

Commentary

A Framework for Improving the Quality of Cancer Care: The Case of Breast and Cervical Cancer Screening¹

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Abstract

This commentary presents a conceptual framework, Quality in the Continuum of Cancer Care (QCCC), for quality improvement studies and research. Data sources include review of relevant literature (cancer care, quality improvement, organizational behavior, health services evaluation, and research). The Detecting Early Tumors Enables Cancer Therapy (DETECT) project is used to apply the QCCC model to evaluate the quality of secondary prevention. Cancer care includes risk assessment, primary prevention, screening, detection, diagnosis, treatment, recurrence surveillance, and end-of-life care. The QCCC model represents a systematic approach for assessing factors that influence types of cancer care and the transitions between them, the factors at several levels (community, plan and practice setting) that potentially impact access and quality, and the strategies groups and organizations can consider to reduce potential failures. Focusing on the steps and transitions in care where failures can occur can facilitate more organized systems and medical practices that improve care, establish meaningful measures of quality that promote improved outcomes, and enhance interdisciplinary research.

Introduction

Growing interest in improving the quality of cancer care requires systematic understanding of the factors that influence health outcomes. A recent IOM³ report (1), while emphasizing

care for cancer patients, recognizes that effective prevention and screening are also critical services in reducing cancer mortality. This commentary is designed to provide a conceptual framework for improvement across the full spectrum of cancer care from prevention to end-of-life care but uses screening services as an application.

The framework, QCCC, fills at least four conceptual needs: (a) to emphasize the relationship of services and processes of care to outcomes; (b) to identify the potential for failures in between and during key types of care; (c) to consider the complex environmental factors that impact care; and (d) to suggest strategies available to health plans, organized health systems, and medical practices to improve performance. Responsibility for care and outcomes is shared among communities, health care systems, clinicians, and patients (2). The overarching question is how each can contribute to care that improves overall outcomes (3). This commentary emphasizes the roles that health care systems and providers may play in improving the quality of cancer care. The QCCC framework represents a heuristic approach for both health services research and quality improvement. We use an ongoing study of the quality of breast and cervical cancer screening as a case study for demonstration of the concepts.

A Model To Improve Quality: The Cancer Care Continuum

The IOM report *Ensuring Quality Cancer Care* (1) stresses the importance of quality services along the full span of the cancer care continuum. As depicted in Fig. 1, the span of care includes risk assessment, primary prevention, screening, detection, diagnosis, treatment, recurrence surveillance, and end-of-life care. Failures in cancer care fall into two categories: (a) breakdowns in specific types of care delivered to individuals at different points in the history of their cancer; and (b) breakdowns during the transitions between these types of care. The types of care provided and the transitions between them are what can collectively be called the *processes of care*. In the past, we have tended to focus largely on the types of care, but shortcomings in the transitions between them are equally important. Because the ultimate aim for health care is to improve short- and long-range patient and systems outcomes, we need to improve all of the processes of care (4, 5).

Decades of research provide evidence concerning the efficacy of both primary prevention and risk identification (6). Risk assessment includes environmental exposures such as lead, lifestyle factors such as smoking, and familial factors such as genetic risk and family function. Primary prevention includes counseling related to lifestyle behaviors including smoking, diet, exercise, and alcohol use, as well as chemoprevention. Health care professionals can apply effective and efficient strategies to assess high-risk behaviors and help individuals to modify them (7, 8). Prevention strategies include counseling and education, referrals to associated professionals and community agencies such as nutritionists or support groups, and

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³ The abbreviations used are: IOM, Institute of Medicine; QCCC, Quality in the Continuum of Cancer Care; DETECT, Detecting Early Tumors Enables Cancer Therapy; HEDIS, Health Plan Employer Data and Information Set; HMO, health maintenance organization; CRN, Cancer Research Network.

