

Longitudinal Assessment of a Diabetes Care Management System in an Integrated Health Network

DAVID L. LARSEN, RN, MHA; WAYNE CANNON, MD; and STEVEN TOWNER, MD

ABSTRACT

OBJECTIVE: To describe the results of longitudinal assessment of the results of a disease management process developed in a large integrated health care system that successfully improved care for patients with diabetes. Outcome measures included rates of testing of hemoglobin A1c (HbA1c) and low-density lipoprotein (LDL), rate of annual eye exams, and LDL and HbA1c values.

METHODS: Intermountain Health Care (IHC) initiated the development of a Diabetes Care Management System (DCMS) in early 1998. The DCMS was developed as a comprehensive population-based disease management system. It includes provider education programs; performance feedback to physicians; clinical quality performance incentives for physicians; patient education programs; patient incentive, reminder systems to encourage compliance with best care process models; and tracking of physician behavior change and patient compliance with diabetes therapy. A multifaceted intervention and education approach was chosen because of the complexity of the diabetes treatment process.

RESULTS: The percentage of patients with at least one annual HbA1c test increased from 78.5% in 1998 to 90.5% in 2002. During the same time period, the percentage of patients whose most recent HbA1c was less than 7.0 increased from 33.5% to 52.8%, average HbA1c decreased from 8.1 to 7.3, and the percentage of patients whose most recent HbA1c was greater than 9.5 decreased from 34.6% to 21.4%. The percentage of patients who had an LDL cholesterol screening test within the prior 2 years increased from 65.9% in 1998 to 91.7% in 2002. During the same time period, the percentage of patients whose most recent LDL cholesterol was less than 130 mg/dL increased from 39.9% to 69.8%. The percentage of diabetes patients who had an annual eye exam increased from 52% in 1998 to 62% in 2002.

CONCLUSION: A multifaceted approach to improving diabetes management has led to improved performance in clinical measures related to diabetes care that have been shown to reduce the risk of patients with diabetes developing diabetes-related complications. All components of the diabetes management continuum of care, including primary care physicians, specialists, office staff, patients, diabetes educators, and others, were involved in the care improvement activities.

KEYWORDS: Diabetes, Disease management, Clinical practice guideline, Care process model, Integrated health system, Registry

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Aggressive management of diabetes is well known to decrease both mortality and morbidity from complications related to the disease. From 1998 to 2003, Intermountain Health Care (IHC) developed a system-wide initiative to improve care for patients with diabetes. This initiative is known as the Diabetes Care Management System (DCMS). It is a coordinated effort involving IHC senior management, IHC-employed physicians, network physicians not employed by IHC who see IHC Health Plans patients, and IHC Health Plans, all of which is coordinated through the Primary Care Clinical Program of IHC. Specific goals of the DCMS include the following:

1. increase the annual testing rate of hemoglobin A1c (HbA1c) in adult patients with diabetes,
2. increase the percentage of adult diabetes patients with favorable HbA1c values,
3. decrease the percentage of adult diabetes patients with unfavorable HbA1c values,
4. increase the percentage of adult patients with diabetes tested at least once every 2 years for low-density lipoprotein (LDL) cholesterol,
5. increase the percentage of adult diabetes patients with favorable LDL values,
6. decrease the percentage of adult diabetes patients with unfavorable LDL values, and
7. increase the percentage of adult diabetes patients with an annual diabetes eye exam.

IHC is an integrated health network with 400 employed physicians, 100 outpatient clinics, 22 hospitals, and a health plan that insures 467,000 members. There are also approximately 800 affiliated non-IHC-employed primary care physicians.

Disease management activities throughout the system are led by "clinical programs." Clinical programs established to date include cardiovascular, women and newborn, neuromusculoskeletal, pediatric subspecialty, oncology, behavioral health, intensive medicine, and primary care (Figure 1). Clinical programs are formed around like processes of clinical care such as the Primary Care Clinical Program. Each clinical program builds Care Management Systems (disease management programs) around the highest-volume clinical processes such as asthma, diabetes, depression, hypertension, heart failure, otitis media, and attention deficit hyperactivity disorder for primary care. Each clinical program provides the resources necessary to focus on the development, implementation, and outcomes measurement of each clinical process.

