

Implementing a Multidisease Chronic Care Model in Primary Care Using People and Technology

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ABSTRACT

Management of chronic disease is performed inadequately in the United States in spite of the availability of beneficial, effective therapies. Successful programs to manage patients with these diseases must overcome multiple challenges, including the recognized fragmentation and complexity of the healthcare system, misaligned incentives, a focus on acute problems, and a lack of team-based care. In many successful programs, care is provided in settings or episodes that focus on a single disease. While these programs may allow for streamlined, focused provision of care, comprehensive care for multiple diseases may be more difficult. At Intermountain Health Care (IHC), a generalist model of chronic disease management was formulated to overcome the limitations associated with specialization. In the IHC approach, which reflects elements of the Chronic Care Model (CCM), care managers located within multipayer primary care clinics collaborate with physicians, patients, and other members of a primary care team to improve patient outcomes for a variety of conditions. An important part of the intervention is widespread use of an electronic health record (EHR). This EHR provides flexible access to clinical data, individualized decision support designed to encourage best practice for patients with a variety of diseases (including co-occurring ones), and convenient communication between providers. This generalized model is used to treat diverse patients with disparate and coexisting chronic conditions. Early results from the application of this model show improved patient outcomes and improved physician productivity. Success factors, challenges, and obstacles in implementing the model are discussed. (Disease Management 2006;9:xx-xx)

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INTRODUCTION

IT HAS BEEN ARGUED that the current primary care model in the United States is better suited to treat acute, time-limited illnesses than to address chronic illnesses.¹⁻⁵ With increasing time demands, primary care physicians often

treat patients in a reactive fashion, with short appointments and limited patient instruction.² Given a particular patient's unique needs, busy practitioners may not know or follow established practice guidelines, or have the time or the facilities to coordinate care between all the people who need to be involved in the care of

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a particular patient.⁶ In other words, these providers are susceptible to the “tyranny of the urgent”⁷—with more acute patient needs taking precedence over chronic ones. These problems are only magnified by the highly fragmented nature of medical care in the United States, which often leads to poor communication and less than optimal follow-through for chronically ill patients.^{3,8,9} Therefore, chronically ill patients are often themselves responsible to initiate care needed to comply with standard guidelines (either preventive or specific for their illnesses). As a result, up to 50% of chronically ill patients in the United States—especially the elderly—receive inadequate care.¹

Successful models of chronic care and disease management in primary care have been created, but these successes generally have been achieved in limited settings^{2,10–12} such as single-payer managed care systems (eg, Kaiser Permanente) or health plans (eg, Group Health Cooperative).^{11–13} Conversely, care management approaches are less frequent in independent provider clinics, where the majority of patient contacts occur and where the opportunity for intervention is greater. The sporadic implementation of these care management approaches in typical clinic settings may be due in part to the recognized fact that the financial benefits that result from improved patient health most often accrue to the payer and not to the provider.¹⁴ In fact, there may be perverse incentives for quality for providers.¹¹ For example, expenses incurred by physician groups may be higher when providing high-quality care, leading to less ability to accept discounts from payers. Since payers do not generally recognize higher quality, high-quality providers may be shifted out of the market; pay-for-performance projects attempt to remedy these issues.

The nature of processes associated with primary care also contributes to the lack of appropriate care management systems being integrated at the point of care. Healthcare teams, composed of patients, nurses, physicians, social workers, therapists, and others, in which participants work together to regularly communicate about, create, and implement plans of care, are important for successful care management. Often, these teams do not function well in pri-

mary care settings.¹⁵ The historical autonomy of providers and fragmentation of care delivery due to lack of incentives to collaborate may work to prevent formation of such teams.¹⁶ In addition, in a generalist setting, the knowledge of specialists and experts, either directly or through guidelines, is necessary for optimal care but not always easily available at the point of care.¹⁷ The additional perceived burden of accessing and adhering to guidelines may limit provider adoption of best practices.¹³

As described recently by Casalino,¹⁸ one approach to solving these problems with quality of healthcare delivery focuses on insurers or external companies communicating frequently with patients (usually via telephone) to improve adherence to guidelines. These programs attempt to overcome fragmentation, misaligned incentives, and physician resistance by educating and motivating the patient directly. However, they also add a layer to a complex and often dysfunctional system. Another way to solve this problem was elucidated by Bodenheimer et al. in the Chronic Care Model (CCM).¹⁹ The CCM identifies elements desirable for an effective system-based model for chronic disease management: patient self-management support, clinical information systems, delivery system redesign, decision support, and healthcare organization and community resources.^{19,20} All these components, especially delivery system redesign,²¹ combine to create a proactive healthcare delivery team that communicates regularly with self-activated patients to improve care.¹⁵