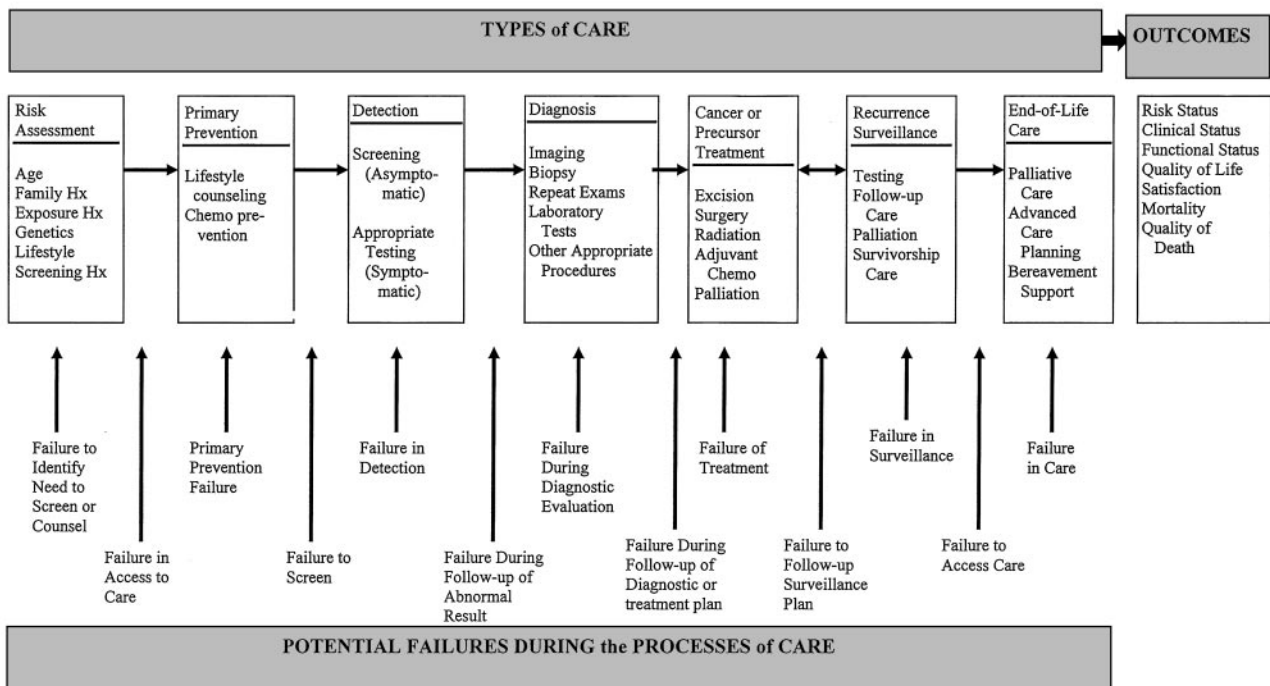


Fig. 1. Cancer care continuum.

prescription of pharmacotherapy for smoking cessation, to name just a few.

The evidence on efficacy and effectiveness of secondary prevention via screening and detection is strong (9). These care types are the next two boxes of the Fig. 1 (*Detection* and *Diagnosis*) and involve two distinct steps: (a) testing for cancer or precursors in asymptomatic (screening) and/or symptomatic patients; and (b) diagnostic evaluation following an abnormal test result. Once an abnormal test occurs, potential outcomes of a diagnostic evaluation include reassurance that nothing is wrong, identification of an ambiguity requiring further evaluation, identification of a precancerous condition (*e.g.*, colonic polyp, cervical lesion caused by human papilloma virus), or diagnosis of cancer.

Once a precancerous or cancerous condition is diagnosed, treatment and the management of immediate side effects begin. For precancerous conditions, the treatment goal is to prevent the condition from progressing to cancer (10). Treatment of an actual cancer could include surgery, radiation, chemotherapy, or some combination of the three. Patient compliance with recommended treatment or physician adherence to guidelines may be an issue in treatment for any type of cancer. After completion of therapy, lifelong surveillance must occur to identify recurrence, detect new cancers, and manage long-term side effects. This makes cancer a chronic condition (11) that requires attention to the social and psychological aspects of survivorship (12). Finally, because 50% of cancer patients ultimately die of their disease, end-of-life care is also important. Considerable attention has been focused on the issues of advanced care planning, palliation, and bereavement support (13, 14).

