Use of Services by Diabetes Patients in Managed Care Organizations

Development of a diabetes surveillance system

CDC DIABETES IN MANAGED CARE WORK GROUP:
MICHAEL M. ENGELGAU, MD
LINDA S. GEISS, MA
DIANE L. MANNINEN, PHD
CARLYN E. ORIANS, MA
EDWARD H. WAGNER, MD
NEAL M. FRIEDMAN, MD
JUDITH S. HURLEY, MS, RD
KATHRYN M. TRINKAUS, PHD
DEBORAH SHATIN, PHD
KRISTA A. VAN VORST, MS

OBJECTIVE — To develop a diabetes surveillance system that estimates the prevalence of diabetes and characterizes service use in diverse managed care organizations (MCOs).

RESEARCH DESIGN AND METHODS — Computerized inpatient, pharmacy, outpatient, and laboratory records were used to develop an algorithm to identify diabetes patients and to develop surveillance indicators common to the three participating MCOs. Using 1993 data, the availability, specifications, and limitations of various surveillance indicators were determined.

RESULTS — An extensive set of diabetes surveillance indicators was identified from the four sources of data. Consistent data specifications across MCOs needed to consider variation in the type of data collected, a lack of documentation on level of coverage, differences in coding data, and different models of health care delivery. A total of 16,363 diabetes patients were identified. The age-adjusted prevalence of diabetes ranged from 24 to 29 per 1,000 enrollees. Approximately one-third of patients with diabetes (32–34%) were taking insulin. The majority had one or more visits to a primary care physician during the year (72–94%). Visits to specialists were less frequent. Ophthalmologists and optometrists were the most commonly used specialists: 29–60% of the patients with diabetes at the three MCOs had visited an ophthalmologist or optometrist. About one-fifth had an overnight hospital stay during the year.

CONCLUSIONS — This diabetes surveillance system is a useful tool for MCOs to track trends in prevalence of diabetes, use of health services, and delivery of preventive care to individuals with diabetes. This system may also be useful for health care planning and for assessing use changes after new developments in diabetes care or new quality management initiatives.

Diabetes Care 21:2062–2068, 1998

From the Division of Diabetes Translation (M.M.E., L.S.G.), National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia; the Battelle Centers for Public Health Research and Evaluation (D.L.M., C.E.O.); the Group Health Cooperative of Puget Sound (E.H.W.), Seattle, Washington; Lovelace Health Systems (N.M.F); the Southwest Center for Managed Care Research (J.S.H., K.M.T.), Lovelace Respiratory Research Institute, Albuquerque, New Mexico; and United HealthCare (D.S., K.A.V.V.), Minnetonka, Minnesota.

Address correspondence and reprint requests to Michael M. Engelgau, MD, Division of Diabetes Translation, Mailstop K-10, Centers for Disease Control and Prevention, 4770 Buford Highway, NE, Atlanta, GA 30341-3724. E-mail: mxe1@cdc.gov.

Received for publication 24 July 1998 and accepted in revised form 3 September 1998.

Abbreviations: CDC, Centers for Disease Control and Prevention; ER, emergency room; ICD-9, *International Classification of Diseases, Ninth Revision*; MCO, managed care organization; NHIS, National Health Interview Survey.

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

Managed care organizations (MCOs) are becoming the main source of health care services for individuals with diabetes. In 1990, 95% of employee health care benefits were under some form of managed care (1). Increasing demands for data are being placed on MCOs externally, by employer-purchasers and accreditation agencies, and internally, by their own adoption of disease management strategies and quality assurance initiatives (2). Diabetes surveillance systems could help MCOs determine the prevalence of diabetes among subscribers, assess the health services delivered, and understand the patterns of service use by patients with diabetes, but there have been few efforts to develop diabetes surveillance systems for use within or across MCOs.

Using computerized administrative data maintained by three MCOs, we developed a diabetes surveillance system in diverse managed care settings that identified patients with diabetes and described their use of health care resources. The purpose was to provide a basis for monitoring changes in patterns of care resulting from new developments in diabetes care or new quality management initiatives to allow for comparisons both across MCOs and with national surveillance data. This report describes the development of and findings from a diabetes surveillance system.