Successful implementation of these components requires significant amounts of information in the hands of providers in order to change care and encourage best practice. In the case of multiple diseases and illnesses in a diverse patient population, it is easy to see how higher information needs might overwhelm a generalist care management implementation; thus, single disease implementations^{22–26} are logical answers to cope with information overload.²⁷ For patients with multiple diseases, multiple insurer or single disease management programs could be used. If the information overload problem could be solved, however, the benefits of a CCM implementation for multiple diseases are substantial. For instance, up

to half of patients with chronic disease who are seen in the ambulatory care setting have multiple chronic diseases. In addition, an efficient primary care team has been shown to be instrumental in providing a seamless care experience and comprehensive plan for the patient who moves between specialists' offices, the hospital, and other settings.^{1,17} From a workflow perspective, optimal distribution of tasks between team members and efficient use of patient and provider time may be more easily achieved in the generalist setting if the delivery system can be optimized.^{15,28} General problem-solving and self-care skills can be taught, and patient readiness to change can be addressed; these techniques have been shown previously to lead to improved outcomes for a variety of chronic diseases.^{29,30}

In this paper, we describe efforts at Intermountain Health Care (IHC) to address this acknowledged lack of collaborative, patient-centered, effective, and efficient care by intervening in two specific ways. First, generalist care managers were installed as part of the primary care teams, and second, an information system was installed to provide information and knowledge at the point of care, improving communication between all members of the team, including the patient and his or her caregivers.³¹ In our case, we address the myriad of specific recommendations and reminders needed for multiple diseases with supportive information technology (IT). As part of delivery system redesign, we use a designated team member called a care manager to teach the patient general skills and self-management, and to improve team processes. Together, these two elements help provide just-in-time specialized knowledge while minimizing time constraints on physicians and still ensuring that patients get individualized education and attention.^{32,33} Our hypothesis is that an adapted version of the CCM model will be heavily used for multiple diseases, and that care of patients will be efficient and quality of care will improve.

METHODS

The purpose of this paper is to describe the IHC implementation of care management in

the context of the CCM, and to provide statistics about its use. To do so, we qualitatively describe our implementation in accordance with each of the components of the CCM. Then, we provide data that reflect the adoption of each aspect of the program and the resulting effect on clinical outcomes.

Healthcare organization: CCM element 1

In the CCM, appropriate top-level support and commitment to quality in the healthcare community are necessary to implement innovations in the process of care delivery. The primary setting of our intervention is in seven clinics operated by IHC. IHC is a not-for-profit, integrated healthcare delivery organization located in Utah and Idaho that serves over 1 million patients. In 2003, IHC's primary care clinicians, located in over 70 clinics, provided care for 1.3 million unique patients and generated more than 4 million clinic visits. Specialists are present in some clinics. Pay for care comes from multiple sources.

In harmony with the vision foreseen in the CCM, IHC's administrative and clinical management teams support process and quality improvement at all levels of the organization, and these leaders encourage open discussion of key safety and quality concerns.³⁴ IHC has an infrastructure for innovations in the treatment of chronic disease that revolves around primary care teams and involves multiple stakeholders; this infrastructure supports the development of enterprise-wide guidelines for asthma, diabetes,³⁴ depression, cardiovascular disease,³⁵ and other diseases as recommended by the CCM. Enterprise-wide, measurable goals are then set for key elements of the guidelines in order to determine and improve the quality of care provided. IHC actively works to facilitate process changes that must occur to achieve these improvements, as recommended by the CCM.

Delivery system design and team-based care: CCM element 2

IHC redesigned care delivery by adding care managers to teams and by inserting IT into the workflow in an effort to improve adherence to evidence-based guidelines and to improve con-

tinuity of support for the patient. The job descriptions for our “care managers”^a are derived from the Case Management Society of America’s definition of case management: “a collaborative process of assessment, planning, facilitation, and advocacy for options and services to meet an individual’s health needs through communication and available resources to promote quality, cost-effective outcomes.” The care managers “serve as a catalyst for quality, cost-effective care by linking the patient, the physician, and other members of the care coordination team, the payer and the community.”³⁶ Training for care managers is formal and addresses new standards of care as they are adopted by IHC as well as ongoing refresher updates on chronic disease management. One generalist care manager is located in each of seven primary care clinics that serve adult patients with a diverse spectrum of diagnoses and needs. Referral to the care managers is not based on a particular illness or algorithm, but is based on need as perceived by the team members. In order to apply the model to such a diverse set of patients, the care manager prioritizes the care plan for the referred patient and the team. The care manager assesses the patient’s psychosocial, economic, environmental, and cultural background as well as other factors that affect the patient’s health within the context of the patient’s chronic conditions. Care manager efforts are focused to reduce variation in care and to provide a wide range of chronic illness services within the primary care team’s work flow.