Despite the linear progression of services suggested by Fig. 1, a patient may enter the continuum of care at different points and at different times in the natural history of a cancer

(15). Environmental exposure and lifestyle, health care delivery system function, and the characteristics of the patient and cancer itself all contribute to the various outcomes, as depicted in the far right of Fig. 1 (1). These include the traditional medical outcomes such as risk and clinical status, as well as patient-centered outcomes such as functional status (16–18), quality of life and death (19), and patient and family satisfaction (20).

Good care depends upon the decisions and actions of both individual patients and health care professionals during the multiple processes of care, as depicted by the various potential failures in the lower row of arrows in Fig. 1. Their actions, however, often depend on organized support systems. The challenge is that navigating through the spectrum of care involves a variety of providers and requires knowledge about appropriate actions and timing. For example, a woman at risk of breast cancer may be unaware of that risk or the opportunity to minimize morbidity through screening or chemoprevention. Therefore, the transition from a woman at risk to one seeking appropriate care is an important step, one that can originate via the woman's initiative or be prompted by her health care system or health care team once either is aware the patient is within their responsibility and due for screening. Once this step occurs, the quality of care will depend upon how well those services are delivered. For example, poor mammographic imaging or interpretation may result in a failure to detect an abnormality. Poor outcomes can also result from failures in the transitions between types of care. For example, the failure to follow-up on abnormal tests can result from problems in the health care system (*e.g.*, failure to notify the patient) or failure in the patient to adhere to recommendations. Fig. 1 therefore emphasizes that to improve the quality of cancer care, attention must be directed to both the transitions between care types and the actual service delivery.

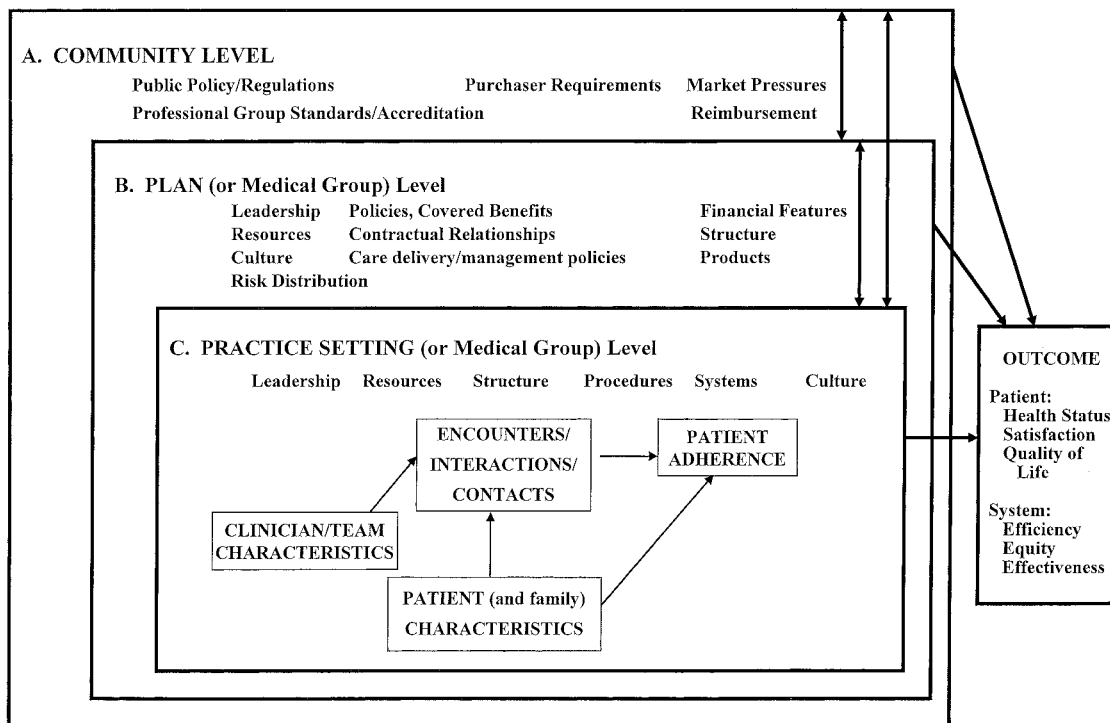


Fig. 2. Levels and factors that impact the processes of care.