RESEARCH DESIGN AND METHODS — Investigators at the Centers for Disease Control and Prevention and the Battelle Centers for Public Health Research and Evaluation conducted this study in close collaboration with the Group Health Cooperative of Puget Sound, Lovelace Health Systems, and a United HealthCare affiliate, three MCOs that provided diversity both in the types of health care plans they represent (i.e., staff model versus independent practice association) and in the populations they serve (patients in the northwest, southwest, and southeast regions of the country). The three MCOs also maintain different types of demographic and utilization data and store their data in different formats.

We used four sources of computerized data records to identify patients with diabetes at the three MCOs: inpatient (hospitalization) records, pharmacy records, outpatient visit records, and laboratory test records. Patients were eligible for inclusion in the data set if, in 1993, they had one or more overnight hospital stays with a primary or secondary diagnosis of diabetes (*International Classification of Diseases, Ninth Revision* [ICD-9] 250); had filled one or more prescriptions for either insulin (regular insulin, NPH insulin, lente insulin, ultralente insulin, protamine zinc insulin) or an oral hypoglycemic medication (tolbutamide, chlorpropamide, acetohexamide, tolazamide, glyburide, glipizide, metformin); had two or more outpatient visits with any diagnosis of diabetes (ICD-9 250); or had undergone two or more glycosylated hemoglobin laboratory tests (*Current Procedural Terminology* [CPT] code 83036). The case definition algorithm we used did not distinguish between type 1 and type 2 diabetes. We excluded women with a diagnosis of pregnancy during 1993 to eliminate from the data set patients with gestational diabetes. This decision also resulted in the exclusion of women with type 1 and type 2 diabetes who experienced a pregnancy in 1993.

We included five categories of variables in the surveillance data set: patient demographics, overnight hospital stays, outpatient visits, selected laboratory tests and procedures, and prescription drugs.

The surveillance data set was analyzed using SAS version 6.11. Prevalence of diabetes was computed using the age-sex distribution of 1993 commercially insured members in each of the three MCOs. The health care use patterns of the patient group were examined by insulin status and age. Descriptive analyses of prevalence and utilization data are presented as numbers, percentages, means, and rates.

Because use rates are affected strongly by age, comparisons across MCOs or with national data must address differences in age structure. In presenting rates, we therefore chose either to adjust for age or to present the data stratified by age. Age adjustment was based on 1980 estimates of the resident U.S. population and of the population with diabetes to permit comparison with national diabetes surveillance data (3). We used logistic regression to test the significance of the effect of insulin use on use of services at each MCO.

RESULTS

Surveillance indicators

We derived data specifications for each of the five variable categories in the surveillance data set (APPENDIX). In developing these data specifications, we encountered several limitations. The first problem was the lack of information on items such as race and length of hospital stay. Although there are important racial and ethnic differences in both the prevalence of diabetes and the development of diabetes complications (4), we were unable to include these variables because the three MCOs, as is common practice in the industry, do not typically collect race and ethnicity information. Thus, for this study, we did not look at racial or ethnic differences. Furthermore, one MCO did not record information on length of hospital stay for out-of-system hospitalizations. To address this problem, we used the mean length of stay for all hospitalizations of members of the MCO in 1993.

The second problem was lack of documentation on the level of coverage provided to members. For example, not all members of the three MCOs were eligible for pharmacy benefits under the terms of their specific benefit contracts, yet only one MCO identified in their database which members had pharmacy benefits and which did not. When patients pay out of pocket for care, medications, or supplies (such as glucose test strips) that are not part of their MCO benefits, they may acquire these from sources other than their MCO. Additionally, some pharmacy claims may not be entered in the MCO database when the member's copayment for a drug exceeds the drug's price. Thus, lack of coverage information may result in underestimating use of services and prescription drug use. However, the resulting pattern of insulin use we observed was remarkably similar across the three MCOs, suggesting that pharmacy coverage for insulin did not vary dramatically across the MCOs.