The care manager acts as a catalyst to bring the team together; primary care teams are retrained to improve work flow and collaboration. The most basic unit of the team consists of a physician, medical assistant, the care manager, and the office manager. Depending on the patient’s needs, the care manager augments this team with specialists such as endocrinologists or cardiologists, social workers, educators, counselors, and community advocates. These flexible and expandable teams help to

make the care plan individualized, but also consistent and seamless.

Self-management support: CCM element 3

In our general setting, educating the care managers to inculcate general self-management skills is essential. The care managers have been trained in behavior change counseling and are given a thorough understanding of the clinical guidelines adopted by the system. Care managers are trained to assess the patient’s readiness to change,^{37,38} to coach and motivate the patient, and to educate the patient about his or her responsibility to care for the illness and to discuss the benefits of being proactive in managing his or her health. More of the care managers’ resources are focused on those patients who are contemplating or ready to begin self-managing behaviors; those who are not ready receive encouragement to consider change.

The care manager and patient meet face-to-face to create a care plan that is structured to reflect clinical guidelines and the patient’s personal challenges and goals; elements of this plan are entered into the care manager’s electronic system for follow-up.³⁹ Home environment, patient preferences, and support system are considered and integrated into the plan as needed. Patient education is a crucial part of the self-management strategy, the goal being to improve patients’ health literacy with regard to their health and illnesses. Self-monitoring assists in systematically identifying patterns of behavior and helps to improve awareness of triggers that spawn unhealthy patterns. Although the care manager represents a knowledgeable advocate, the patient and the family or caregivers are trained to take care of themselves when they can, speak up when they cannot, and access clinic and other community resources to ensure such needs are met in predictable and appropriate ways.

Connecting to community: CCM element 4

In accordance with the description by Netting and Williams⁴⁰ of an expanded version of the CCM which highlights the significance of connections to the community, our care managers and the care team focus on linking the

^a“Care manager” is used in preference of “case manager” as “case” is felt to be more inclusive and less distancing to the patient, per the American Association of Retired Persons (AARP).

patients and their caregivers to community resources. They strive to balance the healthcare needs of the patient with the resources available through insurance benefits, publicly funded programs, and private dollars available from the patient. We view the community resources as essential to reduce inefficient utilization of high-intensity interventions.^{41,42}

We facilitated connection to community resources in several ways in our implementation. First, we performed a thorough assessment of community resources available to meet the unique needs of the patients. Next, the teams—especially the care managers—were trained to perform a clinical and social assessment of the needs of and resources available for patients. Community resources were introduced to the care managers in a series of educational events using real-life case studies. Finally, the training was supported with electronic external references maintained via a Web page that was available to all team members, including the patient and the caregiver. These on-line resources include such diverse topics as respite and tax breaks for caregivers, community meal provision, different housing options, and obtaining health and environment assessments at home. Since eligibility and available resources vary by county, links are provided to a set of geographically specific Web sites. The specific resources allow further individual care planning and education by the care managers as they help connect patients to the community.

*Support for evidence-based practice:
CCM element 5*

We provide the two major components of organizational decision support as defined by the CCM (ie, clinical practice guidelines and physician education in several ways.⁴³ At IHC, clinical practice guidelines are developed by an organized group of clinician experts and opinion leaders who review current research.³⁴ They create quality improvement-based practice guidelines as both a decision support and measurement tool (ie, the adherence to and the outcomes from the guidelines are routinely reviewed by the clinical program leadership, and adjustments are made to improve outcomes.⁴⁴ These practice guidelines are distributed

through workshops incorporated in the electronic health record (EHR). IHC also provides modest financial incentives to providers when these goals are achieved.

The group of experts who focus on primary care comprise the Primary Care Clinical Program (PCCP). This group has defined guidelines as well as goals for adherence and outcomes for several chronic conditions. For example, goals for glycosylated hemoglobin (HbA1c) testing frequency (eg, up to once per quarter for those with HbA1c of >8% and at least yearly for other patients known to have diabetes) and target reduction in levels (eg, HbA1c reduced to <7.0%) are defined, and these goals are delivered to clinicians through medical directors and physician leaders.

Care managers in IHC support the same clinical guidelines as clinicians and attend the same interdisciplinary workshops. In addition, care managers develop their own guidelines and processes to support the clinical program goals. Care managers also meet together monthly to collaborate on methods for improving patient outcomes and practice efficiencies and to receive training in disease management.

Information systems: CCM element 6

Information systems supporting collaborative care for multiple diseases need to provide three core functionalities, which we refer to as the ABCs of collaborative care: enable *Access* to relevant patient information, encourage *Best practices*, and facilitate *Communication* between providers.