Levels and Factors Impacting the Processes of Care

Several models have been proposed over the past several decades to better understand the complex set of factors that ultimately influence patient and provider behaviors. Most notable among these are the Behavioral Model of Utilization developed by Anderson, Aday, and colleagues (15, 21, 22) and the PRECEDE-PROCEED Model of Green and Kreuter (23), both of which emphasize a multisectoral, multilevel ecological approach to program analysis, planning, and evaluation. Both models emphasize that factors at the public policy level, the community level, the organizational level, and in the practice setting interact in a synergistic manner to affect provider delivery and patient utilization of services. Both models stress the need for careful assessment of these factors when choosing interventions to improve quality and address specific individual and public health needs.

Fig. 1 illustrated a natural history of cancer care. A wealth of research has focused on patient and provider characteristics that influence the use of services, but intervention at this level is insufficient to achieve meaningful cancer care improvement (2). Provider-patient interactions are affected by the environment in which they occur, an assumption fundamental to Fig. 2, which considers factors that influence practice. Given the multilevel focus of Fig. 2, the outcomes of these interactions include effectiveness of health care from a population perspective, efficiency (the resources used to produce health improvements), and equity [the fairness or disparity in addressing health needs (24)]. These macrolevel outcomes affect and are affected by the political, provider, payor, and patient dynamics that ultimately impact individual care.

To assess the reasons for less than optimal performance and make prudent choices about strategies to maximize performance, it is important to understand the complex contextual

and environmental factors that affect utilization, processes of care, and ultimate outcomes of medical services (15, 25). As illustrated in the concentric boxes of Fig. 2, these factors include elements in the immediate practice setting (Box C; Ref. 26) as well as in the larger care delivery organization or health plan/insurance entity (Box B) and the external community (Box A; Ref. 27).

Considering factors in the larger community (Fig. 2, Box A), there are many examples of the interactions of health professionals, legislators, and community activists to promote policies that affect health and medical care. For example, concern about environmental exposure may lead to clinicians' participation in formulating public policies to protect individuals from environmental risks such as lead exposure, air pollution, and chemical exposure in the workplace. Public policy makers and health professionals play major roles in the promulgation of primary prevention activities such as smoking cessation or water quality improvements.

Public policies such as mandated coverage by insurance and entitlement programs facilitate patient access and adherence (28, 29) as well as reinforce health plan, care delivery system, and provider behavior. As another example, release and diffusion of national evidence-based guidelines by professional societies prompt health care organizations to consider how they could improve performance through implementation of these guidelines. As a service becomes more well known to patients (mammography, for example) and ingrained in their behavior (e.g., the annual gynecologic exam), patient expectations put pressure on clinicians and organizations to provide these services. Concomitantly, as standards of practice become normative, litigation risk can represent a motivation for insuring good and bad quality implementation, depending upon whether the standard is evidence based.

There are also numerous examples of the important mutual influences between community level forces and medical groups and health plans (Fig. 2, *Box B*). Employer/payor requirements for performance measures, such as HEDIS, also motivate development and improvement of services at the health system, plan, and practice setting levels (30). Characteristics of health plans and care systems that influence performance may include financial features, such as how risk is shared and how providers are paid, as well as structural features such as ownership, age, size, and specialty (27). Additional important policies include demand management, care management, provider interaction, quality improvement/consumer satisfaction, and products or programs (27, 31). The current climate of organizational turmoil in health care delivery and financing compounds the uncertainty about the importance of these various factors (32). The relationship between factors will also vary depending on the specific clinical service, its complexity, characteristics, and differential diffusion as normative practice (33). Finally, a range of patient factors will affect patients' use of services and self-management of their problems.

