding plans, the average score was 77.6. The average score for the bottom quartile was 53.9 ( $P < .001$ ). The mean number of systems or interventions for the upper-quartile group and the bottom-quartile group was 17.5 and 12.5 ( $P < .01$ ), respectively. There were significant differences in the 2 groups in the following areas: computer-generated reminders, physician champions, practitioner quality-improvement work groups, clinical guidelines, academic detailing, self-management education, availability of laboratory results, and registry use. After adjusting for structural and geographic variables, practitioner input and use of clinical-guidelines software remained as independent predictors of CDS. Structural variables that were independent predictors were nonprofit status and increasing number of Medicare beneficiaries in the MCO.

**Conclusions:** MCO structure and greater use of systems/interventions are associated with higher-quality diabetes care. These relationships require further exploration.

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patients with diabetes receive care well below appropriate standards believed to reduce morbidity and mortality from the disease.<sup>2,3</sup> Diabetes increases with age and is quite common among Medicare beneficiaries; approximately 18% of the United States population over age 60 years have diabetes.<sup>4</sup> Prevalence and cost have made diabetes an important focus for quality measurement and improvement within the Medicare program.

The managed care industry has been at the forefront of efforts to improve the effectiveness and efficiency of care.<sup>5,6</sup> It has taken the lead in public reporting of diabetes care quality by using a set of comprehensive measures formulated in the Diabetes Quality Improvement Project (DQIP).<sup>7,8</sup> Managed care plans collect data on DQIP quality indicators to assess care related glucose control (glycosylated hemoglobin [HbA<sub>1c</sub>] testing and level), lipids (lipid profile testing and level), and examinations for eye disease and kidney disease. Plans use the DQIP indicator data to implement quality-improvement interventions.

This is an era of increasing emphasis on organizational responsibility for quality of care.<sup>9-11</sup> It is important to understand the effects of managed care plans' quality-improvement interventions that are focused on their practitioners and patients. Managed care plans typically do not directly supervise individual clinician-patient interactions. It is unclear what efforts by plans

Diabetes is an epidemic for which human and economic costs are great and are predicted to increase. The economic cost of diabetes is already alarming, with lost productivity and direct medical expenditures amounting to an estimated \$132 billion.<sup>1</sup> People with diabetes incur more than twice the direct medical costs (ie, hospitalizations, physician visits, medications) than people who do not have the disease.<sup>1</sup> In spite of the obvious importance of this disease to those who have it, healthcare professionals who care for them, and society as a whole, there is still wide variation in care among individuals with diabetes. Many

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have been related to measurable improvements in diabetes care. To our knowledge, this study is the first attempt to describe ongoing plan-based quality-improvement interventions and systems that plans have in place, and correlate those systems or interventions with the quality of diabetes care among Medicare managed care plans.

## RESEARCH DESIGN AND METHODS

The data on quality of care delivered to plan members with diabetes were available to the authors as a result of the Medicare contract-mandated reporting of the Health Plan Employer and Data Information Set (HEDIS<sup>®</sup>, a registered trademark of the National Committee for Quality Assurance) and as part of a special contract award between the Centers for Medicare & Medicaid Services (CMS) and IPRO, the New York State Medicare quality-improvement organization. Comprehensive diabetes care measures in HEDIS (which are a subset of the DQIP measures) were reported by all Medicare managed care plans using HEDIS 2001 technical specifications. The authors administered a survey to plans, requesting information about interventions designed to support and/or improve diabetes care. Survey results were compared with the results of the HEDIS diabetes scores to identify best practices in diabetes among Medicare managed care plans.

### Study Sample

In 2001, 201 Medicare+Choice managed care organizations (MCOs) reported their HEDIS results to CMS as required under their Medicare contracts (reporting on care provided in the year 2000). The authors excluded 28 health plans because they had special cost, risk, or demonstration contracts. The study team also excluded an additional 10 plans that did not report a complete and validated measure set. Last, the authors excluded 29 plans without an active Medicare managed care contract at the time of the study survey in 2002. The final study sample size was 134 managed care plans.

### Diabetes Care Measures

We used 6 HEDIS diabetes care measures. These were HbA<sub>1c</sub> testing annually, an HbA<sub>1c</sub> level higher than 9.5% (indicating poor HbA<sub>1c</sub> control), biennial lipid testing, a low-density lipoprotein level less than 130 mg/dL (indicating good lipid control), eye exams every 2 years in low-risk patients and annually in high-risk patients, and an annual nephropathy evaluation.