The third problem was differences in the administrative coding of data across the three MCOs, for example, coding for outpatient visits. One MCO used a billing area code (e.g., cardiology) to identify specialists, whereas the other two MCOs used a practice specialty code. Establishing a working definition of an outpatient visit was also problematic because of variations in billing practices. For example, at one MCO, laboratory tests could be billed by either the physician or the laboratory. Because our goal was to count the number of unique encounters, we did not count claims billed by a laboratory on the day of a physician office visit as a separate encounter.

There also was variation in the number of diagnoses that could be recorded for both outpatient visits (3 to 10) and inpatient visits (2 to 5). However, we did not note any trend between the frequency of having diabetes recorded and the number of available fields for diagnoses. Because the emphasis of our study was on the total number of hospitalizations rather than the particular diagnoses, the impact on the study results would be expected to be small. No adjustments were made to reflect the variation in the number of diagnosis fields.

A final problem that we had to address in developing data specifications was differences in the model of health care delivery and MCO structure. For example, one MCO used urgent care centers as a major source of primary care in 1993. To prevent underestimation of the use of primary care services in that MCO, we adjusted our approach to measuring the use of primary care services by combining the number of primary care encounters and the number of visits for urgent care.

Both plan structure and laboratory structure influence the delivery of services and, in turn, the ability to quantify services received. For example, some MCOs maintain centralized laboratory facilities, whereas others contract with multiple outside laboratories. Furthermore, some MCOs directly employ their physicians, whereas others rely on physicians who are loosely affiliated. These differences influenced our ability to estimate the proportion of patients who had received selected laboratory tests, particularly tests, such as cholesterol screening, that are generally delivered as part of a panel of tests. Only two of the MCOs were able to identify the tests in relevant panels. We, therefore, reported only on laboratory tests that were least affected by the use of panel tests.

Diabetes prevalence and medication use

The case definition algorithm identified a total of 16,363 individuals with diabetes at the three MCOs. The inpatient and pharmacy criteria combined identified 82% of the population. Adding the outpatient criteria raised the percentage to 94%, and the laboratory test criteria contributed the remaining 6%.

Overall, slightly more than 50% of the patients were male (MCO 1, 50.2%; MCO

Table 1—*Number of patients with diabetes and the prevalence of diabetes per 1,000 members at three MCOs by age and sex, 1993*

	MCO 1			MCO 2			MCO 3		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Age-group									
0–44 years									
n	824	896	1,720	222	217	439	357	356	713
Rate	7.7	7.5	7.6	5.8	5.8	5.8	6.7	6.7	6.7
45–64 years									
n	2,516	2,219	4,735	467	334	801	833	764	1,597
Rate	64.0	52.4	58.0	53.9	42.8	48.6	55.4	47.0	51.0
65–74 years									
n	1,499	1,488	2,987	47	24	71	466	442	908
Rate	129.0	99.0	112.1	102.8	74.1	90.9	123.2	94.6	107.4
≥75 years									
n	808	989	1,797	—*	—*	17	284	294	578
Rate	113.0	85.6	96.1			103.0	134.1	95.0	110.9
Subtotal ≥65 years									
n	2,307	2,477	4,784	55	33	88	750	736	1,486
Rate	122.9	93.2	105.5	102.4	80.7	93.0	127.1	94.7	108.7
Total									
n	5,647	5,592	11,239	744	584	1,328	1,940	1,856	3,796
Rate	34.2	29.7	31.8	15.7	12.8	14.2	26.1	24.2	25.1
Age-adjusted rate	31.7	26.0	28.6	26.1	22.2	24.3	29.9	24.6	26.9

*Number suppressed because <10 in the cell.

2, 56.0%; MCO 3, 51.1%) (Table 1). At MCOs 1 and 3, ~40% of the patients were ≥65 years; at MCO 2, <7% of the patients were in this age-group.

The prevalence of diabetes ranged from 14.2 per 1,000 enrollees at MCO 2 to 31.8 per 1,000 enrollees at MCO 1 (Table 1). Adjusting for age, the prevalence was much more uniform across the three MCOs; it ranged from a low of 24.3 to a high of 28.6 per 1,000 enrollees. In general, the prevalence increased with age and was slightly higher for male enrollees than for female enrollees.