When considering levels B and C in Fig. 2, it is important to note that fundamental transformations within the health care system in the past decade have undermined the usefulness of the previous typology of indemnity insurance plan, HMO, independent practice organization, and preferred provider organizations (31). Managed care and health insurance terminology has become imprecise and confusing (34). Brach *et al.* (31) emphasize that the roles of reimbursing care, administrative oversight to organize care, and provider work to deliver care are no longer distinct characteristics. Characteristics in levels B or C in Fig. 2 may be independent, overlapping, or combined. For example, a large medical group may contract with several insurance plans, and it may use the resources of one to organize systems that facilitate practice management regardless of what the other insurance plans offer. A few HMOs have staff model delivery systems where there is little distinction between levels B and C, whereas most health plans have a contractual relationship with care providers that make these two levels quite distinct. Differing models of organization have challenged policy makers, insurers, clinicians, and patients. However, the functions described in levels B and C must be aligned for optimum care quality by the people operating within the various potential levels of the practice and environment. This alignment is defined as the degree to which clinicians, organized delivery systems, payors, and purchasers share the same mission, vision, objectives, and strategies and work toward their accomplishment (35). The degree of alignment can have major effects on how clinicians practice and how patients get care.

Fig. 2 also highlights the importance of practice setting characteristics (and in some cases, plan characteristics) on the interactions between patients and the health care system (*Box C*). Wagner (36, 37) notes that productive interactions within the health setting result from informed, activated patients and a prepared, proactive team. Desirable care team behaviors include adherence to guidelines, promotion of shared decision-making with patients and patient self-management support, collaborative care with specialists, and referral as needed. The parallel patient behaviors include recognition of environmental risk, changes in lifestyle, participation in shared decision-making, and adherence to evidence-based screening, follow-up, detection, treatment, and surveillance. These productive interactions are more likely to be found in delivery settings that have well-developed incentives, practice arrangements, and information systems (36, 37). These interactions may be by telephone or mail as well as in face to face encounters, as in notification

of services due or test results. These communications may be tailored to the specific person (as in notification that screening is due) or more general, as in a mass-mailed educational flyer. Furthermore, the interactions can bypass the clinician, emanating directly from a centralized program or person at the practice, group, or plan level. Thus, if cancer care outcomes are to be maximized, clinician and patient behavior need to be enabled.

Organizational Strategies to Improve Quality

Green and Kreuter (23) articulate several groups of factors that influence patient and provider behavior. The constructs include patient and physician *predisposing factors*, such as awareness and knowledge, health beliefs, and attitudes; *enabling factors*, such as skills, resources, reimbursement levels, and attributes of practice systems; and *reinforcing factors*, such as social support, professional practice norms, public policy, and payor requirements. These concepts have all been introduced in Fig. 2.

Factors that predispose, enable, and reinforce patients, however, may not be the same as those that affect clinicians. Predisposing factors for patients include awareness and knowledge of the process of care (*e.g.*, screenings or treatment), beliefs, values and fears, as well as individual and family health history. For clinicians and care teams, predisposing factors include knowledge of and agreement with clinical guidelines and protocols and assumptions about patients and their adherence. Enabling factors for patients include cost, ease of access, and acceptability and availability of services. For clinicians, enabling factors include sufficient time to assess patient needs, reminders, and availability of supporting technology and staff. Reinforcement for patients can include clinician encouragement such as patient-centered counseling as well as societal expectations. Payor requirements, leadership expectations, collegial norms, and performance reports reinforce clinician performance.

Recent analyses emphasize the important role health care organizations play in improving quality of care (37–42). Although the definition of organization varies (31), the challenge is to find and implement strategies that affect these numerous predisposing, enabling, and reinforcing factors. Implementation of an organized set of processes and procedures is paramount in the practice setting (and at a more centralized level in larger organizations) to minimize the potential for failures in the processes of care. Numerous investigators have reported on the efficacy and effectiveness of various systems strategies implemented independently or in combination (38, 43–45). The relative effectiveness of these strategies varies across settings, across the technology or service in question, and across time, and multiple strategies are needed (44, 46).