Access to relevant patient information is provided by a longitudinal EHR, which supplies a single consistent access point for multiple clinicians. Our current information system contains the six components identified as important for chronic disease by Casalino et al.—a standardized problem list, progress notes, lists of prescribed medications, drug-drug interaction reminders, laboratory results, and radiology results.¹² We also have information regarding allergies, other tests such as electrocardiograms, procedures, provider messages, and 1–2-page patient summaries. A longitudinal EHR with these types of information is available to all clinicians, including care man-

agers, in all IHC clinics and provides information across time and from multiple settings, including hospitals, emergency rooms, specialty practices, and general outpatient practices. The comprehensive view provided by the EHR is especially important for patients with chronic illness because their care may involve multiple providers and settings.¹⁷

IHC has multiple programs to support *Best Practices*. In addition to our experience in generating alerts, reminders, and suggestions based upon automatic evaluation of rules, we generate report cards regarding the level of attainment of clinical goals for each physician. By clicking an "infobutton" within the EHR⁴⁵ at the point of care, it is possible to access context-specific reference literature describing the best available evidence for treating a specific condition or understanding a test result. In addition to these important mechanisms, the care management structure has two additional information system components to address the need to increase best practices within the context of the primary care work flow: the Patient Worksheet and the Care Management Tracking (CMT) system.

The Patient Worksheet is a patient summary that provides a condensed view of the patient record that can be reviewed easily either electronically or on paper. The summarized, structured Patient Worksheet was designed to interlace pertinent clinical data for multiple chronic illnesses and alerts into a document that can be reviewed quickly at the point of care, thus allowing it to be easily integrated into work flow. The content of this summary is dynamically generated based on one or more of the patient's chronic conditions (up to five) that are listed within the EHR. This worksheet displays patient demographic information, specific problems and conditions, the patient's current medication profile, laboratory test results, and other diagnostic and physical exam results related to each patient's specific problems, as well as disease-specific or preventive care advisories.⁴⁶ The advisories to be presented are determined through the automatic application of computer-based logic rules to clinical data available in the EHR. For patients seen by a care manager, the last care manager

progress note also is included. Typically, the creation of the worksheet is prompted by the clinic schedule and is available to team members prior to the beginning of a patient visit, and the clinician reviews the information with the patient. The advisories are written in the same format as the necessary orders to make it easy for the physician to comply. After explaining the pertinent recommendations, many clinicians give the worksheet directly to the patient and his or her caregivers along with verbal and written directions to aid in self-management.

We have developed a CMT system for care managers that allows them to schedule tasks and receive automated reminders, or "ticklers," about planned chronic care visits or follow-up. The CMT system allows care managers to schedule a follow-up visit or phone call with a patient at the same time as they are documenting the care of the patient. The care manager can create reminder lists based on patient criteria (ie, tickler lists) which enable them to call or meet with patients to ensure high adherence; examples include calling to remind patients to come in for laboratory tests such as HbA1c or lipid panels that need to be drawn at certain intervals, or to assess symptoms and the need for care after hospitalization. The CMT also facilitates time tracking of care management activities for each patient so that the team can review where the care management effort is spent and determine what activities are most productive.

Finally, one of the most important components of the information system is the facilitation of *Communication*. Our information system does so by providing transmission of secure, patient-oriented comments and messages among team members and between team members and others involved in care, including specialists; these comments are linked to the patient chart automatically. Communication also occurs in person via shared team meetings and visits and by phone.

Data collection

Our CMT system implementation based on the CCM was installed in seven clinics. Data collec-

tion took place during 2003. The care managers used the CMT to store structured information about their daily activities. The care managers tracked the type of encounter (eg, education session, phone call), reason for the encounter (eg, following guidelines, medication assistance), and the conditions treated during the encounter. The value and utility of the computer-generated alerts used to remind the care manager of guideline compliance issues were assessed by self-report of the care managers. All use of the longitudinal clinical information system by providers was tracked and analyzed whether or not the patients in question were part of the CMT system. Audit tables containing information about the patient whose information was accessed, the provider who was accessing the record, and the particular purpose of the access were used to examine use of the messaging system, patient worksheet, alerts, and other information system applications. Administrative data for billing and demographics collected as part of usual care was used to aggregate characteristics of the population being treated in the clinics as a whole and in the subset of care management patients. The Chronic Illness and Disability Payment System (CDPS) was used to compare the case-mix of practice populations.⁴⁷ Outcome and process metrics used to assure guideline adherence and to measure the quality of care were abstracted from information system data.

The data collected from these sources were grouped and analyzed according to previously defined categories.⁴⁸ Previous analyses for clinical, cost, and process outcomes are described elsewhere; in brief, care managed patients were matched by age, gender, comorbidity, and previous utilization to non-care-managed controls in a series of retrospective cohort studies, and then compared on changes in clinical and process indicators. Clustering was done by physician and clinic to account for cohort differences.

Statistical analysis

As analysis intent was primarily descriptive, statistical analysis was limited to Student's *t*-text and two-way analysis of variance for continuous variables and Fisher's exact tests for 2×2 tables.