The proportion of patients taking insulin only, oral glycemic medication only, both insulin and oral hypoglycemic medication, or no diabetes medication were similar across the three MCOs (Table 2). Of the patients, 26–28% were prescribed insulin only, 40–48% were prescribed oral hypoglycemic medication only, and ~6–7% had prescriptions for both insulin and oral hypoglycemic medication. Use of oral hypoglycemic medication was more prevalent than use of insulin among patients aged ≥45 years, whereas the reverse was true for younger patients. Of the patients with diabetes, 19–26% were prescribed neither insulin nor oral hypoglycemic medication.

Outpatient visits

In general, primary care services were used more than any other service (Table 3). The age-adjusted percentage of all patients with at least one visit to a primary care provider during the year ranged from 73% at MCO 2 to 94% at MCO 1. The rate of primary care visits was higher for patients not taking insulin than for patients taking insulin. At all three MCOs, the mean number of visits to specialists was higher for patients taking insulin.

The use of specialists varied considerably across the three MCOs. For example, endocrinologists and cardiologists were seldom used by patients at MCO 1 (5 and 9%, respectively, adjusted for age), but were used with much greater frequency at the other two MCOs (21% used endocrinologists at each, and 17 and 23% used cardiologists at MCO 2 and MCO 3, respectively). Patients at MCO 3 frequently used podiatrists (19%), unlike patients at MCOs 1 and 2 (4 and 7%). Use of orthopedists was somewhat more uniform across the three MCOs (8–13%). Eye spe-

Table 2—*Number and percentage of patients with diabetes at three MCOs by type of diabetes medication and age, 1993*

	MCO 1				MCO 2				MCO 3			
Medication	0–44 years	45–64 years	≥65 years	All ages	0–44 years	45–64 years	≥65 years	All ages	0–44 years	45–64 years	≥65 years	All ages
Insulin only	838 (49)	1,071 (23)	1,017 (21)	2,926 (26)	154 (35)	175 (22)	16 (18)	345 (26)	342 (48)	428 (27)	285 (19)	1,055 (28)
Oral agents only	537 (31)	2,382 (50)	2,461 (51)	5,380 (48)	168 (38)	418 (52)	44 (50)	630 (47)	202 (28)	685 (43)	622 (42)	1,509 (40)
Oral agents and insulin	88 (5)	344 (7)	332 (7)	764 (7)	22 (5)	51 (6)	—*	79 (6)	37 (5)	127 (8)	73 (5)	237 (6)
No medication	257 (15)	938 (20)	974 (20)	2,169 (19)	95 (22)	157 (20)	22 (25)	274 (21)	132 (19)	357 (22)	506 (34)	995 (26)

Data are *n* (%). *Number suppressed because <10 in the cell.

Table 3—*Use of physician, ER, and hospital inpatient services by patients with diabetes at three MCOs by insulin status, 1993*

	Insulin using			Non–insulin using			Total		
Type of service	MCO 1	MCO 2	MCO 3	MCO 1	MCO 2	MCO 3	MCO 1	MCO 2	MCO 3
Age-adjusted percentage of patients									
Primary care/urgent care	93.1*	65.5*	83.5*	94.8	76.7	90.5	94.1	73.3	87.9
Endocrinologist	9.8*	34.3*	38.9*	3.0	14.8	11.6	5.4	20.8	21.3
Cardiologist	11.5*	14.1	25.7*	8.4	18.1	21.9	9.3	17.1	23.1
Nephrologist	5.1*	3.4	4.8*	1.4	2.5	2.7	2.7	2.8	3.4
Ophthalmologist/optometrist	67.0*	43.0*	57.3*	55.5	26.6	49.9	59.4	31.3	52.6
Orthopedist	13.2*	6.1	15.3*	10.2	8.0	11.9	11.2	7.6	13.0
Podiatrist	5.6*	6.7	23.7*	3.0	6.8	17.3	3.8	6.9	19.2
ER	22.4*	17.6	17.3*	13.5	19.7	12.7	16.4	19.2	14.1
Hospital discharges†	27.2*	32.5*	21.9*	16.2	18.1	14.8	19.6	21.8	17.2
Number of visits (age-adjusted mean)									
Primary care/urgent care	24,026 (6.65)*	1,267 (3.27)*	6,759 (5.64)	41,917 (5.56)	3,412 (3.92)	14,777 (5.83)	65,943 (5.85)	4,679 (3.71)	21,536 (5.71)
Specialists‡	12,780 (3.56)*	1,822 (4.04)*	8,180 (6.60)*	15,692 (2.00)	1,944 (2.35)	9,961 (3.88)	28,472 (2.51)	3,766 (2.85)	18,141 (4.80)
ER visits	1,422 (0.39)*	166 (0.31)	650 (0.54)*	1,686 (0.21)	357 (0.34)	1,095 (0.43)	3,108 (0.27)	523 (0.34)	1,745 (0.46)
Hospital discharges†	1,731 (0.49)*	174 (0.46)*	398 (0.34)*	2,063 (0.26)	245 (0.27)	573 (0.22)	3,794 (0.33)	419 (0.32)	971 (0.26)