Each clinical program has its own work group and develop-

ment team. The work group is a small core group of approximately 10 physicians and staff members that develops the disease management system, which is then refined by the larger development team. This is then coordinated through central leadership and a large guidance council of approximately 25 members, composed of primary care medical directors and nurse managers, all under the direction of the Primary Care Clinical Program staff.

Diabetes Care Process Model

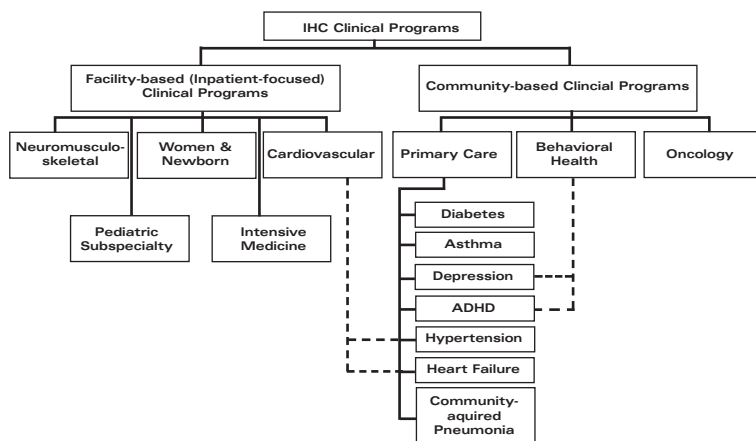
The center of the DCMS is an evidence-based diabetes best-care practice model (CPM). This detailed CPM is based on nationally recognized guidelines from the American Diabetes Association, with updates from current scientific literature, and was developed by a multidisciplinary group of providers, including endocrinologists, primary care physicians, pharmacists, diabetes educators, and nurses.¹⁻¹¹ Pharmacists are included on all development teams and in work groups, where appropriate, to provide input on fundamental knowledge and expert advice in CPM development. They also are valuable in providing input regarding drug formulary preferences and other health plan issues. The diabetes CPM was distributed to physicians via academic detailing of small groups of 6 to 8 primary care physicians, conducted by an endocrinologist, to discuss the science of the CPM, and the regional medical director, to talk about implementation with the supporting programs described below.

Diabetes Performance Measurement System and Diabetes Registry

The second part of the DCMS was the development of a measurement system founded on diabetes best-care practices. A diabetes datamart (registry) was established by combining data from 5 different data sources: electronic laboratory, health plan claims, physician billing, clinical information system, and case mix (from hospital/facility billing data). These 5 databases comprise the available outpatient clinical information and financial data used to identify patients with diabetes to populate the registry and then match patients with the dates and results of their lab tests, e.g., HbA1c and LDL cholesterol. These databases were also used to identify and match patients with their primary care physician and specialist, if applicable. The registry was initially populated in July 1999 with approximately 18,000 patients and has been updated quarterly; the most recent update period ended June 30, 2003, and includes approximately 25,500 patients.

The 5 databases are updated each calendar quarter, and the registry is refreshed using a multiple-step process to import the new data into the registry. Of the 25,500 patients in the registry, approximately 9,500 are members of IHC Health Plans (a multiproduct health plan with a health maintenance organization and point-of-service options). The remaining 16,000 patients

FIGURE 1 Diagram of IHC Clinical Program Structure



consist of patients with diabetes not insured by IHC Health Plans but treated by IHC-employed physicians from the IHC Physician Division.

The 25,500 patients in the diabetes registry are treated by approximately 750 primary care physicians. The primary care physician with the most diabetes patients in the registry has 278 patients, and the registry is used to produce reports for physicians who have as few as 1 or 2 patients.