RESULTS

Health care organization

The provider clinics selected for this implementation are similar to medium-sized primary care clinics elsewhere in the United States. As shown in Table 1, seven urban health centers, with 54 primary care providers (7.7 providers per clinic) who see adult patients (excluding Pediatricians), form the primary setting of the intervention. Each provider in the clinic sees, on average, 292.6 ± 104.3 patients per month. The age of providers, their experience, and the case-mix of patients they see also match the characteristics described in other, similar studies of physician demographics in primary care clinics. The volume and complexity of patients seen in the clinics is also similar to internal medicine and family practice populations reported in these studies.^{49,50} Table 1 also shows that the clinics' revenues stem from multiple payers, including public, several private, and self-pay or charity sources. In all, 46 of the physicians referred patients to care management during the study period, and eight did not use this resource.

T1

TABLE 1. DESCRIPTION OF IMPLEMENTATION CLINICS AND PHYSICIAN POPULATION

	n (%)
Number of clinics	7
Number of physicians	54
Number of physicians per clinic	7.7 (5–10)
Specialty	
Internal medicine	21 (39%)
Family practice	33 (61%)
Physician characteristics	
Age	42.8 ± 11.8^a
Years in system	6.8 ± 4.5^a
Appointments per full month, average	292.6 ± 104.3^a
Productivity per month, with relative value units	383.9 ± 117.0^a
Payer by clinic	
Government (Medicare, Medicaid, other)	17.6%
IHC health plan	35.0%
Self-pay/charity	20.1%
Other private insurances	27.3%

^aMean \pm SD.

IHC, Intermountain Health Care.

T2 → As seen in Table 2, care management services were given to 2,356 patients, or 1.7% of the 106,766 adult patients seen in these clinics in 2003. Each care manager, on average, saw 336.7 ± 116.4 unique patients. On average, patients referred for care management had double the CDPS case-mix scores of the non-referred patients in the population, indicating that a resource intensive subpopulation was referred. The high utilization of the referred population is further evidenced by the fact that these patients had 6.5 visits per year on average (or 15,134 physician visits for 2003), compared with 2.6 visits for the rest of the clinic population. Those referred were more likely to be female, single, and of a non-white race than the others (factors that were found to indicate care management need in other studies).^{51,52}

Care management services provided according to condition addressed and CCM category

T3 → The 2,356 patients seen had a total of 3,146 problems or chronic conditions addressed by the care managers, or an average of 1.5 ± 1.2 problems per patient. Table 3 displays the wide variety of conditions treated. Patients with diabetes ($n = 866$, 36.8% of all patients) and mental health issues ($n = 774$, 32.9%) were treated most commonly. Social and organizational needs such as caregiver fatigue, medication assistance, and financial needs accounted for

18.6% ($n = 438$) of problems treated. Beyond the diagnoses or problems listed, 27 additional chronic diseases and conditions (eg, arthritis, cognitive issues such as Alzheimer's disease) account for 45.4% of the remaining problems treated in patients.

These problems are treated through various types of care management encounters. In addition to the traditional physician-only visits, there were 10,194 encounters or tasks completed by the care manager, or an average of 4.3 ± 3.9 encounters per patient. These types of encounters are displayed in Table 3. The care team used various redesigned modalities to provide care. Special care manager and care team face-to-face visits with patients accounted for 3,415 (or 33.5% of all) activities, while telephone calls with patients accounted for 4,094 (or 40.2%) activities. Individual efforts by a medical team member on behalf of a patient (eg, calling a specialist individually) accounted for 16.4% of activities, while care conferences (ie, team meetings about a patient) accounted for 9.9% of activities. Both coordination and care conferences included specialists in addition to the primary care team in a number of cases. Activities such as medication assistance (3,565 encounters, or 35% of the total) sometimes included both a face-to-face visit (eg, education about programs and assessment of financial need) and a coordination aspect (eg, filling out provider paperwork to initiate pro-

TABLE 2. DIFFERENCES BETWEEN ADULT PATIENTS REFERRED TO AND NOT REFERRED TO CARE MANAGEMENT IN SEVEN CLINICS

	Total	Care manager	No care manager	
Number of patients	106,766	2,356 (1.7%)	104,410 (98.3%)	
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Student's t
Case-mix score ^a	0.73 \pm 0.61	1.45 \pm .88	0.71 \pm 0.59	$p < 0.001$
Age (years) ^b	48.8 \pm 18.8	54.9 \pm 18.6	48.6 \pm 18.9	$p < 0.001$
Visits/year	2.7 \pm 3.0	6.5 \pm 6.4	2.6 \pm 3.1	$p < 0.001$
	n (%)	n (%)	n (%)	Fisher's exact
Female, %	56.4%	62.2%	56.3%	$p < 0.001$
Caucasian, %	92.8%	90.3%	92.9%	$p < 0.001$
Married, %	65.4%	57.7%	65.4%	$p < 0.001$

^aThe Chronic Illness Disability Payment Score (CDPS) was used, adjusted for a general health plan population.