To investigate the relationship between the use of various interventions and plans' overall quality of dia-

betes care, a composite diabetes score (CDS) was created for each plan. Lacking national consensus for the most appropriate weighting of the individual HEDIS measures as part of a composite score, the study team weighted each of the measures equally in the composite score. This was done in consultation with a technical expert panel created for the project and after analysis of alternate scoring schemes. The technical expert panel consisted of experts from the DQIP team<sup>8</sup> and included representation from the American Academy of Family Practice, the American College of Physicians, the American Diabetes Association, the Centers for Disease Control and Prevention, the National Committee for Quality Assurance, and the Veterans Health Administration. A full list of organizations represented on the technical expert panel is available from the authors.

The study team used principal-component analysis and Cronbach's alpha reliability coefficient testing to assess the degree to which combinations of the 6 measures shared an underlying overall construct of diabetes care. The information captured by the first principal component and the fairly high internal-consistency results both supported the viability of a single construct (data are available from the authors). Comparisons of the unit-weighted composite scores with those from regression weights resulted in sufficiently high agreement to justify equally weighting each measure in the composite and, thereby, increasing the interpretability of the composite measure scores.<sup>12</sup> Of note, the direction of the HbA<sub>1c</sub> indicator was reversed in the composite score to be comparable to the other components, where a higher score stands for better performance. When HbA<sub>1c</sub> scores were reported, a lower score was desirable (ie, values greater than 9.5% indicated poor control). This was reversed for purposes of the composite score so that scores lower than 9.5% were counted as desirable outcomes of the indicator.

### Survey of Best Practices

The survey used to obtain information on the MCOs' quality-improvement interventions incorporated components described by Dr. Edward Wagner and colleagues<sup>13</sup> in the Assessment of Chronic Illness Care survey, Version 3.0,<sup>14,15</sup> a survey based on the Chronic Care Model of Disease, which identifies important components of quality care.<sup>14,15</sup> Additional elements (eg, use of physician champions in quality improvement) came from the work of Dudley and colleagues and Felt-Lisk and Kleinman.<sup>16,17</sup> The technical expert panel reviewed the work of the study team and made suggestions for revisions or additions to the survey. The investigators chose 3 plans as a convenience sample to field-test the ques-

tionnaire. In these 3 plans, inter-rater reliability was determined by having 2 individuals complete the survey. There were inter-rater reliabilities of 94% in 2 of the plans and 62% in the third plan. The survey was refined based on field-test results prior to distribution to the 134 managed care plans. The survey contained 20 multiple-part questions with the following content areas: practitioner-centered initiatives for diabetes care (8 questions), member-centered initiatives for diabetes care (6 questions), administrative and structural characteristics (6 questions), and a single open-ended question on MCO community/local initiatives for diabetes care. (See the Box for a sample question.) The **Appendix** contains a detailed list of the elements included in the survey.

Four weeks prior to receiving the survey, plans received letters encouraging them to respond to the survey that was about to be mailed. Plans understood that their responses were voluntary and that the results would remain confidential. CMS and IPRO followed health-privacy criteria as defined by 42 CFR Section 480 for quality-improvement organizations. Over a period of 4 weeks, there were 2 mailings of the survey and a telephone call reminder to all plans. A computerized data entry option was provided for each plan.

ANALYSIS

To differentiate plans into meaningful categories, we grouped the responding plans into 3 categories based on their CDS: the top 25% of plans, the middle 50% of plans, and the bottom 25% of plans. We chose this a priori grouping to primarily focus on the relationship between quality of care delivered and the systems/interventions in place in those plans in the top and bottom quartiles of the CDS. Differences among plans at the extremes of quality were more likely to be more accurate reflections of true differences in care delivered and more meaningful clinically. The study focused on assessing differences in quality-improvement interventions and systems in place between the top 25% and the bottom 25% of reporting managed care plans. The difference between the high-CDS group and the low-CDS group was tested by using chi-square tests of association.  $P \leq .05$  was considered statistically significant.

RESULTS

Of the 134 managed care plans, 90 completed the survey, resulting in a response rate of 67%. Fifty-three of

Sample Question\*

**3. Practitioner Reminder Systems**

Did your MCO send information or materials to practitioners to increase adherence to diabetes clinical guidelines (eg, chart stickers; real-time, computer-generated reminders linked to patient visits)?