*$P < 0.05$ for insulin users compared with non–insulin users. †Overnight stay required. ‡Restricted to the following specialists: endocrinologist, cardiologist, nephrologist, ophthalmologist/optometrist, orthopedist surgeon, and podiatrist.

cialists (ophthalmologists or optometrists) were the most often used specialty, especially by patients taking insulin (43–67%). Nephrologists were the least used of the specialties analyzed at the three MCOs (3–5%).

Insulin status was associated with the use of particular types of specialists. Patients taking insulin were much more likely than patients not taking insulin to have had at least one visit to an endocrinologist and somewhat more likely to have used an ophthalmologist or optometrist during the year. Cardiologists, nephrologists, orthopedists, and podiatrists were more likely to have been used by patients taking insulin at MCOs 1 and 3, an effect that was not observed at MCO 2.

The percentage of patients using emergency room (ER) services varied by MCO and insulin status. The age-adjusted percentage of patients using ER services was highest at MCO 2, at 19%, and lowest at MCO 3, at 14%. The use of ER services was higher for insulin users at MCOs 1 and 3, but this trend was not observed at MCO 2. The age-adjusted mean number of visits to the ER was highest at MCO 3, at 0.46, and lowest at MCO 1, at 0.27. This suggests that although relatively fewer patients use the ER at MCO 3, those patients who do use the ER tend to use it more frequently.

Inpatient use

Of all patients with diabetes, 17–22% (age-adjusted) had an overnight hospital stay during the year. As shown in Table 3, inpatient hospitalization varied by insulin status. The proportion of patients taking insulin who were hospitalized overnight ranged from 22 to 33%, with an age-adjusted mean number of discharges ranging from 0.34 to 0.49. In contrast, the proportion of patients not taking insulin who were hospitalized overnight ranged from 15 to 18%, with an age-adjusted mean number of discharges from 0.22 to 0.27, half that of their insulin-taking counterparts.

The overall age-adjusted hospital discharge rate ranged from 258.3 to 331.9 per 1,000 patients with diabetes. Age-adjusted rates were at least 50% higher among insulin users than for those not using insulin. For patients using insulin, the age-adjusted rate ranged from 339.0 to 490.2 per 1,000 patients with diabetes; for patients not taking insulin, the age-adjusted rate ranged from 219.4 to 273.2 per 1,000 patients with diabetes. The use of hospital services increased with age (Table 4). The discharge rate for patients aged ≥65 years was more than twice the rate of patients in the youngest age-group.

Laboratory tests and procedures

At MCO 1 and MCO 3, at least one glycosylated hemoglobin test was administered to 81 and 74%, respectively, of the patients with diabetes (Table 5). At MCO 2, only 34% received this test. A similar pattern emerged for dilated eye examinations: 46 and 38%, respectively, of patients at MCO 1 and MCO 3 had an eye examination, compared with 23% of the patients at MCO 2. At all three settings, dilated eye examinations were more common for insulin users than for non–insulin users. About half of all patients with diabetes received the macro urine protein test at the three MCOs. The micro urine protein test, introduced in 1993, was not common at any of the MCOs.

CONCLUSIONS — The algorithm we used to identify cases of diabetes yielded diabetes prevalence estimates that are slightly lower but similar to the 1993 national prevalence estimate (29.1 per 1,000 U.S. population) (3). In fact, because our case definition relies on use of health services, it will miss the small, but potentially significant, proportion of MCO members with diabetes who do not use such services in a particular year. Additionally, the populations served by the MCOs may not reflect the U.S. population.

