

Does the Chronic Care Model Serve Also as a Template for Improving Prevention?

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ACUTE AND INFECTIOUS DISEASES ARE NO LONGER the major cause of death, disease, and disability in the United States. Today, chronic diseases, such as coronary heart disease, hypertension, asthma, and diabetes affect more than 100 million Americans and account for three-quarters of the nation's annual health care costs (Institute for Health & Aging 1996). With the continued aging of the U.S. population, both the prevalence and costs of chronic-illness care are expected to rise at least 15 percent by the year 2010, and 60 percent by 2050 (Institute for Health & Aging 1996). Yet, much of this growing chronic-disease burden is preventable through more effective prevention and management. McGinnis and Foege (1993) estimated that 50 percent of mortality from the 10 leading causes of death is attributable to lifestyle behaviors that cause or complicate chronic illness. Finding effective strategies for preventing *and* managing chronic disease will be a major challenge for health care in the 21st century.

The rapid growth in the number of Americans with a chronic illness has taxed the health care system and revealed a number of deficiencies in the organization and delivery of chronic-illness care (Kenny, Smith,

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Goldschmid, et al. 1993; Stockwell, Madhavan, Cohen, et al. 1994). These deficiencies include the widespread failure to follow established practice guidelines (Schuster, McGlynn, and Brook 1998; Starfield 1998; U.S. Department of Health and Human Services 2000). Several authors (Fox and Fama 1996; Kottke, Edwards, and Hagen 1999; Wagner, Austin, and Von Korff 1996a) have argued that these deficiencies result from an approach to health care developed and organized around the diagnosis and treatment of acute conditions and symptoms. Most advocates for improved chronic-illness care propose solutions that involve realigning organizational incentives and priorities, reengineering the present reactive, symptom-driven health care system, and training providers and patients to work as partners in a collaborative care process (Glasgow, Wagner, Kaplan, et al. 1999; Holman and Lorig 2000; Wagner, Austin, and Von Korff 1996a).

Similar deficiencies exist in the delivery of recommended clinical preventive services to healthy populations in primary care settings (U.S. Preventive Services Task Force 1996). Lifestyle screening and counseling services are delivered less often than medical procedures in both chronic care (Glasgow and Strycker 2000) and prevention (Kaplan 2000). Only 56 percent of Americans have been screened for major lifestyle risk factors—including diet, tobacco use, alcohol or drug use, exercise, or risky sexual practices—considerably shy of the Healthy People Year 2000 goal of 80 percent (U.S. Public Health Service 1991). Advocates for improved preventive care also argue for the need to change incentives, systems, and training of providers and patients (Goldstein and DePue 1998; McPhee and Detmer 1993; Solberg, Kottke, Brekke, et al. 1998; Solberg, Kottke, and Brekke 1998). Our thesis in this paper is that the changes recommended to improve the delivery of effective preventive care are fundamentally the same as those recommended in the Chronic Care Model (CCM) of effective chronic-disease management.

Chronic-disease prevention and management constitute a major part of the practices of family physicians, internists, geriatricians, and other medical specialists. The rising incidences of asthma, developmental disabilities, and behavioral disorders make chronic illness a significant component of modern pediatric practice, as well. If each effort to improve the care of a given chronic illness or the delivery of a preventive intervention requires unique changes to practice systems, progress will be slow. If, on the other hand, improvements in chronic-disease prevention and management can follow a common set of system changes and improvement strategies, progress will be faster and far less expensive and confusing.

Wagner and colleagues (Wagner 1998; Wagner, Austin, and Von Korff 1996b) have developed a heuristic model that identifies and organizes the changes needed in the health care system, the practice, and the patient to improve outcomes. They derived the CCM by reviewing and synthesizing successful interventions in many different settings across multiple chronic diseases, and therefore intended it to be generic, applicable across diseases and types of health care organizations (Wagner, Austin, and Von Korff 1996a; Wagner, Davis, Schaefer, et al. 1999). The model provides a functional blueprint or template, as well as a set of organizing principles, for basic changes to support care that is evidence-based, population-based, and patient-centered. It defines the broad areas that must be considered (e.g., information systems, self-management support), but not a specific set of intervention prescriptions; rather, it is a framework in which improvement strategies can be tailored to local conditions.

Wagner and colleagues derived the CCM from literature review and from improvement activities at the Group Health Cooperative of Puget Sound in Seattle, Washington. They refined it in response to input from a large panel of experts and tested its validity by comparing it with nominated “best practice” programs (Wagner, Davis, Schaefer, et al. 1999). This model is currently being implemented in more than 300 diverse health care systems in the context of collaborative quality-improvement efforts (Institute for Health Improvement [IHI] Breakthrough Series) for asthma, congestive heart failure, depression, diabetes, and prevention of frailty in the elderly, and has been found to provide an extremely helpful organizing framework for these diverse quality-improvement efforts (Wagner, Glasgow, Davis, et al. 2001). The model, and associated change strategies, appears to work well across a variety of different organizations, including fee-for-service, hospital-based, Veterans Administration (VA), managed care, and community health settings (Wagner, Glasgow, Davis, et al. 2001). A rigorous four-year evaluation of the outcomes of these model-driven efforts is currently under way, to be completed by 2003.

Before asking whether the CCM can help improve both prevention and management of chronic illness, it is useful to consider how these two activities are similar and how they differ. As summarized in table 1, there are a number of ways in which the setting, actions, and evidence on prevention and chronic-illness management are comparable. Both tasks are complex and multifaceted, and could benefit from decision guides to help establish priorities among various alternative actions and targets.