Patient detail reports are produced quarterly for each primary care physician from the diabetes registry. The reports include: (1) name, medical record number, and phone number for each patient; (2) the most recent values for HbA1c, LDL, and urine microalbumin; and (3) the date of the patient's last eye exam. Patients are sorted by risk (lack of needed test or abnormal test result).

A Provider Summary Report (Figure 2) is included with this patient detail report; it shows a physician his or her testing rates compared with peers in both the physician's geographical region and the entire IHC system. The Provider Summary Report also shows relative values of HbA1c and LDL in patients cared for by the provider and how those values compare with the region or system. These results are also available through a password-protected site on the IHC intranet. On this Web site, a physician can view his or her Provider Summary Report and the same patient detail report that is distributed quarterly. The patient detail report may be sorted by risk (HbA1c values higher than 9), or alphabetically. The intranet Web site also has performance reports for these same measures by quarter over the last 4 years for the region or system.

Patient Education and Self-Management

The third part of the DCMS is a broad array of patient education programs. These include IHC-developed patient handouts, outpatient programs that bring a certified diabetes educator and

FIGURE 2 Examples of Provider Summary Report for Diabetes Patient

Diabetes Summary Report

Provider:

Period: January 2002-December 2002

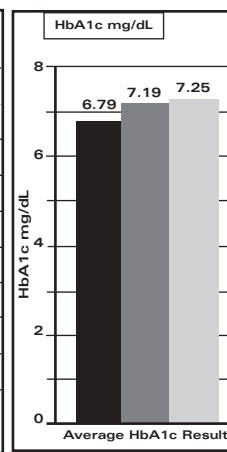
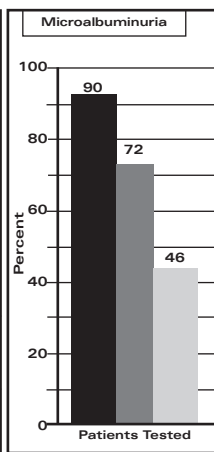
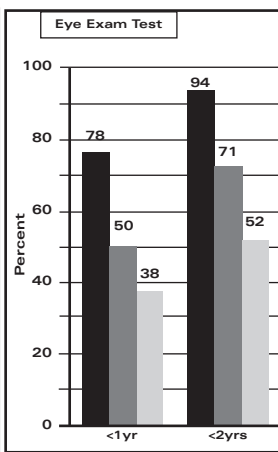
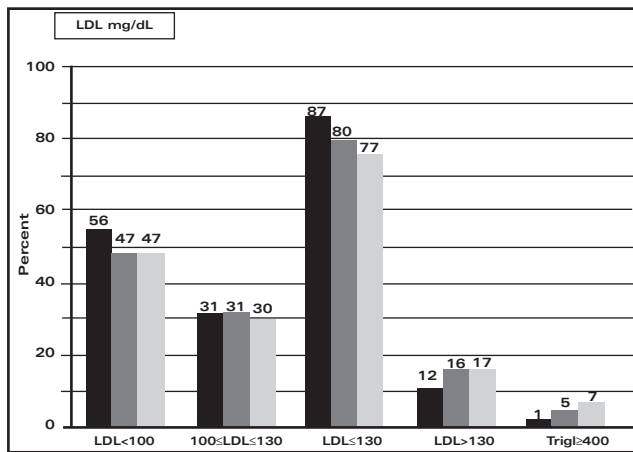
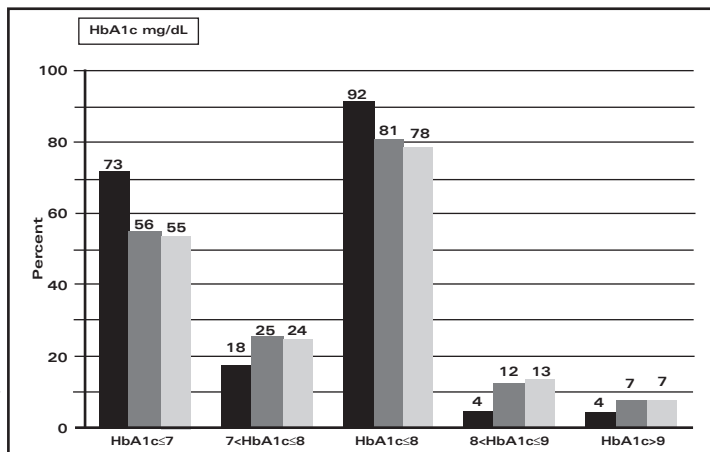
Patients Tested (Proportion of Total Patients %) - All Patients