If clinical and administrative leaders want to improve cancer care, they must develop organizational strategies for the factors affecting clinical performance (Fig. 2) and for the types of care and transitions in the continuum of cancer care processes (Fig. 1). Fig. 3 illustrates several categories of strategies that could be undertaken by leadership at multiple levels to predispose, enable, and reinforce patients and providers to desired behaviors. It is adapted from Wagner's Chronic Care Model (36, 37, 47) and incorporates the work of other investigators (2, 36, 48, 49).

Leadership at Multiple Levels. Because the current care delivery model and the expectations of both patients and clinicians are focused on acute illness and symptom management in a time-limited, visit-based, and reactive mode, a major effort

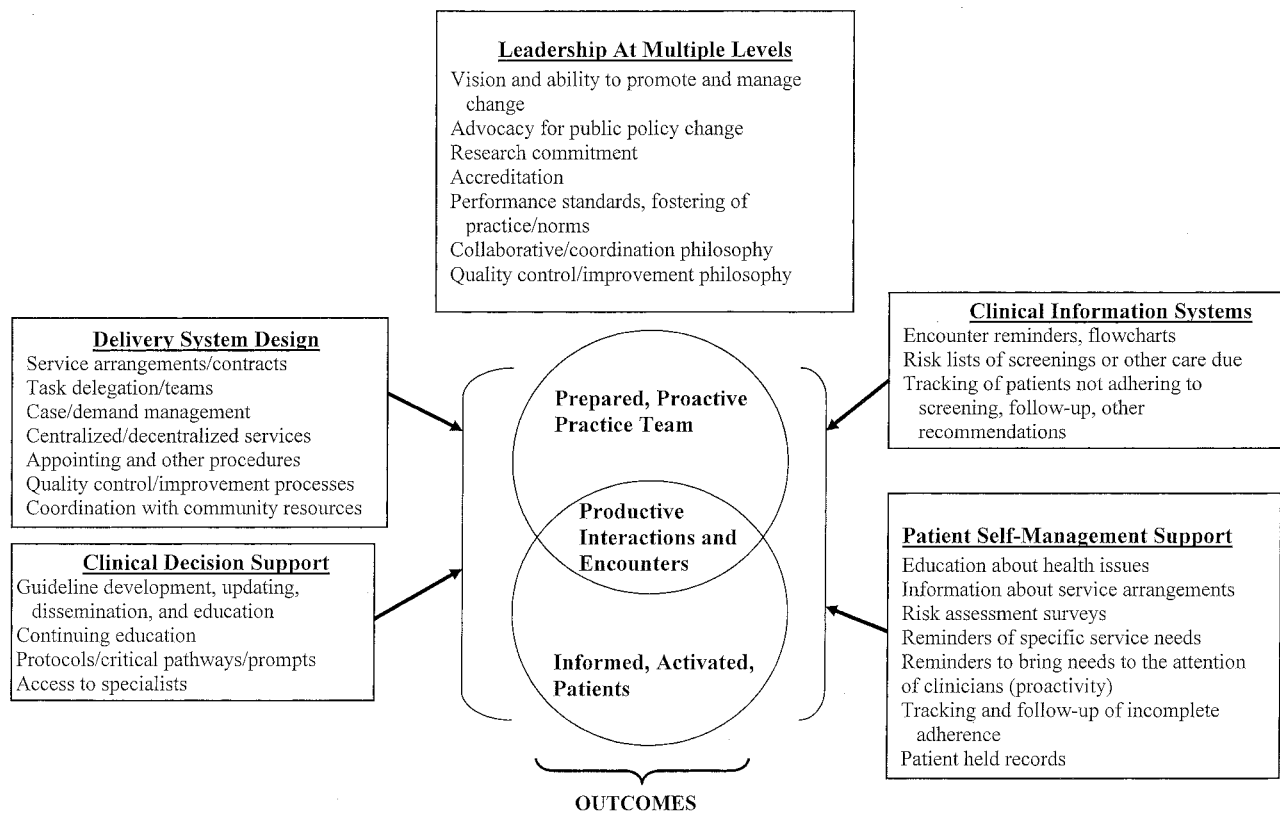


Fig. 3. Organizational strategies to improve quality of care. *, at practice setting, group, and/or plan level.