TABLE 1
 Similarities and Differences between Chronic-Illness Management
 and Prevention

Similarities	<ul style="list-style-type: none"> ● Both involve regular (non-symptom-driven) screening and counseling for health behavior change to prevent disease. ● Both require being able to identify a defined population of patients. ● Both require ongoing planned care with proactive follow-up. ● Both are complex, require addressing multiple health behavior changes or risk factors, and need decision guides for priorities. <ul style="list-style-type: none"> —Bulk of intervention needs to be in primary care. —Providers often work without adequate information. ● Acute illness/reactive care model is inadequate for both. ● Both require active patient involvement in adherence to complex screening, behavior change, or treatment regimes; patient activation, tailoring and shared decision making are important for both. ● Providers are inadequately trained for their roles in both. ● Both require linkages to community resources outside the health care setting and benefit from supportive community policies and programs. ● Policymaker/decision-maker fears that both are costly and may not be cost-effective.
Differences	<ul style="list-style-type: none"> ● Visits for patients needing primary prevention are less frequent than for patients with chronic illness. ● Patients with diagnosed chronic illness (and the providers treating them) are likely to have stronger motivation to change health behaviors. ● Patient and provider demands are greater for chronic-illness care since, in addition to regular screening and health-behavior change, there are issues involving adherence to prescribed medical care for the disease. ● Prevention is more outside the medical culture, and less often tracked or reimbursed. ● Perceived health and economic benefits of prevention in healthy populations may be less than among patients with chronic illness. ● There are fewer health care specialists and greater reliance on community/centralized programs for prevention.

In both areas, evidence-based interventions have been identified, but it is clear that these interventions are not being delivered in practice (Goldstein and DePue 1998; Solberg, Brekke, Kottke, et al. 1998; Wagner, Davis, Schaefer, et al. 1999). Because chronic-illness management and prevention needs are generally not urgent, they are often not addressed. Most of these needs are “silent,” that is, not asked for by patients, and therefore often go unassessed and untreated. Proactive population-based, patient-centered care is recommended for both, as the symptom-based reactive-care approach has proved inadequate for them. Many prevention and chronic-disease management activities (e.g., behavioral counseling, linkage with community resources, registry management) are outside the scope and culture of clinical medicine, so providers often have little or no training in the skills required to improve care. Specific target behaviors (e.g., healthy eating, regular physical activity, regular preventive checks) often are identical for prevention and disease management. Finally, in both prevention and chronic-illness care, effective strategies for improving practice performance share many similarities, as we discuss below.

There are also differences between prevention and chronic care, however, that will need to be addressed by a model that attempts to apply to both areas. Both patients and providers who are primarily oriented to curative medicine may be less receptive to the delivery of preventive care than they are to chronic-illness care. Unlike the management of most chronic diseases, many components of effective preventive care can be delivered without much involvement by the patient’s primary care team. For instance, many health plans routinely invite patients to centralized screening services. There are differences in the time frame within which both patients and health care systems can expect to see a “return on their investment.” This time frame is typically much longer for prevention than for many chronic-illness activities. In addition, preventive-care services, especially those involving health behavior changes, may not have diagnostic codes, may not be tracked, and often are not reimbursed. Finally, there are fewer specialists involved in the delivery of prevention services, which are more likely than chronic-illness care to be delivered in community settings.

On balance, despite these differences, it appears that there are sufficient commonalities in setting, context, and available data regarding what is effective for prevention and for chronic-illness care to consider whether a common model can apply to both. As figure 1 shows,

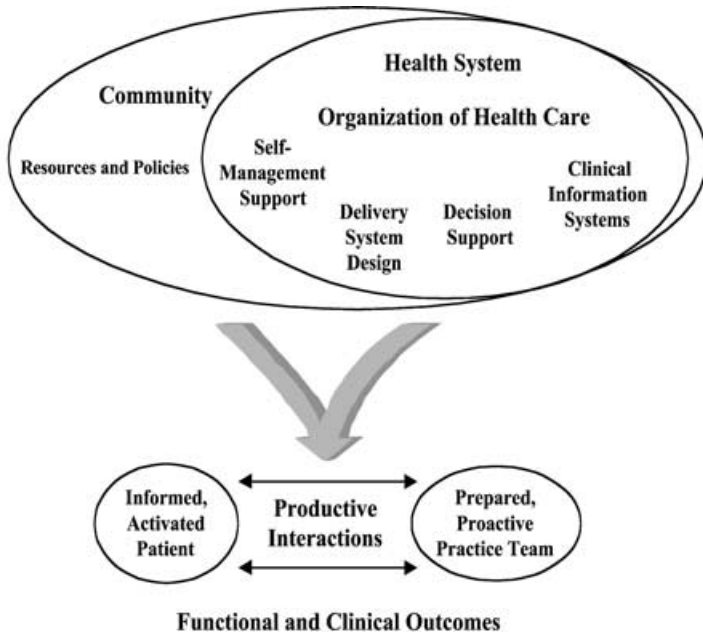


FIG. 1. Chronic-care Model.

improving chronic-illness and preventive care and outcomes requires interactions between patients and their professional caregivers that ensure that patients receive effective interventions and that patients' and their families' needs for information, behavioral support, and continuity are met (i.e., productive interactions). To achieve productive interactions, patients need the confidence and skills to manage their health and get what they need from the health care system (i.e., informed, activated patients), and providers need the information, resources, and time to ensure and deliver effective interventions (i.e., prepared, proactive practice team). Effective behavioral, educational, and supportive interventions enhance patient confidence and skills, which increases the likelihood of appropriate behavior change. For prevention especially, because of the central role played by social-environmental factors influencing lifestyle (Emmons 2000; Glasgow, Strycker, Toobert, et al. 2000; Orleans, Gruman, Ulmer, et al. 1999; Smedley and Syme 2001), many of the interventions are most appropriately and effectively implemented through linkages with community resources, policies, and organizations.

Self-management support prepares the patients to understand their role in the process and to play an active, collaborative role in establishing goals

that are both valued and achievable. *Community resources* address barriers to achieving these goals, and especially social-environmental factors that determine long-term success. Ensuring that professional caregivers have ready access to relevant clinical and preventive knowledge (*decision support*) and patient-status information (*clinical information systems*) is central to improving practice team performance. But knowledge and patient data are not sufficient to improve performance unless the composition and functioning of the practice team, appointment systems, and approaches to ensuring continuity and follow-up change (*delivery-system design*). Finally, quality improvement will likely fail without the support of the larger health care organization and its leadership (*health care organization*).

Components of the CCM

The Health System: Organization of Care

CCM. Acute-episode-oriented health care must be reengineered to create an environment in which organized efforts to improve health care for chronically ill individuals are systematically supported and encouraged (Glasgow, Hiss, Anderson, et al. 2001; Wagner, Austin, and Von Korff 1996a; 1996b). Critical elements include making chronic-illness care a key goal of the organization, ensuring that leadership is committed and visibly involved, instilling support for change and quality-improvement trials, and realigning or creating incentives for providers and patients to improve care and adhere to evidence-based guidelines (including both financial and nonfinancial incentives, such as recognition and status).