The proportion of patients in our population taking only insulin (27%) is lower than national estimates derived from the 1989 National Health Interview Survey (NHIS) diabetes supplement (40%) (5). Also in that national survey, only 12% of patients with diabetes were not taking any diabetes medication, a lower proportion than the 20–26% we observed. This discrepancy may be partly explained by differences in a national sample compared with a managed care population sample, by some patients in our study not having a pharmacy

Table 4—*Number of hospital discharges, discharge rate (all discharges), and hospital days among patients with diabetes at three MCOs by age and insulin status, 1993*

	Insulin using			Non–insulin using			Total		
Age-group	MCO 1	MCO 2	MCO 3	MCO 1	MCO 2	MCO 3	MCO 1	MCO 2	MCO 3
0–44 years									
Discharges*	252	31	76	88	56	43	340	87	119
Discharge rate	272.1†	176.1	200.5	110.8	212.9	128.7	197.7	198.2	166.9
Hospital days	1,386	123	301	383	260	353	1,769	383	654
45–64 years									
Discharges	624	133	162	599	171	155	1,223	304	317
Discharge rate	441.0†	588.5†	291.9†	180.4	297.4	148.8	258.3	379.5	198.5
Hospital days	3,774	992	975	2,683	1,055	867	6,457	2,047	1,842
65–74 years									
Discharges	493	—‡	94	698	15	173	1,191	20	267
Discharge rate	569.3†		410.5†	329.1	272.7	254.8	398.7	281.7	294.1
Hospital days	2,723		631	3,675	61	1,073	6,398	117	1,704
≥75 years									
Discharges	362	—‡	66	678	—‡	202	1,040	—‡	268
Discharge rate	749.5†		511.6	516.0		449.9	578.7		463.7
Hospital days	2,214		334	3,186		1,143	5,400		1,477
Subtotal ≥65 years									
Discharges	855	10	160	1,376	18	375	2,231	28	535
Discharge rate	633.8†	454.5	446.9†	400.6	272.7	332.4	466.3	318.2	360.0
Hospital days	4,937	83	965	6,861	86	2,216	11,798	169	3,181

*Overnight stay required (rate per 1,000 patients with diabetes). †$P < 0.05$ for insulin users compared with non–insulin users. ‡Number suppressed because <10 in the cell.

benefit, or by claims not being filed where copayments exceeded pharmacy costs.

The proportion of individuals who had been hospitalized in the MCO population (17–22%) was similar to that reported from 1989 national survey data (23.8%) (6). In the MCO population, hospitalization rates increased with age, and patients treated with insulin were more likely to be hospitalized than those not using insulin. National data revealed these same findings for age and increased hospitalization among type 2 patients using insulin compared with patients not using insulin (6).

In our study, the total number of visits to primary care providers and specialists combined ranged from 7–11 visits per year, which can be compared with the mean of 10 physician visits per year by diabetes patients found in the 1989 NHIS diabetes supplement. In making this comparison, however, it is important to recognize that our estimate does not represent the total number of physician visits because we restricted our measure of specialist visits to the specialists listed in Table 3. Other specialist visits (e.g., obstetrics/gynecology visits) are therefore not included in our total. Patterns of treatment in 1993 may also differ from those in 1989.

Our finding that insulin status was associated with higher use rates is consistent with the recent study by Hayward et al. (7) that found higher outpatient and laboratory use rates for patients taking insulin after controlling for patient demographics, disease severity, and disease duration. Insulin status was also associated with use of primary care and specialist providers in our study. The mean number of visits and the proportion of patients with one or more visits were higher among patients taking insulin. At MCO 2 and MCO 3, the mean number of visits to specialists actually exceeded the mean number of visits to primary care providers for patients taking insulin. This reflects the fact that MCO 2 and MCO 3 used endocrinologists to treat patients, whereas MCO 1 relied on primary

Table 5—*Percentage (age-adjusted) of patients with diabetes at three MCOs receiving selected laboratory tests and procedures by insulin status, 1993*