(From list below, indicate which type(s) and volume of distribution)

- 3a. **Manual Reminders**—chart stickers or flow sheets sent to plan practitioners
  - Not used
  - Sent to 0%-25% of practitioners who care for members with diabetes
  - Sent to 26%-50% of practitioners who care for members with diabetes
  - Sent to 51%-75% of practitioners who care for members with diabetes
  - Sent to 76%-100% of practitioners who care for members with diabetes
- 3b. **Mailed Lists**—lists of patients who have not received a service (eg, HbA<sub>1c</sub> test, eye exam)
  - Not used
  - Sent to 0%-25% of practitioners who care for members with diabetes
  - Sent to 26%-50% of practitioners who care for members with diabetes
  - Sent to 51%-75% of practitioners who care for members with diabetes
  - Sent to 76%-100% of practitioners who care for members with diabetes
- 3c. **Computer-generated Reminders**—Any computer-generated notices that prompt a practitioner to order a needed service (eg, HbA<sub>1c</sub> test, eye exam) at the time of a patient's visit.
  - Don't know
  - Not used
  - Used by 0%-25% of practitioners who care for members with diabetes
  - Used by 26%-50% of practitioners who care for members with diabetes
  - Used by 51%-75% of practitioners who care for members with diabetes
  - Used by 76%-100% of practitioners who care for members with diabetes

\*The complete survey is available from the authors by request.

the responding MCOs were independent practice association (IPA) model (59% of respondents), 28 were group model (31%), and the remaining 9 (10%) were staff model. Sixty-one plans (68% of respondents) were for profit. Fifty-one plans (57% of respondents) had National Committee for Quality Assurance accreditation. The Joint Commission on Accreditation of Healthcare Organizations or the Accreditation Association for Ambulatory Health Care accredited an additional 3 plans. Twenty-eight plans (31% of respondents) were in the Northeast, 24 (27% of respondents) were in the South, 19 (21%) were in the Midwest, and 19 (21%) were in the West. The mean Medicare membership among respondents was 32 983 with a standard deviation of 37 896. The minimum number of Medicare beneficiaries in the responding plans was 1060 and the maximum was 258 681. The mean number of years the respondent plans had been in business was 16.3 with a standard deviation of 10.2 years; the minimum was 1 year, and the maximum was 55 years. An average of 98% of Medicare members in each responding plan were in a Medicare health maintenance organization (HMO) contract, with the remainder being in preferred provider organization (PPO) or point of service (POS) contracts.

The only statistically significant difference ( $\chi^2 = 3.9$ ;  $P \leq .05$ ) between responders and nonresponders was the "any accreditation" indicator: those who were not accredited were more likely to respond (78.3%) than those who were accredited (61.4%). Nonstatistically significant differences between responders and nonresponders were that nonresponders were somewhat more likely to be from the South and West regions (34% each), their model was more likely IPA (71%), they were slightly less likely to be run for profit (59%), they had larger Medicare memberships (mean = 54 526, SD = 78 887), they were in business slightly fewer years (mean = 14.7, SD = 7.7), and their Medicare members were more likely to be HMO members (mean = 99.9%, SD = 0.5) instead of PPO or POS members.

The survey response rates are presented in **Table 1**. The lowest-performing group had a response rate of 69%. The middle group had a response rate of 72%. The plans in the highest-performing group had a response rate of 55%. The mean individual CDS and DQIP scores for the 90 responding plans did not differ significantly from those of the 44 nonresponders (**Table 2**).

The scores for each of the individual diabetes indicators in the top and bottom quartiles of plans are shown in **Table 3**. For the 90 responding plans, the mean CDS was 65.6. The CDSs for the high-, middle-, and low-performing plans were 77.6, 66.0, and 53.9, respectively. The differences in the clinical quality of care delivered by the plans in the top and bottom groups are considerable and are statistically significant (**Table 4**).