Applications to Prevention. As Thompson and colleagues (Thompson 1996; Thompson, Taplin, McAfee, et al. 1995) and others (Goldstein and DePue 1998; Schauffler 1999) have described, our current acute-illness-based model of care provides a variety of disincentives for preventive care. With a few exceptions (e.g., childhood immunization, mammography), most preventive actions are not reimbursed for either patients or physicians, and systems employing capitation implicitly provide incentives for *not* performing preventive (or management) activities. Health care systems that have successfully improved the delivery of preventive services have included visible and tangible top leadership support for prevention goals, and have translated this support into systems and tools for quality measurement and improvement

(e.g., issuing report cards on physician performance of preventive behaviors). They have also improved incentives for providers and for patients: either increasing coverage and provider reimbursement or removing patient co-payments (Curry, Grothaus, McAfee, et al. 1998; Schauffler 1999; Thompson 1996). The underlying causes of many risk factors are social, economic, or environmental (Emmons 2000; Smedley and Syme 2001), and the community resources component of the CCM addresses these issues.

Clinical Information Systems

CCM. Timely information about individual patients—and populations of patients—with chronic conditions proved to be a common feature of effective programs. The most basic need is to establish a disease registry that not only identifies the population to be served (e.g., all patients with asthma or heart disease) but also includes information on the performance of various aspects of guideline-informed care. Health care teams with access to a registry can call patients with specific needs and deliver proactive care, receive feedback on performance, implement reminder systems, generate tailored treatment planning or encounter forms, and produce tailored patient or provider messages to facilitate care and self-care.

Applications to Prevention. Clinical information systems are also critical to prompt and support planned preventive care. Solberg and colleagues (1997) have underscored a need for status summaries—that is, routine ways to summarize the status of preventive services on a patient's chart (e.g., using chart labeling, a special card, or flow sheet) parallel to those described above for chronic illness care. Regularly updated information on the preventive service needs of health plan members should inform, prompt, and contribute to priority setting between patients and providers. User-friendly information systems can also aggregate data by provider or clinic relative to others in the system or to quality-improvement goals. Kreuter and colleagues (1996) used data from an immunization registry to prompt providers, and also to generate individualized calendars for the families of infants enrolled in Medicaid, which prompt not only future planned visits for immunization and well-baby care but also developmentally appropriate parent-child interactions.

Delivery-system Design

CCM. Wagner and colleagues (1996b) found that effective chronic-illness management involved changes to existing acute-care visit and care-delivery models. Such changes affected practice-team composition and/or functioning (Wagner 2000), the organization of visits, and the handling of follow-up (Calkins, Boulton, Wagner, et al. 1999; Wagner, Austin, and Von Korff 1996a; 1996b). Many effective interventions enhance the practice teams by involving professionals with specific behavioral and clinical expertise, such as nurse case managers, pharmacists, or health educators. Innovations in the organization of visits have made it easier for practice teams to conduct productive interactions. For example, Sadur and colleagues (1999) integrated group visits led by a diabetes nurse educator into primary care practice with significant improvements in glycemic control, patient satisfaction, and health care utilization. A hallmark of effective chronic-illness care is follow-up, which need not involve face-to-face visits. Studies across multiple chronic diseases have demonstrated the effectiveness of telephone follow-up (Wasson, Gaudette, Whaley, et al. 1992).

Applications to Prevention. For many preventive services, the primary care provider initiates the intervention with brief screening, advice, and referral; but the actual procedure and more time-consuming activities are delivered in other settings by nonphysician members of the health care team (Solberg, Brekke, Kottke, et al. 1998). Group visits have been used in preventive visits for children for some time. Feasible and cost-effective preventive protocols include using nonphysician staff to deliver counseling and coordinate care. For instance, Hollis and colleagues (2000) implemented an office-based system for smoking cessation in which the primary care provider gave 30 to 60 seconds of quitting advice to identified smokers, then referred the patients for behavioral counseling or an in-practice videotape. Some preventive-care interventions can be delivered outside the context of patient visits, using planned proactive mailings or phone calls to at-risk patients. Outreach procedures, using proactive counseling calls, individually tailored mailings, or other centralized resources have been used to help patients initiate and maintain screening behaviors as well as changes in lifestyle behaviors (Curry 1998; Orleans, Schoenbach, Wagner, et al. 1991; Skinner, Campbell, Rimer, et al. 1999; Curry 1998).

Decision Support

CCM. Effective chronic-illness management programs require that providers have the knowledge required for optimal patient care (Wagner, Austin, and Von Korff 1996a). The value of evidence-based practice guidelines or protocols, if integrated into practice and supported by effective provider training and behavioral change methods, is now widely recognized (Grimshaw and Russell 1993; Katon, Von Korff, Lin, et al. 1995; McCulloch, Price, Hindmarsh, et al. 1998). In improving clinical care for chronic disease, primary care practice teams also benefit from appropriate input and collaborative support from relevant medical specialties. New specialty roles that effectively improve chronic-disease patient outcomes include alternating visits between generalists and specialists (Katon, Von Korff, Lin, et al. 1995), joint visits (McCulloch, Price, Hindmarsh, et al. 1998), and case-manager discussion of patients with a specialist or specialty team (Aubert, Herman, Waters, et al. 1998; Rich, Gray, Beckham, et al. 1996).

Applications to Prevention. Decision support for chronic-illness care has its parallel in evidence-based age- and gender-appropriate clinical preventive services. There is a strong tradition of guidelines and recommendations in prevention, exemplified by the U.S. Preventive Services Task Force Clinical Practice Guidelines (1996) and individual preventive services guidelines, such as the new guideline for the treatment of tobacco use (U.S. Department of Health and Human Services 2000). Decision-support tools and prompts are important for prevention because in the absence of symptoms, providers may be less likely to initiate recommended preventive actions or services. As in chronic care, simply educating providers about guidelines does little to change prevention practice behaviors (Anderson, Funnell, Butler, et al. 1995; Ockene and Zapka 2000). Rather, system prompts and reminders (Solberg, Brekke, Fazio, et al. 2000) are needed to translate guidelines and education into action.