	Insulin using			Non–insulin using			Total		
Test/procedure	MCO1	MCO2	MCO3	MCO1	MCO2	MCO3	MCO1	MCO	MCO3
HbA_{1c} (≥1 test)	80.3	38.9*	73.8	81.3	32.1	73.9	81.0	34.3	73.8
HbA_{1c} (≥2 tests)	52.5*	21.9*	49.2*	56.0	17.3	45.2	54.7	18.9	46.4
Dilated eye exam	54.1*	34.6*	43.2*	41.8	18.6	35.1	46.0	23.2	37.8
Urine protein (macro)	57.0*	43.7	56.8	48.7	48.9	53.5	51.5	47.4	54.7
Urine protein (micro)	0	0.5	0.9*	0	0.2	0.1	0	0.3	0.5

*$P < 0.05$ for insulin users compared with non–insulin users.

care providers as the major source of care for patients taking insulin. Insulin use did not affect receipt of procedures, with the exception of dilated eye examinations.

The measures reported here should be viewed as a core data set of variables for describing or assessing the delivery of health care services to patients with diabetes that can be expanded in the future. The data set contains a limited number of measures that can be readily obtained from MCOs with internal data systems for recording hospital discharges, outpatient encounters, laboratory tests, and pharmacy use. Individual managed care plans may well be interested in expanding this data set to include other use or performance measures. Guidelines for the prevention or reduction of major diabetic complications recommend some elements of care that we were unable to capture adequately (8). These include foot care, cholesterol screening, serum creatinine measurement, and test strips used in the self-management of diabetes. MCOs may have the opportunity to improve their ability to monitor these services through their systems of computerized data records. Moreover, as MCOs move toward greater incorporation of clinical data in their electronic records, the potential to expand a surveillance system to include outcome measures will increase greatly.

This report spells out some of the difficulties that MCOs are likely to encounter in developing a surveillance system. But as this study showed, the difficulties are not insurmountable and there are sufficient similarities in the data systems maintained by MCOs to permit successful surveillance across health plans. Methods such as those found in this report and other methods such as those developed by the National Committee for Quality Improvement (NCQA) (e.g., Health Plan for Employers Data and Information Set [HEDIS]) can assist MCOs in development and refinement of their health information systems. The result will be information systems that are practical, appropriate, and useful and that can be broadly implemented.

The addition of subsequent years of data will enable investigators examining MCOs to study changes in patterns of care. Ultimately, by adding clinical data to the use measures described here, diabetes surveillance systems in managed care settings may be able to systematically examine the link between process measures and outcome measures in diabetes care (9). The use of surveillance data from multiple health plans

Table A1—*Data specifications*

Description	Specification
I. Patient demographics	
Age as of 7/1/93	
Sex	
Days enrolled in 1993	
Drug benefits offered	Yes or no
II. Outpatient visits	
Total outpatient visits	Broad definition—any visit not connected to hospital
No. visits where diabetes listed	ICD-9 code 250 as any listed diagnosis
No. visits where diabetes listed as primary	ICD-9 code 250 listed first or primary
No. visits to physician	Includes both doctors of medicine (MD) and doctors of osteopathy
No. visits to primary care provider	Includes family practitioner, pediatrician, internal medicine, and doctors of osteopathy
No. visits to endocrinologist	
No. visits to cardiologist	
No. visits to nephrologist	
No. visits to ophthalmologist/optometrist	
No. visits to orthopedic surgeon	
No. visits to podiatrist	
No. visits to urgent care	
No. visits to emergency room	
III. Hospital stays (inpatient/overnight)	
Total hospital discharges	Overnight stay required
No. hospital visits with diabetes listed	ICD-9 code 250 as any listed diagnosis
No. hospital visits with diabetes primary	ICD-9 code 250 listed first or primary
No. hospital visits for ketoacidosis	ICD-9 codes 250.1, 250.3
No. hospital visits for stroke	ICD-9 codes 430–434, 436–438
No. hospital visits for hypoglycemia	ICD-9 code 251
No. hospital visits for major cardiovascular disease	ICD-9 codes 390–448
No. hospital visits for ischemic heart disease	ICD-9 codes 410–414
No. hospital visits for lower-extremity amputation	ICD-9 procedure code 84.1; CPT-4 codes 28810, 28820, 28825, 28800, 28805, 27888–9, 27880–2, 27886, 27590–2, 27596, 27598, 27290, 27295
No. hospital visits for kidney transplants	ICD-9 procedure code 55.6; CPT-4 codes 50360, 50365
Total days hospitalized for any reason	Substituted average length of stay for the plan in that year if no. days not available for a particular hospitalization (i.e., an offsite hospital)
IV. Lab tests or procedures performed, outpatient only	
No. glycosylated hemoglobin tests	CPT-4 code 83036
Dilated eye examination	CPT-4 codes 92002, 92004, 92012, 92014, 92018, 92019, 92225, 92226, 92235, 92250
Urine protein 1	CPT-4 codes 81000–81003
Urine protein 2	CPT-4 codes 82042–82044
Creatinine clearance	CPT-4 code 82575 and relevant panel tests
Laser treatment for retinopathy	CPT-4 codes 67210, 67228
No. lower-extremity amputation (outpatient only)	CPT-4 codes 28810, 28820, 28825, 28800, 28805, 27888–9, 27880–2, 27886, 27590–2, 27596, 27598, 27290, 27295; ICD-9 procedure code 84.1