	Provider	Region	System
HbA1c	190 (99%)	1,326 (90%)	18,987 (81%)
LDL/Trig ¹	185 (96%)	1,357 (92%)	19,271 (82%)
Eye exam ²	28 (78%)	156 (50%)	3,556 (38%)
Microalbuminuria ³	172 (90%)	1,064 (72%)	10,747 (46%)
Total patients	192	1,481	23,567

¹ LDL measures represent 2 years, ending in the chosen period.

² Eye exam % calculated using IHC Health Plans patients only.

³ Includes spot microalbuminuria or 24-hour microalbuminuria or positive UA tests for protein, within the reporting period, or any history of treatment for nephropathy.



■ Provider ■ Region ■ System

a registered dietician into physician offices, and Web-based patient education programs. Patient handouts are available to physicians through the electronic medical record used by IHC-employed physicians, the IHC intranet, or on the Internet (www.IHC.com).¹² Hard copies can be ordered for the cost of shipping and handling. These materials are also available to patients at the Diabetes Online Resource Center Internet site (www.IHC.com).¹³ Telephone-based care management is provided for patients with diabetes who are high risk (HbA1c values higher than 9), and many large IHC-employed physician clinics have on-site nurse care managers to assist with patient self-management.

Pharmacists at IHC participate in the diabetes CMS in several ways. Clinical pharmacists from IHC Health Plans provide routine consultation with disease state managers on complicated cases. IHC clinic-based pharmacists work closely with patients to educate them on the importance of glucose testing and medication compliance. Pharmacists in all IHC facilities

work to make sure all diabetics have glucose meters, understand how to use them, and provide additional training to supplement training received from diabetes educators. All pharmacists throughout the IHC system continually work to help patients avoid drug interactions and adverse events.

Physician Office Implementation Tools

The fourth part of the DCMS includes tools that were developed for physicians and their office staff to facilitate the implementation of the DCMS in their office. The tools include

1. templates on the electronic medical record (EMR) to make charting easier for patients with diabetes;
2. a report, produced by the EMR, for patients with diabetes in advance of their medical visit that provides an electronic flowchart of all of the patient's key diabetes management parameters and alerts the physician to interventions that need to occur at that medical visit;
3. manual diabetes data flowsheets that record lab values and

clinical findings at each visit and can therefore be easily trended across multiple visits;

4. patient self-history forms;
5. methods to alert the physician that the patient has diabetes;
6. monofilament fibers and training in their use for foot exams; and
7. organized resources such as the American Diabetes Association or the Juvenile Diabetes Foundation for patients in financial need or with other socioeconomic problems.

To introduce and implement the DCMS, small-group meetings of 6 to 8 physicians were conducted, with separate small-group meetings for the physicians' office staff. These meetings allowed a physician-educator who was a diabetes expert to present the CPM, answer questions, and then present to each physician the diabetes Provider Summary Report related to that physician's practice. This report allowed each physician to compare his or her performance with the CPM. The first encounter with the performance reports for many physicians resulted in a predictable response—the physician-specific data did not match the physicians' perception of their level of testing and control for their diabetic patients. Initial physician challenge of the data in the performance reports evolved into familiarity and confidence in the data and cooperation in using the reports to improve their clinical performance.