Self-management Support

CCM. Effective self-management support helps patients and families cope with the challenges of living with and managing chronic illness in ways that minimize emotional impact and disability (Lorig 1993; Wagner, Austin, and Von Korff 1996a; 1996b). The availability of appropriately tailored educational resources, skills training, and psychosocial

support are key CCM elements. Successful self-management programs rely on a collaborative process between patients and providers to define problems, set priorities, establish goals, identify barriers, create treatment plans, and solve problems (Glasgow, Wagner, Kaplan, et al. 1999; Glasgow and Eakin 2000; Von Korff, Gruman, Schaefer, et al. 1997). Patient-centered interventions that activate patients for managing illness appear especially beneficial (Anderson, Funnell, Butler, et al. 1995; Greenfield, Kaplan, Ware, et al. 1988; Roter, Hall, and Merisca 1998).

Applications to Prevention. Patient activation—helping patients to recognize their need for preventive services and to take action to obtain them—is critical for prevention (Solberg, Kottke, and Brekke 1998). Self-management interventions apply especially well to preventive interventions involving lifestyle modification (e.g., smoking cessation, dietary and physical-activity changes, seat-belt use). Collaborative goal setting, identification of personal barriers and supports, development of individual problem-solving strategies, and follow-up support are all critically important (Ockene, Emmons, Mermelstein, et al. 2000; Orleans 2000). Shared decision-making models also apply—especially in circumstances where the evidence base is inconclusive, or where treatment involves uncertain risks and benefits (e.g., prostate cancer screening; hormone-replacement therapy) (Frosch and Kaplan 1999; U.S. Preventive Services Task Force 1996).

There has been substantial use of self-help materials and brief telephone counseling to change preventive health behaviors, and as resources either in the context of clinic visits (Solberg, Brekke, Kottke, et al. 1998) or as outreach strategies (Curry, Wagner, and Grothaus 1991; Orleans, Schoenbach, Wagner, et al. 1991; Solberg, Brekke, Kottke, et al. 1998). In fact, there is a rapidly growing literature on the effectiveness of tailored outreach activities involving telephone counseling and/or mailed print materials to support health-behavior change (Lichtenstein, Glasgow, Lando, et al. 1996; Skinner, Campbell, Rimer, et al. 1999; U.S. Department of Health and Human Services, 2000; Marcus, Bock, Pinto, et al. 1998).

Community Resources

CCM. The performance of health care systems can often be improved by establishing linkages with community resources relevant to

effective chronic-illness care, such as peer support, exercise, or long-term care. Community resources are especially important for vulnerable populations such as the elderly, child/youth, low-income, and underserved populations.

Applications to Prevention. The underlying causes of many risk factors are social, economic, or environmental (Syme and Balfour 1998), and the community resources component of the model addresses these issues. The prevention literature documents the importance of environmental supports to help patients initiate and maintain health behavior changes (Curry and McBride 1994; Irvin, Bowers, Dunn, et al. 1999; Perri, Sears, and Clark 1993). This appears true of stopping unhealthy behaviors, initiating health-promoting behaviors, and adhering to recommended activities (e.g., mammogram screenings) (Starfield, Power, and Weiner 1994). Many prevention services are delivered through community agencies (e.g., mobile screening vans), voluntary agencies, and civic programs (e.g., senior or community centers). Successful examples of how neighborhood and community coalitions have organized to address various health promotion issues have been strongly linked to primary care (Fisher, Auslander, Munro, et al. 1998). Community linkages also include policy initiatives that promote clinical preventive services (e.g., earmarking tobacco taxes for the prevention and treatment of tobacco dependence). Finally, recent and future reports on community preventive services (Special Issue of *American Journal of Preventive Medicine* 2001) should provide further impetus to use evidence-based community interventions.

Exemplary Prevention Programs

Using the above discussion of chronic care and prevention as a backdrop, we now describe several successful prevention programs. Although none were developed by using the CCM (most were initiated before it was articulated), we use the components of the model to describe these programs to see how well the CCM fits prevention. We first summarize a recent survey of leading prevention programs throughout the country to see how well the CCM characterizes these programs. Next, we present two sample screening programs (mammography and cancer screening) and two behavioral-counseling programs (smoking cessation). In each area, examples come from the Group Health Cooperative of Puget Sound

because we are most familiar with these programs and because of their base of empirical support. We then follow this with an example from a different, and very challenging, non-HMO health care setting. As in chronic-illness care, in which effective care models were first demonstrated in HMO settings, we are confident that these same principles will apply across diverse settings—including PPOs, fee-for-service, and safety-net providers—as they have in chronic-illness applications of the CCM (Wagner, Glasgow, Davis, et al., 2001).

Survey of Successful Prevention Programs

Following the developmental strategy initially employed by Wagner and colleagues (1999) to validate the CCM in nominated “best practice” chronic-disease-management programs, the Center for Advancement of Health, in concert with the Robert Wood Johnson Foundation, surveyed the directors of 45 best-practice prevention programs to test for the presence of the six core components of the CCM (Center for Advancement of Health 2001). The 45 diverse programs nominated by a committee of experts in prevention services consisted of 21 counseling programs (e.g., tobacco cessation, weight management, physical activity, risky drinking, sun safety, general wellness), 16 child and/or adult immunization programs; and 8 cancer-screening programs (mammography, cervical cancer). The health care systems in which these programs were based comprised 37 managed care organizations (22 were group or staff model, and 15 were part of IPA, PPO, or network models), and 8 academic or community health centers.

The findings supported the broad applicability of the CCM to these model prevention programs. At least 75 percent of the program directors surveyed reported maintaining clear *health care organization* priorities for prevention and strong senior leadership support, using computerized *clinical information systems* to develop patient registries and assist the delivery and tracking of preventive services, and using clinical practice guidelines for *decision support* along with procedures encouraging their use (e.g., provider training and feedback). More than 50 percent reported using planned visits and phone calls as part of their *delivery-system design*, telephone counseling and patient-education manuals/mailings for *self-management support*, and links or referrals to *community resources* (Center for Advancement of Health 2001). A more detailed publication

by the Center will provide a finer-grained picture of how CCM components map onto these varied prevention programs involving diverse health care systems and populations.