We found that the overall mean CDS for the 134 plans was 66.0. For the 90 plans that responded to our survey, the mean CDS was 65.6. The average number of quality interventions for the 90 responding plans was 15.3 out of a 32 possible interventions (48%). The average number of interventions for the lowest-performing group was 12.5; the average number of interventions for the middle group was 15.6, and the average number of interventions for the highest-performing group was 17.5 ( $P < .01$  for differences among means, analysis of variance F test = 5.4). In pairwise comparisons, the mean number of interventions for the lowest-performing group was significantly lower than that for the middle group or the highest-performing group. The difference between the number of interventions used by the middle and high-performing groups was not significant. Interventions related to practitioners and structural changes were different between the high-performing and low-performing groups. The mean number of practitioner interventions among the high-performing group was 7.1; it was 4.3 in the low-performing group ( $P = .004$ ). The difference in the mean number of administrative/structural interventions for high-performing versus low-performing groups also was significant (4.9 vs 4.1;  $P = .024$ ). High- and low-performing groups had similar mean numbers of member-focused interventions (0.9 vs 0.8;  $P = .807$ ).

High-performing plans, those in the top quartile, reported greater use of the surveyed systems or interventions. In the case of 9 of the interventions, the differences between the high- and low-performing plans achieved statistical significance (**Table 5**). The 9 interventions are

**Table 1.** Survey Response Rates\*

Survey Response Rate by Plan Performance	No. of Surveys Distributed	No. of Surveys Returned	Response Rate, %
Total	134	90	67.2
Lowest performing	29	20	69.0
Middle performing	72	52	72.2
Top performing	33	18	54.5

\* $\chi^2 = 3.3$  ( $df = 2$ ) and  $P \leq .20$  for the test of differences (received vs not received).

**Table 2.** Average Individual DQIP Indicator Rates and Composite Diabetes Score for HEDIS Samples of Eligible Medicare+Choice Plans for Care Rendered in 2000\*

Indicator <sup>†</sup>	Survey Responders (n = 90)		Survey Nonresponders (n = 44)		Total No. M + CPs Sent Survey (n = 134)	
	Mean	SD	Mean	SD	Mean	SD
HbA <sub>1c</sub> test	83.2	7.9	84.5	5.8	83.6	7.3
HbA <sub>1c</sub> poor control	32.3	15.0	31.5	14.1	32.1	14.7
Eye exam	62.3	15.2	65.4	12.5	63.3	14.4
Lipid profile	82.9	7.0	82.3	6.6	82.7	6.8
Lipid control	52.8	10.1	51.7	11.2	52.4	10.5
Nephropathy	44.8	16.0	47.7	12.5	45.8	14.9
Composite diabetes score	65.6	8.7	66.7	7.8	66.0	8.4

\*DQIP indicates Diabetes Quality Improvement Program; HbA<sub>1c</sub>, glycosylated hemoglobin; HEDIS, *Health Plan Employer Data and Information Set*; M + CP, Medicare+Choice plan.

<sup>†</sup>Responders do not differ statistically from nonresponders on any of the individual indicators or the aggregated composite diabetes score.

**Table 3.** Mean Composite Diabetes Score for Responding Medicare+Choice Plans for Care Rendered in 2000 (N = 90 plans)

Indicator	Top 25% Medicare+Choice Plans (n = 18)		Middle 25%-75% Medicare+Choice Plans (n = 52)		Bottom 25% Medicare+Choice Plans (n = 20)	
	Mean	SD	Mean	SD	Mean	SD
HbA <sub>1c</sub> test	90.3	3.9	84.1	4.3	74.4	9.8
HbA <sub>1c</sub> poor control	20.1	6.2	29.9	9.5	49.7	17.4
Eye exam	78.6	9.7	62.0	11.1	48.5	14.8
Lipid profile	87.7	5.2	83.9	4.9	75.9	8.0
Lipid control	63.1	6.9	53.1	5.2	42.9	12.7
Nephropathy	66.2	15.4	42.5	10.5	31.5	7.4
Composite diabetes score	77.6	4.6	66.0	3.4	53.9	5.0

HbA<sub>1c</sub> indicates glycosylated hemoglobin.

(1) computer-generated reminders to practitioners, (2) physician champions (strong advocates for quality, identified as physician leaders), (3) opportunities for any practitioner input, (4) practitioner quality-improvement work groups, (5) support for use of diabetes care guidelines, (6) academic detailing to physicians, (7) diabetes self-management education, (8) use of diabetes disease registries, and (9) availability of lab results.

We assessed possible relationships among interventions, structural variables such as profit status, and region. Several multivariate regression models were

tested. Because the number of variables was large and the survey sample size small (n = 90), the regression model-building did not include testing for interaction terms and started with the univariate variables significantly associated with the CDS. We constructed several sets of regression models.