^bAdult was defined as age ≥ 18 .

Category	n	% ^a
Total patients seen	2,356	100%
Conditions treated		
Average conditions treated per patient (SD)	1.5	(1.2)
Patients with 2+ treated conditions	463	19.7%
Diabetes	866	36.8%
Mental health	774	32.9%
Social/organizational needs	438	18.6%
Hypertension	154	6.5%
Preventive needs	117	5.0%
Asthma/COPD	93	3.9%
Other	1,069	45.4%
Care team activities/encounters		
Care management encounters	10,194	100%
Average per patient (SD)	4.3	(3.9)
Face to face visits	3,415	33.5%
Telephone calls	4,094	40.2%
Coordination ^b	1,674	16.4%
Care conferences	1,011	9.9%
Self-management support		
Education sessions	2,615	25.7%
Motivation of patient	3,223	31.6%
Connection to community		
Electronic accesses	1,044	N/A ^c
Connection to external programs	4,782	46.9%
Support for evidence-based practice		
Protocols followed	4,748	46.6%
Diabetes	2,265	22.2%
Mental health	1,748	17.1%
Combined protocols	715	7.0%

^aPercentages exceed 100%, as multiple diagnoses or types of activities are possible for each patient or encounter.

^bCoordination activities include gathering and filling out forms, accessing local resources, and arranging for appointments.

^cData available for 6 months only.

SD, standard deviation; COPD, chronic obstructive pulmonary disease.

grams). Empowering the patient or their caregiver to understand and control the care of their conditions reduced the burden of coordination. To this end, self-management support was provided in 2,615 encounters (25.7%) involving patient education in either group or individual formats. Motivation support for the patient to continue self-managing behaviors was included in another 3,223 encounters (31.6%). The patients and their caregivers were provided connections to community programs in 4,782 (46.9%) of the encounters, with 1,044 of these via electronic access. Finally, the care team utilized computer-based support for evidence-based practice, following specific, previously defined protocols for conditions in 4,748

(46.6%) of their activities, including combined protocols in 715 (7.0%) of the activities.

Substantial use of the information system, decision support and communication components are described in Table 4. In July 2003, care managers saw 410 patients and accessed the EHR for each patient. During the same month, the 54 primary care physicians saw 19,582 patients and accessed 18,486, or 94.4%, of the EHRs for the patients they saw. Summarized patient records with built in support for best practice in the form of the patient worksheet were used by care managers for 22.7% of the patients they saw, whereas physicians viewed the patient worksheet for 7.8% of their patients. Because not all patients have chronic disease,

TABLE 4. MONTHLY INFORMATION SYSTEM USAGE FOR ACCESS, BEST PRACTICE SUPPORT, AND COMMUNICATION BY PARTICIPATING CARE MANAGERS AND PHYSICIANS

	Care manager	Physician
N of sample	7	54 (primary care)
Patients seen in July 2003	410 (2.1% of physician seen) patients	19,582 patients
Access patient data		
Number of patients accessed (% of all patients)	410 patients (100%)	18,486 patients (94.4%)
Best practice—decision support		
Patient worksheet pulls (% of all patients seen)	93 (22.7%)	1,442 (7.8%)
Reference information accesses	Senior web resources	Physician e-Resources
Total per month	174 ± 20 hits/month	554 hits/month
Per clinician-month	24.9 hits/care manager	10.2 hits/physician
Alert type	Tickler list	Patient worksheet diabetes alert
Probability of receiving an alert per clinician day	63% ± 17% ^a	28% ± 4% ^b
Communication		
Patients with 1 or more electronic message generated (% of all patients seen)	302 (73.7%)	7,578 (38.7%)

^aApplied to multiple patients simultaneously, so usage statistics are generated per day rather than per patient.
^bCalculated per day for comparison with care manager statistic.

we looked at the subset of patients with diabetes and found that appropriate standards-based alerts were seen by physicians for 28% of patients with diabetes. Care manager alerts, or “tickler” lists, were triggered on 63% of their working days (alerts are generated on multiple patients at once). The care managers accessed Web-based best practices or connections to community resources 24.9 times per month, on average, about 2.5 times more than the average physician access of 10.2 times per month, even though the physicians averaged 6.3 times as many patient visits. Care managers and physicians sent or received messages on 73.7% and 38.7% of their patients, respectively.