Mammography Screening

Annually, there are more than 180,000 new breast cancers diagnosed and nearly 50,000 deaths from breast cancer (Fletcher, Black, Harris, et al. 1993). More than 75 percent of cases occur in women with no known risk factors. Interventions to prevent breast cancer are emergent; however, early detection, including mammography, remains the key to reduced morbidity and mortality from breast cancer. Maximizing the reach of mammography screening into the population of age-eligible women is a continuing clinical challenge (Curry and Emmons 1994).

The Breast Cancer Screening Program (BCSP) at the Group Health Cooperative (GHC) provides an example of an effective mammography program. The BCSP began in 1986 and has been continuously evaluated and refined (Carter, Thompson, Bourdeau, et al. 1987; Taplin, Mandelson, Anderman, et al. 1997; Taplin, Thompson, Schnitzer, et al. 1990). Care is organized around several core components (see table 2), including a centralized clinical information system for tracking breast cancer risk and screening participation of all women age 40 and older; regional centers for coordinated mammography, clinical breast exam, and follow-up; and automated tracking of mammography screening results.

1. *Organization of Care.* Breast cancer screening is a major strategic emphasis of GHC. Mammography rates are a key indicator that is tracked and reviewed regularly by GHC's leadership. The leadership has supported multiple improvements to the information and patient-notification and -reminder systems. In keeping with national policy, co-payments are waived for all women over age 40 on services related to BCSP.

2. *Clinical Information Systems.* A population-based, centralized clinical information system is at the heart of the BCSP. All women aged 40 and over are mailed a risk-factor survey. The survey assesses evidence-based risk factors that include history of breast cancer among first-degree relatives, age of menarche, menopausal status and age of menopause, parity and age of first birth, prior breast biopsy, and previous mammography participation. Women who do not complete the survey within

TABLE 2
Components of Chronic-Care Model as Implemented for Mammography
Screening at Group Health Cooperative

CCM component	Mammography screening at GHC: BCSP
1. Organization of care	<ul style="list-style-type: none"> ● Incentives ● Continuous Quality Improvement (CQI) infrastructure
2. Clinical information systems	<ul style="list-style-type: none"> ● Visible top-leadership support ● BCSP registry with risk profiles for women aged 40 and older ● Radiology database of mammography-screening results
3. Delivery-system design	<ul style="list-style-type: none"> ● Proactive written invitations for routine screening; personal contact for those requiring follow-up procedures
4. Decision support	<ul style="list-style-type: none"> ● On-line tools available through GHC intranet
5. Self-management support	<ul style="list-style-type: none"> ● NCI and other evidence-based guidelines ● Reminder postcards and outreach scheduling calls for nonparticipants ● Telephone counseling ● Instruction in breast self-exam at screening appointments
6. Community resources	<ul style="list-style-type: none"> ● Regional mammography centers ● Participation in Race for the Cure and other community events

two months have the survey placed in their medical chart to enable their physician to discuss the BCSP, answer questions, and encourage them to enroll. Overall, 87 percent of age-eligible women are enrolled in BCSP.

3. *Delivery-system Design.* Women are proactively invited for routine mammography screening according to their age and risk-factor profile, as determined by the survey. Based on current evidence and consensus panel recommendations, women between ages 40 and 49 are either not invited if they have no risk factors, or scheduled annually or every two years depending on their risk profile. Women aged 50 and older are invited at least every two years, and annually if they have elevated risk. The delivery system tracks mammography results in an automated database. Women with normal mammograms are notified by mail. For suspicious

results, women are contacted in person and, depending on mammography results, are either invited for a repeat mammogram or referred to appropriate specialty care for follow-up. All referrals are linked to the women's primary care providers as well.

4. *Decision Support.* Decision support for the BCSP is provided via on-line tools accessible through GHC's intranet. To illustrate the breadth of support, a keyword search on this intranet for "mammography" yields more than 230 documents; "breast cancer screening" yields more than 100. Interactive documents that are available include: evidence-based guidelines for breast cancer screening and for genetic testing for breast and ovarian cancer; recommendations for mammography screening for women aged 40 to 49 and for managing patient requests for prophylactic mastectomy or oophorectomy; policies related to overriding BCSP screening-interval recommendations and to follow-up on breast cancer patients; and a delivery-system resource guide and links to the National Cancer Institute's information on breast cancer risk and the drug Tamoxifen.

5. *Self-management Support.* Participation in mammography screening does not require daily adjustments in one's life. Women must make appointments for mammograms, based on their recommended screening intervals, and participate in follow-up appointments as clinically indicated. Thus, within the BCSP, self-management support has focused primarily on providing proactive reminders to schedule mammograms, timely follow-ups by phone and mail for women who fail to schedule following a reminder, and instruction in breast self-examination

6. *Community Resources.* Currently, the BCSP serves more than 250,000 women in Washington State through six regional mammography centers. Since the inception of the BCSP, community resources have been enhanced by increasing the number of regional mammography centers and expanding patient hours.

Outcomes. Early evaluations of the BCSP indicated that only about 65 percent of women obtained a mammogram within one year of their written invitation, and compliance rates varied by previous mammography experience. Among key findings from randomized evaluations within the BCSP are: (1) postcard reminders to women receiving their first BCSP invitation for screening increased participation by 60 percent (Taplin, Anderman, Grothaus, et al. 1994); (2) the BCSP standard protocol of risk assessment and personalized feedback improved

participation among women with a family history of breast cancer (Curry, Taplin, Anderman, et al. 1993); and (3) both brief reminder calls and more extensive motivational-counseling calls significantly increased participation compared with reminder postcards, and the two phone interventions are equally effective (Taplin, Barlow, Ludman, et al. 2000). As a result of these studies, the BCSP now uses both reminder postcards and outreach scheduling calls.

Evidence for positive functional and clinical outcomes from implementing the components above is compelling (Potosky, Merrill, Riley, et al., 1997; Thompson, Barlow, Taplin, et al. 1994). First, participation in mammography screening is improving. Based on Health Plan Employer Data and Information Set (HEDIS) measures, the percent of GHC women aged 52 to 69 who have had at least one mammogram in the past two years has increased from 65 percent to 78 percent. Second, the BCSP leads to detection of more cancers at early stages when cure rates are high (Thompson, Barlow, Taplin, et al. 1994). Finally, because the direct costs of breast cancer care increase with the stage at diagnosis, the BCSP has also proved cost-effective (Taplin, Barlow, Urban, et al. 1995).