The first set of models consisted of structural variables including total Medicare membership, years in HMO business, percent Medicare members in HMO contracts, accreditation and tax status, business model, and region. The business model dichotomized IPA model

versus staff, group, or other model. The 4 CMS regions (Northeast, Midwest, West, and South) were analyzed as a set of 3 dummy variables. A second separate set of regression models included survey items significantly associated with CDS on the univariate level. The final selection of the variables in the models was derived by stepwise and confirmed by backward elimination approaches.

In the modeling of structural variables and CDS as an outcome, tax status, total Medicare membership, and accreditation analyzed as the number of National Committee for Quality

Assurance accreditation points were significant predictors of managed care plan performance in diabetes care. Standardized betas were .25 ( $P \leq .01$ ), .26 ( $P \leq .01$ ), and .25 ( $P \leq .01$ ) with an adjusted multivariate coefficient of determination ( $R^2$ ) of .23 for stepwise regression. Performing a multivariate analysis of just the survey items and CDS, level of practitioner participation for any practitioner input and use of guidelines software for practitioners were significant predictors of CDS. Standardized betas were .32 ( $P \leq .004$ ) and .23 ( $P \leq .04$ ) with an adjusted  $R^2$  of .17.

The last model combined predictors from the 2 sets of structural and survey items and CDS. The 4 variables described above remained significant. In this final model, the adjusted  $R^2$  was .30 (F test = 10.5;  $P \leq .001$ ). Standardized betas for the items were .26 ( $P \leq .01$ ) for any practitioner input, .22 ( $P \leq .03$ ) for practitioners' use of guidelines software, .19 ( $P \leq .05$ ) for tax status, and .33 ( $P \leq .001$ ) for total Medicare membership.

## DISCUSSION

Although excellent analyses of the use of chronic-disease management strategies and interventions have suggested an association between these strategies/interventions and clinical quality,<sup>10,18</sup> we believe this study is the first to associate the use of interventions and systems with the clinical performance in delivering diabetes care by all managed care plans serving the

**Table 4.** Statistical Tests for Differences in Mean Indicator Rates Between 3 Levels of Performance\*

Indicator	Comparison of Highest- and Lowest-performing Groups by the <i>t</i> Test		Comparison of All 3 Performance Levels by ANOVA <sup>†</sup>	
	<i>t</i> Test ( <i>df</i> = 36)	<i>P</i>	F Test ( <i>df</i> = 2, 87)	<i>P</i>
HbA <sub>1c</sub> test	6.4	<.001	35.5	<.001
HbA <sub>1c</sub> poor control	6.8	<.001	35.8	<.001
Eye exam	7.3	<.001	31.2	<.001
Lipid profile	5.3	<.001	21.8	<.001
Lipid control	6.0	<.001	31.9	<.001
Nephropathy	9.0	<.001	49.0	<.001
Composite diabetes score	15.1	<.001	161.1	<.001

\*ANOVA indicates analysis of variance; HbA<sub>1c</sub> glycosylated hemoglobin.

<sup>†</sup>All pairwise comparisons of the 3 performance groups were statistically significant using Tukey's least significant difference test.

Medicare population. The findings among the 90 managed care plans responding to our survey showed a somewhat higher use of systems and interventions than did the Casalino and associates survey of 1040 large medical groups.<sup>19</sup> Casalino and associates reported use of 5.1 out of 16 (32%) possible organized processes for managing care. In their survey, 50% of groups were using 4 or fewer of 16 processes. The Casalino et al study did not attempt to link clinical performance to the implementation of systems or interventions. Differences between the Casalino et al paper and this study (eg, surveying large medical groups instead of managed care plans) are major enough that direct comparisons may not be meaningful. However, theirs is the only published study of which we are aware that quantifies the presence of components of the chronic-care model in organized units of practices.