Benefits to clinical care and costs

T5 Table 5 displays the results of analyses assessing the benefits of the program over three broad categories: clinical outcomes and process indicators, satisfaction of providers, and the cost benefit as calculated from productivity gains. Patients with diabetes had better odds of not being overdue for HbA1c testing and bet-

ter completion rates if overdue for both HbA1c and LDL.⁵³ Care managed patients had 0.55% reduction in HbA1c versus only 0.18% reduction in controls. Care managed patients with diabetes also had 3.2% fewer hospitalizations. Physicians who participated significantly in the care management program increased their productivity by 8% compared to low-use controls within care management and 5.5% compared to controls in other clinics.⁵⁴ A separate analysis showed the costs of intervention patients with depression decreasing by 8% while control patients' costs increased by 19%.⁵⁵ Of 18 physicians surveyed for satisfaction with care management, 16 (88.9%) were very satisfied with the program.⁵⁶ Physicians less likely to use the system were less satisfied and either had initial failures with the system or saw it useful primarily for clerical help such as medication assistance programs.

In all, the CMT system was estimated to cost \$100,000 per year for the training program and care manager salary per seven-physician clinic (information systems were available to control clinics, so these costs are not included), and to

TABLE 5. SELECTED INITIAL RESULTS OF CARE MANAGEMENT

	<i>Exposure</i>		<i>Control</i>
<i>N</i> of clinics	7	30	
<i>N</i> of physicians	50	112	
Diabetes ⁵³			
Number of patients	1,185		4,740 (4:1 matching)
Process	Odds ratio (95% CI)		Odds ratio (95% CI)
HbA1c overdue	0.79 ^a (0.72, 0.85)		Reference (=1.0)
HbA1c completed if overdue	1.49 ^a (1.30, 1.71)		
LDL completed if overdue	1.26 ^a (1.02, 1.57)		
Outcome	%HbA1c		%HbA1c
Baseline HbA1c	7.96% ± 1.74		7.71% ± 1.53
Post HbA1c	7.41% ± 1.38		7.53% ± 1.36
Difference	-0.55% ^a		-0.18%
Hospitalizations (per year)	21.0%		24.3%
Difference	(-3.3%)		
Depression ⁵⁵			
Change in costs per patient 2001 to 2002	8% decrease		19% increase
<i>Productivity</i>	<i>High use of care managers (<2% of patients)</i>	<i>Low use of care managers (<2%)</i>	
Number of physicians	32	90	
Physician-months	990	2,840	
Average work RVUs	398.9 ± 61.1	377.9 ± 55.1	
[difference]	[+22.0 ^a (5.5%)]		
Within CM clinics	398.17 ± 60.0	368.0 ± 95.4	
[difference]	[+30.1 ^a (8%)]		
Satisfaction			
Physicians who were very satisfied with program	16/18 (88.9%)	N/A	
<i>Cost-benefit</i>	<i>Per clinic (7 physicians)</i>	<i>Per physician</i>	
Costs			
Care managers	\$75,000	\$10,714	
Training program	\$25,000	\$3,571	
Benefits			
Productivity changes ^b	\$88,200	\$12,600	
Hospitalization reduction ^c	\$79,092	\$11,299	
Depression cost reduction ^d	\$135,218	\$19,317	
Benefits—costs (society)	+\$202,510	+\$28,930	
Benefits—costs (clinic)	-\$11,800	-\$1,686	

^a*p* < 0.001 when compared to controls.
^bBased on 2003 Medicare level per RVU (formula = change in RVUs per year × number of physicians × \$ per RVU).
^cSavings/costs per hospitalization per clinic: average charge for age mix (\$22,201) × Medicare discount rate (48.9%) ÷ number of clinics.
^dEstimated average yearly direct and indirect costs for treated patient with CM 2002, \$2,300; non-CM control, \$2,975.
HbA1c, Hemoglobin A1c test; LDL, low-density lipoprotein; RVU, relative value units; CM, Care Management

generate efficiency savings of \$302,510 for society, a net benefit of \$202,510 when considering additional costs. The clinics, however, lost \$11,800 because much of the benefit accrued to payers and patients in the form of reduced utilization.

DISCUSSION

We have successfully implemented a generalist care management model based on the CCM in seven primary clinics. Patients with a variety of diagnoses and issues are treated, and patient