Application in an Underserved Population Setting

Rimer and colleagues (1999) reported on a randomized trial of tailored interventions to prompt cancer screening (including mammograms, Pap testing, and overall cancer screening) among 1,318 patients in a community health center that serves primarily low-income African-American clients. They evaluated three approaches to enhancing cancer screening: provider prompting; provider prompting plus tailored print; and provider prompting plus tailored print and tailored phone counseling.

Of the CCM components, *organization of care* was included through support of the experimentation inherent in the randomized trial, as well as by provision of resources for the equipment, software, and staff time required to deliver the interventions. *Clinical information systems* were a central feature of the program and included a comprehensive computer system, a computerized health-maintenance-tracking system, and the complex tailoring system for generating individualized print materials. *Delivery-system design* was incorporated by the system-generated prompts,

which were printed out and attached to patient charts to cue providers, and through the individually tailored telephone follow-ups from trained female counselors. *Self-management support* was featured through the multiple components of a tailored printout containing the patient's recommended screening intervals and the dates she was due for screenings; a personalized birthday card; and a newsletter tailored to the patient's readiness to change, barriers to screening, demographics, and medical characteristics. Finally, *community resources* were addressed by the use of a local African-American artist to create the graphics for the program and through responses to the barriers identified by patients, many of which were social-environmental in nature.

This program, conducted in a setting having few resources and serving a low-income, largely African-American clientele (81 percent of participants were African American, 70 percent had incomes less than \$20,000 per year, 34 percent had no health insurance, and only 21 percent had more than a high school education) demonstrated that a well-designed and appropriately tailored intervention program could successfully address multiple preventive behaviors. The combined phone, print, and prompting intervention was more successful than the other two interventions, especially in enhancing Pap test compliance (achieving 70 percent compliance for women without hysterectomies) and overall cancer screening.

Smoking Cessation

Perhaps the most complex form of clinical preventive service involves health-behavior change—that is, changes in tobacco use, diet, physical activity, risky drinking, and risky sexual practices (Kaplan 2000; U.S. Preventive Services Task Force 1996). We chose tobacco use as an example here, and selected the smoking-cessation program at GHC as a well-documented organizational effort to promote population-wide smoking cessation (see table 3).

1. Organization of Care. The GHC's top leaders identified reducing tobacco use as the number one prevention priority, and introduced a "clinical road map" to identify and improve key clinical processes. The road map effort involved realigning the systems and structures of the organization toward identified tobacco intervention goals, and setting explicit targets in the GHC's annual business plans (McAfee, Wilson, Dacey, et al. 1995). Organizational incentives include support for clinic

TABLE 3
 Components of Chronic Care Model as Implemented for Smoking Cessation
 at Group Health Cooperative

CCM component	Smoking-cessation at GHC: "Free & Clear" program
1. Organization of care	<ul style="list-style-type: none"> ● Top-leadership support ● Realignment of incentives, quality targets set, provider performance feedback given ● Elimination of patient co-pays for cessation services
2. Clinical information systems	<ul style="list-style-type: none"> ● Automated patient-enrollment and -tracking systems ● Population-based registry of tobacco users ● Computer-generated patient calls and provider reports
3. Delivery system design	<ul style="list-style-type: none"> ● Planned, proactive phone counseling ● Cessation-specialist staffing support
4. Decision support	<ul style="list-style-type: none"> ● Clinical practice guideline ● Provider/team training and feedback ● Automated patient-progress reports for providers
5. Self-management support	<ul style="list-style-type: none"> ● Self-help materials for patient/family ● Telephone counseling ● Clinic sessions available
6. Community resources	<ul style="list-style-type: none"> ● Referral for additional quitting resources ● Organizational leadership in community action/policy development (e.g., securing funds for smoking-cessation treatment)

staff, provider incentives, and elimination of patient co-payments (Curry, Grothaus, McAfee, et al. 1998; McAfee, Wilson, Dacey, et al. 1995).

2. *Clinical Information Systems.* Enrollees who smoke are identified primarily through the assessment of smoking status at the time of patient visits (McAfee, Wilson, Dacey, et al. 1995). The clinical information system monitors patients' progress and use of quitting services and medications, prompts appropriate counseling calls, and generates progress reports and chart aids on patients for referring physicians. Efforts currently under way include ensuring that diagnostic/billing codes

for tobacco use status are fully supported in the automated administrative clinical information systems. This makes it possible to have a population-based registry of all tobacco users and to recruit and monitor smokers proactively (McBride, Curry, Grothaus, et al. 1998).

3. *Delivery-system Design.* The GHC's smoking-cessation program is designed to minimize physician burden and to ensure access to cessation specialists for face-to-face or telephone counseling and follow-up support. This service is initiated with provider screening, documentation of smoking status, and referral to the "Free & Clear" cessation program. It then moves beyond patient visits, which entails six to eight planned proactive follow-up contacts from a cessation specialist. An automated system triggers a centralized phone call from a nurse to all participants one week after they begin nicotine replacement therapy. The same system sends personalized physician letters to participants.

4. *Decision Support.* The GHC developed a smoking-cessation clinical-practice guideline based on the National Cancer Institute's (NCI) "4-A" model (Ask-Advise-Assist-Arrange) (Orleans, Glynn, Manley, et al. 1993; Thun and Glynn 2000) and consistent with the Agency for Health Care Policy and Research's (AHCPR) clinical practice guidelines (Agency for Health Care Policy and Research 1996). It distributed the guideline to all primary care providers and practices via computer, and provided training, ongoing consultation, and support to fit individual practice arrangements, along with several practical implementation tools (e.g., patient assessment and education materials, chart stickers/vital-sign stamps, flow sheets, advice scripting, and chart audit materials) (Curry 1998; McAfee, Wilson, Dacey, et al. 1995).