Beyond ascertaining the number of interventions, we attempted to determine which interventions were associated with differences in clinical quality. In a cross-sectional, observational study, it is not possible to assign causality. However, we found that of the 9 interventions that occurred significantly more frequently in the high-performing plans, 7 were linked closely to programs, activities, or approaches that are directed primarily toward the provider (reminders to practitioners, physician champions, opportunity for practitioner input into quality-improvement activities, practitioner quality-improvement work groups, supporting physician use of

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**Table 5.** Comparison of Survey Results Among High- and Low-performing Managed Care Plans as Determined by the Composite Diabetes Score

Survey Element	Percentage (No.) of Managed Care Plans		Significance Level by the Chi-Square Test
	High Performing (n = 18)	Low Performing (n = 20)	
<b>Practitioner-focused initiatives</b>			
High-volume practitioners identified	67 (12)	70 (14)	.83
Practitioner incentives/disincentives	28 (5)	20 (4)	.57
Manual reminders used for practitioners	44 (8)	55 (11)	.52
Mailed lists of patients who have not received a service to practitioners	78 (14)	55 (11)	.14
Computer-generated reminders sent to practitioners	39 (7)	5 (1)	.01
Practitioner performance feedback	72 (13)	55 (11)	.27
Physician champion	61 (11)	20 (4)	.01
Opportunities for any practitioner input	94 (17)	55 (11)	.01
Practitioners focus groups	22 (4)	15 (3)	.57
Practitioner surveys	22 (4)	5 (1)	.12
Practitioner QI work groups	83 (15)	40 (8)	.01
Use of diabetes care guidelines supported	67 (12)	30 (6)	.02
Care guidelines & CME programs	44 (8)	25 (5)	.21
Care guidelines & education (academic detailing)	39 (7)	10 (2)	.04
Care guidelines support software	17 (3)	0 (0)	.06
<b>Member-focused initiatives</b>			
Mailed or e-mailed reminders to members	94 (17)	85 (17)	.34
Telephone reminders to members	50 (9)	30 (6)	.21
Direct member incentives	22 (4)	15 (3)	.57
Disease management programs, any	78 (14)	80 (16)	.87
Identification of members with diabetes	78 (14)	80 (16)	.87
Identification of high-risk members	72 (13)	45 (9)	.09
Process and outcomes measurement	78 (14)	60 (12)	.24
Routine reporting of feedback to patients and practitioners	56 (10)	45 (9)	.52
Use of information technology	33 (6)	40 (8)	.67
Opportunities for member input, any	67 (12)	40 (8)	.10
Member focus groups	17 (3)	15 (3)	.89
Member surveys	50 (9)	30 (6)	.21
Consumer advisory groups	17 (3)	15 (3)	.89
Diabetes self-management education—formal instruction	61 (11)	20 (4)	.01
<b>Administrative/structural initiatives</b>			
MCO use of diabetes disease registry	78 (14)	40 (8)	.02
Any use of electronic medical records by practitioners for diabetes	50 (9)	25 (5)	.11
MCO access to claims/encounter pharmacy data for more than half of members	78 (14)	85 (17)	.57
MCO access to claims data for lab tests for more than half of members	89 (16)	95 (19)	.49
MCO access to lab results for more than half of members	67 (12)	35 (7)	.05
MCO access to claims/encounter data for vision care for more than half of members	94 (17)	75 (15)	.10
<b>Community/local initiatives</b>			
MCO involvement in community/local programs	50 (9)	45 (9)	.76

CME indicates continuing medical education; MCO, managed care organization; QI, quality improvement.

guidelines, academic detailing to physicians, and feedback to physicians of laboratory test results for more than half of patients), in contrast to activities directed primarily toward members (eg, reminders to members).

These findings are intriguing in relation to the sources of variation in care. Krein and colleagues recently reported that in the Veterans Health Administration the source of most variation in care provided to patients is not at the level of the physician but at the level of the facility.<sup>20</sup> Earlier studies also suggested that the majority of variation in care does not occur at the level of the individual physician.<sup>21-24</sup> Although we did not examine variability at the level of the physician, we found that the physician-directed interventions are the ones most closely associated with higher HEDIS quality scores for diabetes. This suggests that the role of a facility or health plan may be to create an environment that supports physician performance and enhances the physician's role in ensuring quality. Cabana and colleagues write that overcoming organizational and external barriers is as important as clinician knowledge or attitudes regarding guideline adherence.<sup>25</sup>

We found that the information-system components were somewhat less related to high or low quality of care than were physician-related components. The information-system components that we surveyed were use of electronic medical records, care management software, computer-generated reminders, decision support tools, and availability of pharmacy, laboratory, and eye care data in electronic systems. Of these components of information systems, only use of computer reminders, use of clinical-guidelines software/registries, and availability of lab results were statistically different in the high-performing and low-performing groups. In general, the literature has supported an association between improvements in care and use of information systems. For example, recent work on the use of electronic registries is consistent with care improvements.<sup>26-29</sup> Given the burden associated with implementation and up-keep of information systems, it is important to ensure that the systems put in place provide the maximal support to clinical care.