will be required to produce a new paradigm that enables and reinforces high-quality care (50). This must originate with the leadership of health care organizations, leadership that places a very high priority on excellent care across the natural history and has a clear vision of a new way to do business, the willingness to commit resources to get there, and the ability to lead the process of change (51, 52). Clearly, this will require new accountability measurements, realignment of financial incentives and recognition, and emphasis on the “great leap” type of quality improvement envisioned in the IOM report *Crossing the Quality Chasm* (11).

Leadership is also responsible for cultivating a culture and professional norm that values quality (27). Organizational policies need to encourage self-evaluation, research, and quality improvement (53). As introduced in Fig. 2, the characteristics of level B (plan and medical group) are enormously variable. For example, a staff model HMO represents a centralized structure with clear responsibility for providing quality leadership. A more traditional indemnity plan, although able to institute evidence-based procedures for clinical reimbursement, has far less potential for organizational leadership. Leadership for quality is more diffuse under conditions of no direct accountability, emanating instead from expectations at the practice level (such as hospitals at which clinicians practice or the local practice setting itself).

Delivery System Design. The design of the delivery system at the plan and practice setting levels can have pivotal impact on access, quality, and cost of care (24). Design includes service arrangements and contracting, delivery capacity, designation of centralized versus decentralized programs,

and development of care teams. For example, increased access to mammography via expanded hours, appointment assistance, centralized programs, and mobile facilities has proved effective (54–57). Effective chronic illness care requires a new care delivery model, one based on teams that handle both visits and follow-up (47, 58). The same is true for prevention services, where efficiently integrating screening tests into acute office visits is achieved via task delegation and standing orders that allow staff other than physicians to initiate action (59–63). Case management systems have demonstrated improved outcomes and efficiency (64). Collaborative relationships (formal and informal) with community resources also can facilitate patient participation in health promotion, lifestyle change, and treatment adherence (65, 66). Quality improvement of the processes includes focus on management functions (*e.g.*, patient scheduling) and more recently on clinical practice. Whereas it is frequently difficult to assess the impact of continuous quality improvement efforts because its application is complex and demanding, it is widely believed that it requires a systematic, organization-wide effort (53).

Clinical Decision Support. Gaps in clinician information and skill can be addressed by a number of decision support strategies. These include the establishment of a structure and process to develop, update, and disseminate clinical practice guidelines. Provider orientation and education can reinforce expected standards (67), but gaps and inconsistencies will remain (68). Although clinical guidelines by themselves may accomplish little (69), they provide a consensus basis for implementation of other system changes that can make a difference. Finally, close

collaboration between primary care, specialty clinicians, and special services such as hospice is particularly important for high-quality cancer care.

Clinical Information Systems. Empirical evidence of contributions of clinical information systems to efficient, effective care is extensive. The use of chart prompts and reminders has fairly consistently been shown to improve identification of primary prevention (70), screening (71), advance directives (72), and counseling (8). Use of flow charts has also improved services (73, 74). Evidence related to the value of health risk assessments is conflicting (75). Registry or tracking systems are important to identify patients in need of screening and to track those not adhering to treatment and surveillance recommendations (76). A registry of all patients with the target condition has been recommended as a prerequisite for disease management (77). A registry allows the care team to deliver both proactive and follow-up care, implement effective reminder systems, use performance measurements and feedback, and produce tailored patient information. Computerized medical record and reminder systems are increasingly available as a means of prompting clinicians to inquire about or promote a wide range of services (78–80). Such systems, however, require considerable institutional commitment and resources for maintenance and updating as well as initial design and implementation.