5. *Self-management Support.* The GHC's Free & Clear program combines a behavioral self-help guide (and/or clinic sessions) with proactive telephone counseling and access to a telephone "quit line" staffed by smoking cessation specialists (Orleans, Schoenbach, Wagner, et al. 1991). Program materials, mailings, telephone-counseling protocols, and pharmacotherapy recommendations provide personalized quitting advice, skill training, and psychosocial support tailored to individual quitting motives, barriers, stage of change, level of addiction, and quitting-method preferences (Curry 1998; McAfee, Wilson, Dacey, et al. 1995; Orleans, Schoenbach, Wagner, et al. 1991). All program components are based on a model of collaborative treatment planning, goal setting, and problem solving. A guide for family members, friends, and coworkers prepares them to support the quitter.

6. *Community Resources.* Linkages to community resources include referral to local quit-smoking programs and to related health improvement programs (e.g., weight loss, exercise, stress management) for smokers wanting more help, as well as support for workplace promotional campaigns and smoking restrictions provided to local employers insured by the GHC. In addition, the GHC has worked with community coalitions to obtain a dedicated tobacco excise tax to support prevention activities; to pass a youth-access bill that eliminated cigarette-vending machines; to strengthen clean indoor air laws and ban smoking in office buildings statewide; and, most recently, to partner with other community-based organizations to secure state tobacco settlement funds for tobacco prevention and control (McAfee, Wilson, Dacey, et al. 1995; Thompson, 1996).

Outcomes. Fully implemented in 1993, the GHC program has achieved impressive behavioral, clinical, and economic outcomes. Rates of tobacco use documentation rose from 40 percent in 1994 to 80 percent in 1995 (McAfee, Wilson, Dacey, et al. 1995) and 98 percent in 1999 (Dacey 2000). A randomized study of the self-management support resources documented a 23 percent biochemically confirmed, 16-month quit rate for the self-help program with telephone counseling, and found that personalized telephone support significantly increased patient involvement in care and adherence to recommended self-quitting strategies (Orleans, Schoenbach, Wagner, et al. 1991). Six-month quit rates reported in a more recent study of the Free & Clear program (including nicotine replacement and provider advice and support) ranged from 28 percent to 38 percent among enrollees offered different benefit designs (Curry, Grothaus, McAfee, et al. 1998). By 1994, the prevalence of tobacco use at GHC had dropped to 15.5 percent from 25 percent in 1985. During the same time, comparable data showed a much slower rate of decline in Washington State (23.7 percent in 1987, 21.8 percent in 1994) (McAfee, Wilson, Dacey, et al. 1995). Compared with continued smokers, quitters who took part in the Free & Clear program also were found to have significantly lower use of inpatient and outpatient health care services three to five years after quitting (Wagner, Curry, Grothaus, et al. 1995).

Community Health Center Application

The application of the CCM to preventive efforts for underserved audiences is demonstrated through an ongoing project to promote smoking

cessation conducted through Grace Hill Health Centers: the Federally Qualified Neighborhood Health Centers serving neighborhoods with predominantly low-income and minority populations in St. Louis, Missouri. This innovative effort, which is still under evaluation, supports the utility of the CCM in prevention among underserved and homeless groups. *Organizational leadership* was substantial, beginning with early efforts to secure funding for the program, identify and support the staff required (smoking-cessation teams), support reimbursement for key medications for smoking cessation, and support system improvements. This included allocation of *clinical information system* resources within the agency to establish smoking status as a vital sign in the encounter form used for all patient visits and to establish templates to track services within a patient-tracking system. The percentage of encounter forms that assess smoking status and readiness to quit has risen from virtually zero in April 2000 to 91 percent one year later. These encounter-form data have been used to provide feedback on the performance of individual health centers. *Decision support*, *delivery-system design*, and *self-management support* are integrated with and coordinated by the patient-tracking system, and include the training of lay “coaches” to provide cessation counseling and the development of stage-based staff counseling protocols for high-priority subgroups, such as pregnant women or adults with diabetes.

With respect to *community resources*, Grace Hill has a history of neighborhood-based programs, including wellness committees in areas surrounding its health centers (Fisher, Strunk, Sussman, et al. 1996; Fisher, Auslander, Munro, et al. 1998). These have organized or served as sponsors for Grace Hill’s participation in health fairs, presentations at local churches, and related community events addressing tobacco. Community health services from the health centers also interact with neighborhood residents around key health themes. For example, Mothers Assisting Mothers (MAM) is a program for young, single first-time mothers. Friends of Asthma in the Neighborhood (FAN) developed out of the Neighborhood Asthma Coalition. Community health nurses and neighborhood staff in both of these programs have been trained to provide smoking-cessation counseling to their clients.

The smoking-cessation program is in the last six months of a 24-month evaluation. Smoking-cessation outcomes are not yet available, but exit interviews of patients at the Grace Hill Health Centers allow assessment of the percentage of patients reporting key smoking-cessation services. Especially pertinent to the project’s emphasis on the

community resources component of the CCM: the percentage of patients from the Grace Hill Health Centers who answered “yes” to “Did your doctor or any other health care professional tell you about programs or help in your neighborhood for quitting smoking” has increased by 19 percent, versus a 6 percent *decrease* among patients from comparison health centers.

Relationship to Other Prevention Models

A number of models for the improvement of preventive care have been proposed (Carney, Dietrich, Keller, et al. 1992; Leininger, Finn, Dickey, et al. 1996; Pommerenke and Weed, 1991; Solberg, Kottke, Conn, et al. 1997; Thompson, Woolf, Taplin, et al. 1996; Walsh and McPhee, 1992). These models share many elements with each other and with the CCM. The specific components encompassed by the models tend to fall into three general areas: characteristics of effective practice systems (e.g., reminder systems), specific care processes that ensure delivery of preventive care (e.g., assessment of patients’ preventive needs), and techniques and processes for changing practice systems (e.g., training, incentives). Some previous models (Pommerenke and Weed 1991; Thompson, Woolf, Taplin, et al. 1996; Walsh and McPhee 1992) mixed these factors in an effort either to identify the most critical determinants of preventive-care improvement or to explicate the myriad issues associated with better clinical preventive care.

These models have helped focus interventions to improve preventive performance, but the admixture of system characteristics, care processes, and techniques for achieving change may underestimate the importance of each of the three in guiding efforts to improve preventive care. Solberg and colleagues developed a sophisticated approach to improving preventive-care performance (Solberg, Kottke, Conn, et al. 1997; Solberg, Kottke, Brekke, et al. 1998; Solberg, Kottke, and Brekke 1998). They delineated more clearly the three classes of change ideas described above, and emphasized that quality improvement requires *system* change, not just changes in provider knowledge or attitudes. Further, their Prevention System details the sequence of care processes that ensure successful prevention.