The only member-focused intervention in this survey that was statistically different among those providing the highest-quality and lowest-quality diabetes care was diabetes self-management formal instruction. The intervention of obtaining member input regarding initiatives approached statistical significance.

Our data suggest that interventions as predictors of CDS are associated with MCO membership size and tax status, but not years in business, accreditation status, region, or business model. One must be cautious in interpreting the multivariate analysis, given that the

total number of plans was relatively small and there were many possible interventions. For example, only 3 responding plans used clinical-guidelines software. The data are consistent, however, with an observation that larger, nonprofit plans are more likely to promote key interventions.

There is extensive literature on the individual interventions that we studied. A general conclusion, supported by a meta-analysis of 41 studies looking at a heterogeneous mix of interventions, was that multifaceted interventions hold the key to quality improvement.<sup>18</sup> Our work supports this conclusion in that the lowest-performing plans used the fewest number of interventions.

The most significant limitation to the study is that data on systems and interventions in place were collected by self-report without verification of the accuracy of the reports. Respondents may have been influenced to couch answers in a light that they feel would most favorably reflect their plans. However, interrater reliability in the limited pilot testing suggests consistency, if not accuracy, of the reporting. A second limitation could be response bias if plans that did not respond differed significantly from those that did respond. Third, there are only 38 total plans in the upper and lower quartiles. This limited sample size ensures that the most important effects are those that are found (ie, found to have significance in this smaller group), which suggests that these differences are quite large and potentially meaningful. Fourth, our unit of analysis is the managed care plan and our findings may not necessarily be applicable to either non-Medicare managed care plans or individual physician practices. Last, another limitation that should be addressed in future research is that this survey did not explore the manner and intensity with which each of these interventions was implemented.

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**CONCLUSIONS**

A survey about systems of care and quality-improvement interventions administered to Medicare managed care plans demonstrated that, overall, an average of 15.3 out of a possible 32 interventions were reported by the 90 plans responding to the survey. Plans achieving the highest quality of diabetes care, based on the HEDIS scores, also reported the greatest efforts to support and enhance the physician role in providing high quality of care for diabetes.

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Appendix on following page.

## Appendix. Definitions of Elements Used in the Survey

### Practitioner-focused initiatives

- *Practitioner.* A practitioner is defined as a clinician (eg, physician, nurse practitioner, physician assistant).
- *High-volume practitioners.* Managed care organizations (MCO) identified practitioners who care for high numbers of members with diabetes.
- *Practitioner incentives/disincentives.* The MCO provided either incentives, disincentives, or both, such as financial bonuses, financial withholds, or nonmonetary rewards such as gift certificates to practitioners that were related to achievement of benchmarks in diabetes care (eg, patient satisfaction, glycosylated hemoglobin [HbA<sub>1c</sub>] testing rates).
- *Practitioner reminder systems.* The MCO sent information or materials to practitioners to increase adherence to diabetes clinical guidelines (eg, chart stickers, real-time generated reminders linked to patient visits). Subcategories that may or may not be present and were listed in the survey as separate items for response are:
  - Manual reminders (eg, chart stickers or flow sheets).
  - Mailed lists (lists of patients without evidence of having received a service such as an HbA<sub>1c</sub> test).
  - Computer-generated reminders (any computer-generated note that prompts a practitioner to order a service at the time of a patient visit).
- *Practitioner performance feedback/performance profile reports/audit and feedback.* The MCO shared performance reports with practitioners that display their performance. The reports may also allow comparison against a benchmark rate (local, state, or national).
- *Physician champion.* The MCO designated physician champion(s); that is, locally respected clinicians with expertise in diabetes care. These clinicians are enlisted to motivate practitioners, and encourage both practitioner participation and cooperation with quality-improvement activities.
- *Opportunities for practitioner input.* The MCO provided formal opportunities for practitioner input regarding perceived barriers and suggested solutions for diabetes quality improvement. Subcategories that may or may not be present and were listed in the survey as separate items for response are:
  - Focus groups.
  - Practitioner surveys.
  - Practitioner participation in quality-improvement work groups.
- *Diabetes care guidelines and practitioner education.* The MCO provided and supported use of diabetes care guidelines (ie, practice guidelines, treatment protocols, care pathways, clinical guidelines). Guidelines included systematically developed, standardized specifications to assist practitioner and patient decisions about appropriate healthcare under specific clinical circumstances. Subcategories that may or may not be present and were listed in the survey as separate items for response are:
  - Guidelines distributed by mail or e-mail only.
  - Guidelines distributed and also supported by:
    - Formal training sessions (continuing medical education programs).
    - Academic detailing (visits to practitioner offices to explain and reinforce the provided guidelines).
    - MCO-distributed software such as care management software or automated decision support software.