After the initial DCMS implementation meetings, including the important opportunity for physicians to challenge the data, the diabetes Provider Summary Reports were distributed to each physician on a quarterly basis. These reports became a means of identifying patients that required direct physician contact and follow-up. Periodic small-group follow-up meetings were held to introduce revisions to the CPM, introduce new data included on the performance reports, and conduct more detailed implementation education.

Diabetes Quality Improvement Financial Incentive

A quality improvement (QI) financial incentive program was also developed by IHC Health Plans to improve physician performance on the measured data elements. The QI financial incentive represents 0.5% to 1% of total physician compensation, and one half of the total managed care QI financial incentive for physicians is based on diabetes measures. The 2 diabetes CPMs that are tied to the QI financial incentive are (1) the percentage of diabetes patients who received an HbA1c test in the past year and (2) the percentage of diabetes patients who had an LDL test in the past 2 years.

Direct Patient Outreach

In addition to these aforementioned interactions with physicians, direct outreach to patients was initiated in 1998. Diabetes patients who did not schedule routine diabetes-related office visits or did not have an HbA1c test in the previous 12 months were invited to diabetes screening clinics.

FIGURE 3 Percent of Diabetes Patients With HbA1c Test in Previous 12 Months — Performance Compared With Benchmarks

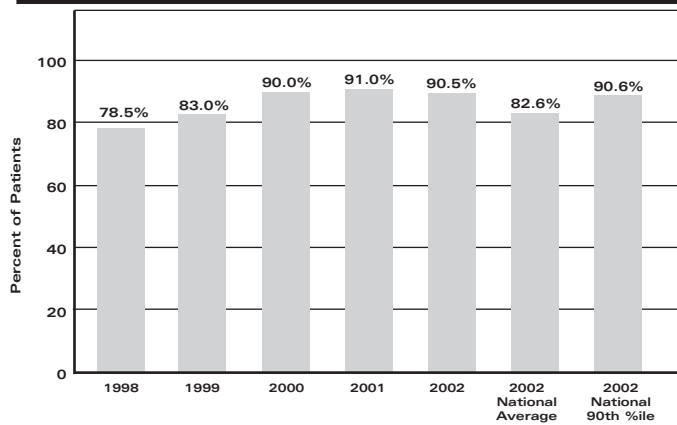


FIGURE 4 Percent of Patients With HbA1c Value ≤ 7

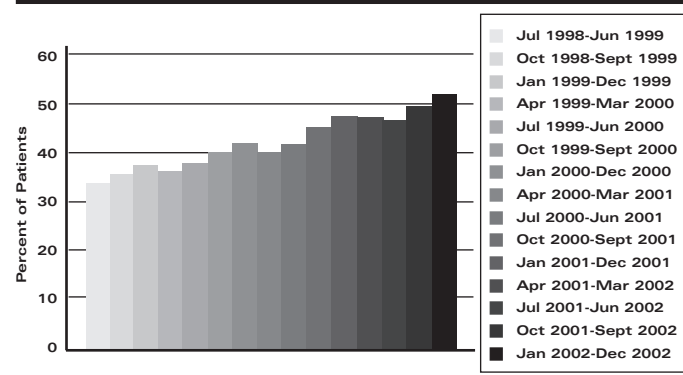
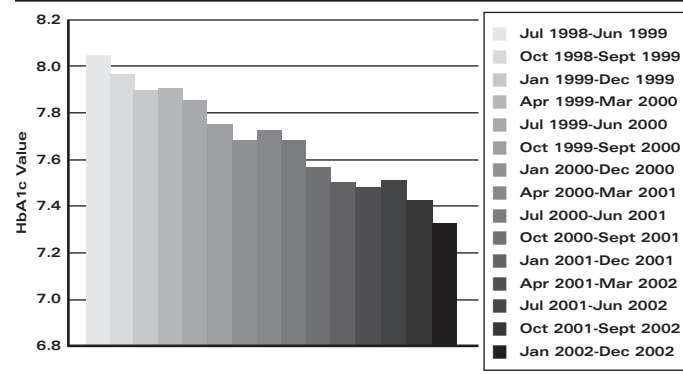