continued on p. 2068

Table A1 (*continued*)

Description	Specification
V. Prescription drugs	
Prescription for oral glycemic medication	Tolbutamide, chlorpropamide, acetohexamide, tolazamide, glyburide, glipizide, metformin
Prescription for insulin	Regular insulin, NPH insulin, lente insulin, ultralente insulin, protamine zinc insulin
Prescription for velosulinR or HumulinBr	To identify pump use
No. prescriptions for glucagon	No. fills
Prescription for ACE inhibitors	Quinapril, ramipril, captopril, benazepril, fosinopril, lisinopril, enalapril

may also suggest areas for future health services research, such as the effect of differences in the mix of primary and specialty care on the quality of care for individuals with diabetes.

Finally, this surveillance system can be useful in assessing changing patterns of care in response to changing guidelines or new developments in diabetes care. The identification of these patterns and others using surveillance data can provide critical information to guide health plans, policy makers, health care providers, quality improvement managers, and others in their efforts to improve care delivered to individuals with diabetes.

APPENDIX — Data specifications are shown in Table A1.

References

1. Quickel KE Jr: Diabetes in a managed care system. *Ann Intern Med* 124:160–163, 1996
2. Selby JV: Linking automated databases for research in managed care settings. *Ann Intern Med* 127:719–724, 1997
3. Centers for Disease Control and Prevention: *Diabetes Surveillance, 1997*. Atlanta, GA, U.S. Department of Health and Human Services, 1997
4. Harris MI: Summary. In *Diabetes in America*. 2nd ed. Harris MI, Cowie CC, Stern MP, Boyko EJ, Reiber GE, Bennett PH, Eds. Washington, DC, U.S. Govt. Printing Office, 1995, p. 1–13 (NIH Publ. no. 95-1468)
5. National Center for Health Statistics: *1989 National Health Interview Survey* (database on CD-ROM). Washington, DC, U.S. Govt. Printing Office, 1993 (CD-ROM Ser. 10, no. 3.)
6. Aubert RE, Geiss LS, Ballard DJ, Cocanougher B, Herman WH: Diabetes-related hospitalization and hospital utilization. In *Diabetes in America*. 2nd ed. Harris MI, Cowie CC, Stern MP, Boyko EJ, Reiber GE, Bennett PH, Eds. Washington, DC, U.S. Govt. Printing Office, 1995, p. 553–569 (NIH Publ. no. 95-1468)
7. Hayward RA, Manning WG, Kaplan SH, Wagner EH, Greenfield S: Starting insulin therapy in patients with type 2 diabetes: effectiveness, complications, and resource utilization. *JAMA* 278:1663–1669, 1997
8. American Diabetes Association: Clinical practice recommendations 1997. *Diabetes Care* 20 (Suppl. 1), 1997
9. Iezzoni LI: Assessing quality using administrative data. *Ann Intern Med* 127:666–674, 1997