Unlike most of the other models, the Prevention System focuses primarily on the changes in clinical behavior associated with better

performance (Solberg, Kottke, Conn, et al. 1997; Solberg, Reger, Pearson, et al. 1997; Solberg, Kottke, Brekke, et al. 1998; Solberg, Kottke, and Brekke 1998). The Prevention System is one effort to identify the care system for clinical preventive services, describing each of the component processes needing understanding, development, and institutionalization at each practice site. Significantly, these care processes are not separable—they must be integrated. For example, the best operationalized screening and summarizing of preventive needs will be for naught if one does not use it to cue staff (using standing orders) to act on that information. Underlying the effective use of these processes are some other key systems concepts: teamwork, with extensive delegation of tasks formerly left to physicians; taking advantage of every opportunity; taking a population approach; and standardizing care.

The CCM, in contrast to the Prevention System, focuses on effective practice systems, and changes needed to those systems. Thus, we see the CCM and the Prevention System as largely complementary—the former describing the characteristics of practice systems associated with improved preventive care, and the latter indicating the specific elements of that care.

Discussion

The CCM synthesizes the elements of successful chronic-disease-management programs, and relates them to improvements in outcomes. The six CCM elements work in concert, providing both patients and their professional caregivers with the information, skills, incentives and resources essential for optimal management of chronic disease. The goals of effective chronic-disease management are preventive in orientation: to prevent exacerbations, complications, treatment side effects, and emotional distress. Therefore, it is not surprising that the CCM seems to apply to prevention, including health behavior change.

While the overall CCM appears to fit prevention, some components, such as community resources, are especially important because a greater proportion of preventive than chronic-disease interventions are conducted outside of the clinical setting, and because the macro-environmental determinants of preventive health-related behaviors are so compelling (Emmons 2000; Orleans 2000; Syme and Balfour 1998). For prevention, the scope and depth of the community-resources and policy-linkage components of CCM may need to be expanded. To

successfully address preventive issues and major prevention challenges—such as reducing health disparities—policy and environmental change efforts will likely be required, and may need to play a more prominent role. As with chronic illness, the key to successful prevention programs is linkages among the six model components. These components cannot be just independent or parallel activities; the different channels need to be integrated and interactive.

An important and possibly underappreciated component of the CCM that appears necessary for success in prevention is a supportive organizational and policy climate or culture (Flocke, Stange, Zyzanski 1998; Goodman, McLeroy, Steckler, et al. 1993; Senge 1990). With so many “good acts to do,” and faced with a societal context that often promotes unhealthy behaviors and provides little time for prevention, these programs need strong organizational support and congruent policies that are aligned to support and maintain delivery of prevention services (Goodman and Steckler 1988; Orleans, Gruman, Ulmer, et al. 1999).

Summary and Conclusions

Although there are differences between preventive care and management of existing chronic illnesses, there are far more similarities (table 1). There is a great deal of overlap in the health care system changes and characteristics required to deliver quality preventive and chronic-illness care. The CCM appears congruent with other frameworks for conceptualizing prevention activities (Dickey, Gemson, and Carney 1999; Goldstein and DePue 1998; Solberg, Kottke, Conn, et al. 1997) and consistent with clinical experience and the empirical literature on preventive interventions, as illustrated by the examples of cancer screening and smoking cessation. We think the CCM can be used as a blueprint for efforts to improve the delivery of clinical preventive services, to help understand and analyze prevention failures, and to develop effective systems-based solutions. The model has played just such a role in spurring creative work to help a variety of health care systems close the gap between best practice and usual practice in the management of chronic disease (Bonomi, Glasgow, and Wagner 2002; Wagner, Glasgow, Davis, et al. 2001). We also note that a number of the health systems in ongoing chronic-care improvement efforts have spontaneously begun to apply the CCM to improvement efforts in the prevention arena.

There are numerous conceptual and practical advantages to having a single model for the organization of health care to deliver both prevention and disease-management services effectively. Thus, it is important to accelerate efforts to apply the CCM to prevention and health-behavior change, and to translate this model into practice. Activities that would help further promote, clarify, and evaluate the application of the CCM to prevention should take the following points into account:

1. The CCM was developed through a systematic and comprehensive literature review of the chronic-disease-intervention literature and is now being tested in a large trial, which includes assessment of the processes and outcomes of chronic-illness care. Similarly, we need systematic evidence-based reviews or meta-analyses of the prevention literature relevant to each CCM component and, if possible, investigations of the relationship between model implementation and outcomes.

2. Another priority for future research is the development and validation of assessment tools to evaluate the extent to which a clinic or system is applying different components of the CCM (Bonomi, Glasgow, and Wagner [in press]). Such instruments could be used for research purposes (e.g., to identify if some model components are more important than others for certain prevention practices) and as feedback and quality-improvement tools to help practices direct attention to needed areas. Finally, such indices could potentially be used as performance indicators in HEDIS (National Committee for Quality Assurance 1996) and other quality-assessment efforts.

3. Translation of the CCM into preventive practice could be stimulated by: (a) a national conference of experts from health care systems (potential adoptees) and applied-health researchers to recommend ways to speed the translation of the model into practice; and (b) the development and evaluation of an action strategy, such as the IHI Breakthrough Series, for implementing model-based preventive care, which in turn would enable the evaluation of comprehensive quality-improvement efforts guided by the model (Wagner, Glasgow, Davis, et al. 2001).

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Acknowledgments: This manuscript was supported under grant #0347984 to Group Health Cooperative from the Robert Wood Johnson Foundation. We thank Emily Snell for research assistance and Barbara McCray for her skill and patience in coordinating the preparation of this paper. We are also indebted to Jessie Gruman, Ph.D., and Heather Altman, M.P.H., at the Center for the Advancement of Health; to Sue Hassmiller, R.N., Ph.D., at the Robert Wood Johnson Foundation; to Ed Fisher at Washington University; and to Richard Gram, Veronica Richardson, and Jane Clark at Grace Hill Health Centers for allowing us to quote from their ongoing research and programs.

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