FIGURE 5 Average HbA1c Value in Diabetes Registry



Diabetes calendars were distributed by mail to all IHC Health Plan members with diabetes. The calendars focused on a different diabetes self-management concept each month, with

TABLE 1 Diabetes Management Performance Measures

Performance Measurement	1998 (n=5,785)*	1999 (n=6,187)*	2000 (n=7,196)*	2001 (n=7,988)*	2002 (n=9,436)*	P Value‡
Annual HbA1c†	78.5%	83.0%	90.0%	91.0%	90.5%	0.002
HbA1c > 9.5†	34.6%	32.4%	24.3%	19.7%	21.4%	<0.001
Average HbA1c	8.1	7.9	7.7	7.5	7.3	<0.001
HbA1c < 7	33.5%	37.1%	42.0%	47.3%	52.8%	<0.001
Biannual LDL†	65.9%	73.7%	85.2%	87.8%	91.7%	<0.001
LDL < 130†	39.9%	49.6%	61.3%	65.5%	69.8%	<0.001
Annual eye exam†	52.0%	47.9%	56.0%	64.0%	62.0%	0.025

* Number of patients in the diabetes datamart (registry).

† HEDIS measure.

‡ A chi-square test of proportions with uncorrected P value was used to measure the statistical difference between each of the listed performance measures in 1999 and 2002.

FIGURE 6 Percent of Patients in Diabetes Registry Not Tested or With HbA1c Values >9.5

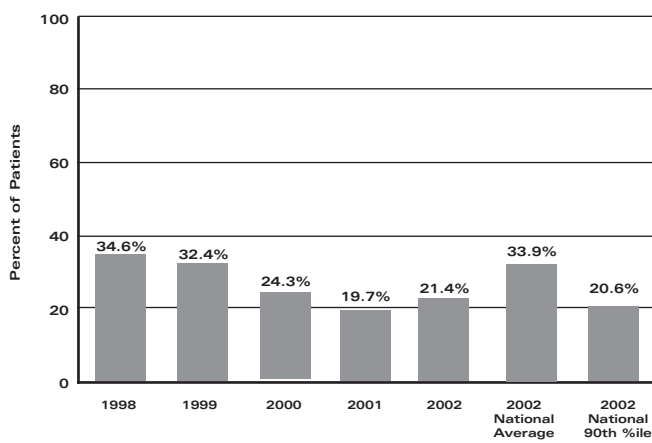
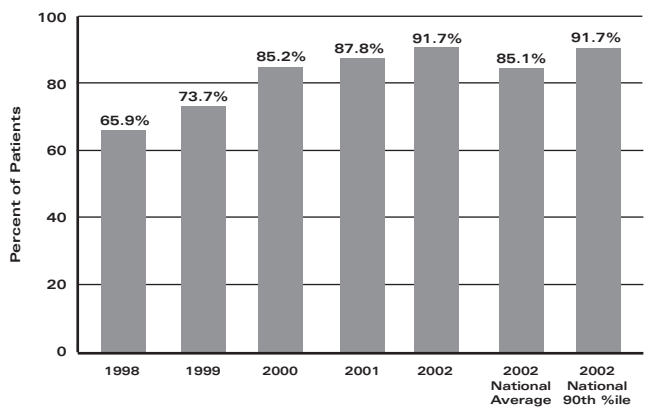


FIGURE 7 Percent of Patients in Diabetes Registry Who Had Lipid Profile Performed in Previous 24 Months



reminders for appropriate self-management activities indicated on various days throughout the month. Each month, a reminder postcard that correlated to the diabetes self-management concept depicted on the calendar was mailed to each of the members with diabetes.