### Member-focused initiatives

- *Member reminder systems.* The MCO sent reminders to members to help them remember scheduled visits, self-monitoring, and testing for diabetes. Reminders could have consisted of telephone calls, e-mails, postcards, or other methods of communication. Subcategories that may or may not be present and were listed in the survey as separate items for response are:
  - Mailed or e-mailed reminders to eligible members of the MCO.
  - Telephone reminders to eligible members of the MCO.
- *Member incentives.* The MCO used member incentives such as coupons for goods or a lottery for gifts after members provided evidence of receiving certain services for diabetes (eg, eye exams, lab tests, all indicated tests within 1 year).
- *Diabetes disease management/clinical case or care management program.* Disease management is defined as any systematic, multifaceted program devoted to the care of identified populations characterized by the presence of a chronic disease (diabetes). It generally includes a written assessment of clinical and related needs of patients, development of a plan of services to meet those needs, arranging and monitoring delivery of services, and evaluating the effectiveness and need for continuation of services. An element of disease management often is assigning responsibility for care of the patient to a case or care manager. Subcategories that may or may not be present and were listed in the survey as separate items for response are:
  - Disease management program had a process for identifying eligible members.
  - Disease management program had risk identification and matching of intervention with need.
  - Disease management program had population-based process and outcome measurements.
  - Disease management program had routine reporting/feedback among the patient, practitioner, health plan, and disease management program.
  - Disease management program used information technology such as software for decision support and call-back systems.

(Appendix continued)

**Appendix.** Definitions of Elements Used in the Survey (*Continued*)

- *Opportunities for member input.* The MCO provided formal opportunities for member input regarding perceived barriers and suggested solutions for quality improvement in diabetes care. Subcategories that may or may not be present and were listed in the survey as separate items for response are:
  - Focus groups.
  - Mailed surveys to members.
  - Member/consumer advisory groups.
- *Diabetes self-management education.* The MCO provided diabetes self-care information to members on topics such as diet, blood glucose monitoring, routine testing, and foot care (eg, pamphlets, booklets, guidelines, videos, Web postings, e-mail materials). Subcategories that may or may not be present and were listed in the survey as separate items for response are:
  - Education materials provided by mail, e-mail, or Internet Web site only.
  - Member education materials provided and supported by formal instruction by trained clinical educators at individual group sessions.

**MCO administrative/structural initiatives and characteristics for diabetes care**

- *Diabetes disease registry.* The MCO had a disease registry database that was updated at least annually by the MCO with patient-specific information about members with diabetes and that could be used for purposes of planning, tracking, analysis, and improvement. Subcategories that may or may not be present and were listed in the survey as separate items for response are:
  - Disease registry with member list only.
  - Disease registry with member list and disease-specific information (eg, tests performed, medication).
  - Disease registry with list of members, disease-specific information, and test results.
  - Disease registry with list of members, disease-specific information, and test results that is capable of generating reminders and/or other functions such as patient tracking, analysis, and improvement.
- *Information-systems capabilities.* These refer to the data availability and capability of the MCO. Subcategories that may or may not be present and were listed in the survey as separate items for response are:
  - Electronic medical records utilized by MCO practitioners for care of patients with diabetes.
  - MCO access to member-specific claims/encounter information regarding medications and prescriptions filled (medication name, dosage, quantity, date filled).
  - MCO access to member-specific claims/encounter information regarding lab tests, including codes and dates.
  - MCO access to member-specific claims/encounter information regarding lab tests, including codes, dates, and results.
  - MCO access to member-specific claims/encounter information regarding vision care services, including visit date and procedure/diagnosis codes.

**Community/local initiatives for diabetes care**

Free-text entry of any local or community initiatives for diabetes care during the study period within the MCO service area(s) where the MCO was a participant.