care is provided according to the modalities defined by the CCM. Our primary innovations of generalist referral to a particular team member, the care manager, and enhanced information system components have been used in 1.7% of the patient population seen in these primary care clinics. In our model, information system components are used to increase teamwork and to target information appropriate for each specific individual within the diverse, complex patient population. Care managers help to bridge the gaps in the system as well as formulate, interpret, and apply care plans with the patient and the rest of the team. Preliminary data indicates this team-based approach allows the physician to increase his or her efficiency by as much as 8%, most likely by reducing time spent on inefficient tasks.⁵⁴ We found that care managers read and valued the computer-generated reminders. Initial data show that diabetes⁵³ and mental health care processes and outcomes were improved compared to our clinics that did not use care managers, with more patients meeting disease control goals. If these gains were maintained, they would lead to a 15%–20% decrease in complications from diabetes over time.^{57,58} Multiple co-existing diseases also were uncovered. For instance, administration of the PHQ-9 (a depression screening instrument) in patients with diabetes revealed that as many as 20% were also suffering from depression; as many as one third of these were untreated (A. Larsen, personal communication). An initial qualitative study also suggests that patients and physicians are very pleased with care management. Cost studies show that the societal benefits of increased organization of care and improved health of patients exceeds the costs to society but incurs a slight cost to the provider group. Other benefits to society, such as the long-term reduction in complications from diabetes and depression, reduction in utilization for other diseases, and reduced indirect costs such as missed work, are likely to accrue from the program but are left out of the analysis due to their complexity. In addition, the satisfaction improvement may reduce turnover in provider groups; this, in turn, would decrease the cost of training new physicians.

The IHC approach is different from most previous implementations. First, it is integrated

into primary care clinic work flow (with the addition of the generalist care manager) and does not rely on the creation of specialized clinics, clinic sessions, or outside personnel. This has the logical advantage of requiring less specialization but increases the risk of information and care management overload. Second, multiple conditions were treated by the care management system, both singly and when co-occurring. This required the development of multiple protocols to support best practice for a variety of conditions. These standards of care were taught to the entire care team and care was redesigned to facilitate the implementation of these protocols, with a broad role given to the generalist care manager to improve protocol compliance. The information system was used to reinforce expected standards of care by the patient care team. We recognize that approaching chronic disease in this way is controversial, as specialized knowledge that is required for patient-centered, evidence-based practice may not translate into protocols but may be found only via specialty referral. Such referrals to specialists occurred when anyone on the team felt that the specific patient's needs exceeded the scope of the care management system. Third, information systems were used more extensively than previously to enhance the collaboration and support best practices. The information system components provide access to role-specific and general information, generate alerts, reminders, and suggestions based on best practice, and help to track the components of the care process itself. We feel that the components of the information system used in our model are much broader than the information system components specified in the CCM. Fourth, we have implemented this system in multipayer provider clinics. We have previously made the case that care management in a primary care office is not a widespread model because of fragmentation and misaligned incentives. Rather, care management is seen most often in single-payer systems like Kaiser and Group Health Cooperative; in these cases the payer benefits from the patient's improved health status. Our model addresses this difficulty by spreading the care of the patient with chronic conditions among multiple members of the care team and encouraging

self-management. Wide adoption of our program may be facilitated by the positive cost-benefit ratio and the similarity between our clinics and others with regard to the patients seen and the physician characteristics. Pay-for-performance demonstration programs with care management will likely further increase the benefit as services such as education and guideline adherence are reimbursed. Our clinics have a variety of patients with a variety of insurance carriers, and the providers are reimbursed on relative value unit productivity. Finally, the model is scalable, with a care manager initially addressing one or more diseases, and gradually adopting more as protocols are developed or adopted within the clinic.

Several implementation challenges have to be overcome in order for others to adopt our implementation of the model. The first is the necessity for information systems at the clinic level that provide several different kinds of information and knowledge; current information system adoption is limited in the outpatient setting.⁵⁹ While other practices are increasing their investment in IT, less than 20% of physicians who practice in the ambulatory setting currently have similar functionality.⁵⁹ Improved access to patient information, best practice knowledge, reminders at the point of care, and improved communication certainly contribute to the system's success; we are in the process of assessing the relative importance of each of these capabilities. Similarly, the care manager's specific contributions are as yet uncertain; others have reported that integration of care managers has sometimes proved challenging.⁴¹ We are evaluating the breadth and amount of care manager contact needed, as well as the contribution of the care manager-specific components of the information system. Finally, the clinic size needed to support a care manager within the clinic is at least six physicians; as many of our own clinics are small and in rural areas, we are experimenting with shared care managers.

Additional investigation is needed to define the criteria for referral and the impact of the CCM on patients with multiple chronic diseases. In our model, less than 2% of patients are referred; the selection of patients for referral seems to be appropriate in terms of their many

illnesses and high utilization, but it is difficult to define appropriate referrals and the amount of care management that will be most effective. Our high satisfaction rates and initial analyses show the unconstrained referral process is working reasonably well; working with the low-use physicians to improve appropriate referrals is still ongoing. Recent reports have suggested some care management programs may not be cost-effective,⁶⁰ our initial results also show that this model may be more cost-effective at the provider level than previous models. Identifying and quantifying the benefit of the case manager to patients, individual physicians, clinics, health system, and payers continues to be a primary objective for our group and others such as the Center for Medicare and Medicaid Services.^{61,62} Based upon our experience with generalist care managers and specific information system initiatives, we feel that it is possible to implement a cost-effective, high-quality, high-utility model for general primary care clinics.

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