Patients with diabetes received a status report by mail regarding their own compliance with appropriate tests or exams to screen for diabetes complications. The report contained dates and laboratory values for the patient's most recent HbA1c and LDL tests and the date of the patient's most recent eye exam.

To encourage eye exams, patients were offered a 60-minute, long-distance telephone debit card as an incentive to complete their annual eye exam. During the time the calling card incentive was in place, the eye exam rates increased by approximately 5%, from 37% to 42%.

Results

The improvement in each of the key performance measures in diabetes management is both clinically important and statistically significant (Table 1). This CPM was implemented for all patients with diabetes in the IHC system. Thus, there is not a control group. However, compared with national benchmarks, currently, these results exceed the 90th percentile in all areas except annual eye exam.¹⁴

The percentage of patients with at least one annual HbA1c test increased from 78.5% in 1998 to 90.5% in 2002 (Figure 3). As the DCMS was implemented, the first emphasis was on improving the percentage of patients with at least one HbA1c measurement. The rate of testing has leveled out at approximately 91% over the last 3 years, without improvement, and is thought to be reflective of a harder-to-reach population to improve beyond the current level of performance. Accordingly, we have implemented a new lab requisition program to address this challenge. This program is described in "Summary and Future Plans" below.

The percentage of patients whose most recent HbA1c value was less than 7 increased from 33.5% in 1998 to 52.8% in 2002 (Figure 4), and the average HbA1c decreased from 8.1 to 7.3 (Figure 5). Improved HbA1c levels have been clinically proven to result in reduction of diabetes complications.⁷⁻⁹ The percentage of patients whose most recent HbA1c value was greater than 9.5 decreased from 34.6% in 1998 to 21.4% in 2002 (Figure 6). The percentage of patients who had an LDL cholesterol screening test within the last 2 years increased from 65.9% in 1998 to 91.7% in 2002 (Figure 7), and the percentage of patients whose most recent LDL cholesterol was less than 130 mg/dL increased from 39.9% in 1998 to 69.8% in 2002 (Figure 8). These achievements in quality improvement should significantly reduce the risk of cardiovascular complications in these diabetes patients.⁷⁻⁹

The percentage of patients who had an annual eye exam increased from 52.0% in 1998 to 62.0% in 2002 (Figure 9).

Improving the rate of eye examinations for patients with diabetes proved to be one of the most difficult performance levels to affect. We found that primary care physicians have relatively little control over whether patients follow their advice to obtain an eye exam. Also, primary care physicians may not focus on this outcome because of the general lack of communication between primary care and secondary care providers. These difficulties led to the development and implementation of the patient incentive program for eye exams.

Summary and Future Plans

A multifaceted approach to improving diabetes management resulted in improved intermediate outcomes in diabetes care (Figure 10) and should result in less risk of long-term diabetes complications for these patients. A multispecialty diabetes work group of 10 members, including primary care physicians, endocrinologists, physician office staff, diabetes educators, and pharmacists led by a physician diabetes champion, developed and implemented the DCMS. Many of the interventions initiated through the IHC DCMS are replicable in other managed care settings. Plans for the future include further enhancements to the patient education materials for diabetes, expansion of the resources devoted to diabetes education and care management, and further development of the EMR system related to tracking and monitoring diabetes patients. The diabetes registry will be used to develop additional patient care management reports such as medication compliance reporting and predictive modeling of patients to identify those patients most likely to incur significant future health care expenditures.

While our integrated health system has used physician-specific performance reports for diabetes care for several years, many physicians have expressed concern regarding the time and office resources that are necessary to schedule patients for routine and follow-up testing and subsequent office visits. In response to this concern, the health system has developed a laboratory requisition direct-mailing process that includes HbA1c, lipid profile, and microalbumin screening.

Diabetes laboratory requisition direct mailing has been piloted in several physician offices. This new enhancement in DCMS identifies diabetes patients who do not have a record of receipt of the appropriate diabetes complication screening tests in the time period specified. Laboratory requisition forms for direct mailing are produced in bulk, aggregated, and then forwarded to each primary care physician's office. The laboratory requisition is produced with prepaid postage and includes space for the physician to personalize the mailing with a signature. The patient direct-mail letters include the list of locations where the lab tests can be performed. The actual tear-off laboratory requisition includes all of the required information necessary to process the laboratory tests automatically. The primary care physician verifies that the patient is active in the practice, personalizes the requisition with a signature, seals the trifold requisition, and either mails

FIGURE 8 Percent of Diabetes Patients With LDL Cholesterol <130 mg/dL

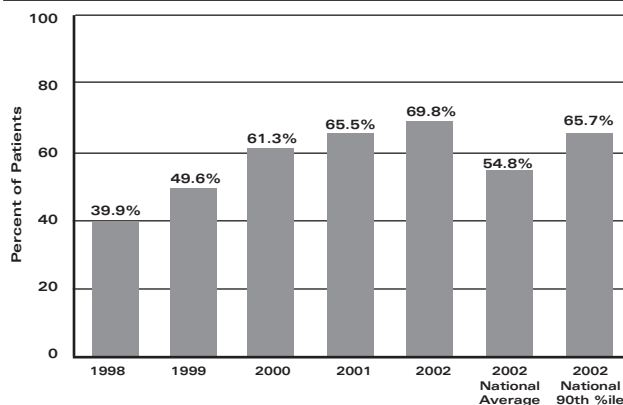


FIGURE 9 Percent of Diabetes Patients Who Received an Eye Exam in Previous 12 Months

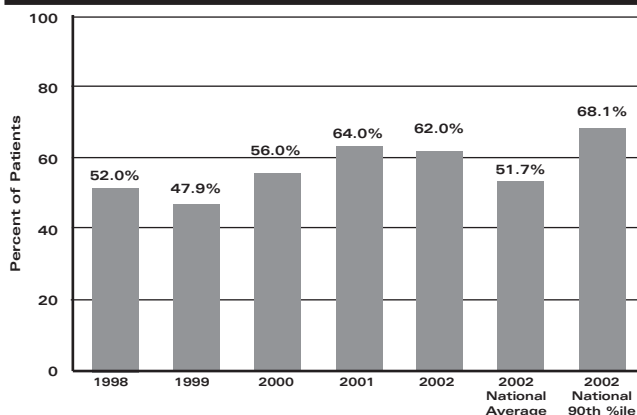
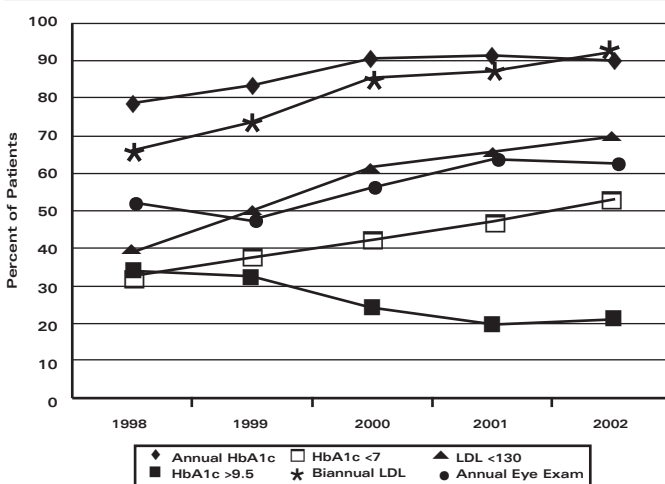


FIGURE 10 Diabetes Care Management System (DCMS) Results, 1998-2002



it to the patient directly or returns the requisitions in bulk to be mailed to patients by the health system.

This laboratory requisition process allows for personalized outreach to patients from each physician's office while incurring minimal use of office staff. This process is expected to reduce the number of physician office visits, and the health system plans to expand the laboratory requisition program to all primary care offices that have patients in the diabetes registry.

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