Patient Self-Management Support. Patients' knowledge, skills, and motivation to manage their health and medical care regimens and to seek what they need from the medical care system can be encouraged via numerous inreach (actions directed within encounters) and outreach (actions directed toward patients in their community or home) strategies. General health education information (*e.g.*, newsletters, pamphlets) and material tailored to specific subpopulations can provide information on general health issues as well as on how to access care and navigate the system. The impact of patient-centered medicine, which focuses on care congruent with and responsive to patients' needs and preferences, is well established (81). Encouraging patient activation can result in improved compliance and better health outcomes (82). Telephone or mail reminders to ensure initial appointments and follow-up (83, 84) have been widely tested (85–88). Health risk assessments have been used to assist providers and patients to determine health promotion and detection needs, although their effectiveness is equivocal (8, 89).

This brief review outlines the numerous strategies that can be considered to improve the processes of care. An often overlooked feature of instituting the innovative strategies is the implementation process itself, which must consider attributes of the innovation, their interaction with the stages of implementation, and characteristics of the organization (33, 90). Many of the factors important to implement innovations are organizational in nature because the main issue is to change the environment in which a service is provided, rather than focus primarily on the clinician's behavior (45). Competing demands in a time- and resource-stressed system, coupled with profound external and internal changes in the structure of organization and leadership, all work against process improvement (91). Efforts to redesign delivery systems, improve decision support systems, and implement clinical information systems and patient self-management strategies (36) must be undertaken within broader understanding of diffusion as a social process (90, 92). Crabtree and colleagues (50, 93) emphasize that the practice environment must be viewed as a complex adaptive system that requires considered analysis and individually

tailored interventions rather than a simple one-size-fits-all approach.

Application of the Model to Secondary Prevention: DETECT

The QCCC framework provides a systematic approach for assessing factors that influence all types of cancer care and the transitions between them. This includes secondary prevention, the identification and treatment of individuals without signs or symptoms of cancer.

Breast and cervical cancers are interesting and important tracer conditions to study processes of care because they are common (94), screening is supported by evidence from randomized trials (95–100) and evidence-based reviews (9), and screening for them involves several steps, providers, and transitions. Factors in the larger environment (Fig. 2) enable screening and detection by promoting awareness, mandating screening benefits in all states (30), facilitating implementation through the use of inreach and outreach, and assuring high-quality detection and diagnostic services (101, 102). Screening levels are among priority measures in the HEDIS. Because population screening generally identifies individuals with earlier-stage breast disease, few cancers should progress to late stage; their occurrence is an important potential marker of screening failure (103, 104).

The DETECT project began in 1999 within the CRN, a collaboration of 10 HMOs. Supported by the National Cancer Institute, the overall goal of the CRN is to increase the effectiveness of preventive, curative, and supportive interventions for major cancers through a program of collaborative research among diverse populations and health systems. One of the first CRN studies, DETECT, provides an example for the application of the QCCC framework to evaluate the quality of secondary prevention. DETECT entails a comprehensive look at how seven health plans implement screening services by reviewing the continuum of care for all invasive cervical cancers and a random sample of late-stage breast cancers.

Given that screening is a covered benefit in HMOs, it is important to understand the reasons for invasive cervical and late-stage breast cancer. Fig. 4 depicts the application of the QCCC framework to the DETECT study. DETECT focuses on two types of care (detection and diagnosis, *shaded* in Fig. 4) and the three transitions surrounding them (also *shaded*). The framework illustrates the various factors that contribute to failure during the processes of care. For example, before detection of a cancer can occur, a woman must move from being in the population at risk to the population that is screened. This transition could occur because an informed activated patient pursues screening, a prepared team recommends or performs screening during a routine visit, or a health care system identifies who is due for screening and sends a letter recommending the patient schedule the exam. If none of these steps occur, or the patient does not follow through, there is a *failure to screen*. If failure to screen accounts for a large proportion of invasive cervical and late-stage breast cancers, then screening can be promoted through the use of inreach, outreach, and activities that promote patient adherence and/or self-referral (85–87, 105). The latter might include media advertising campaigns within healthcare clinics or through plan periodicals, as well as community activities (106).

Even when screening does occur, it is still possible for late-stage disease to develop if the screening test misses a cancer or premalignant condition that is present. Poor test sensitivity and poor reading of the test results could each lead

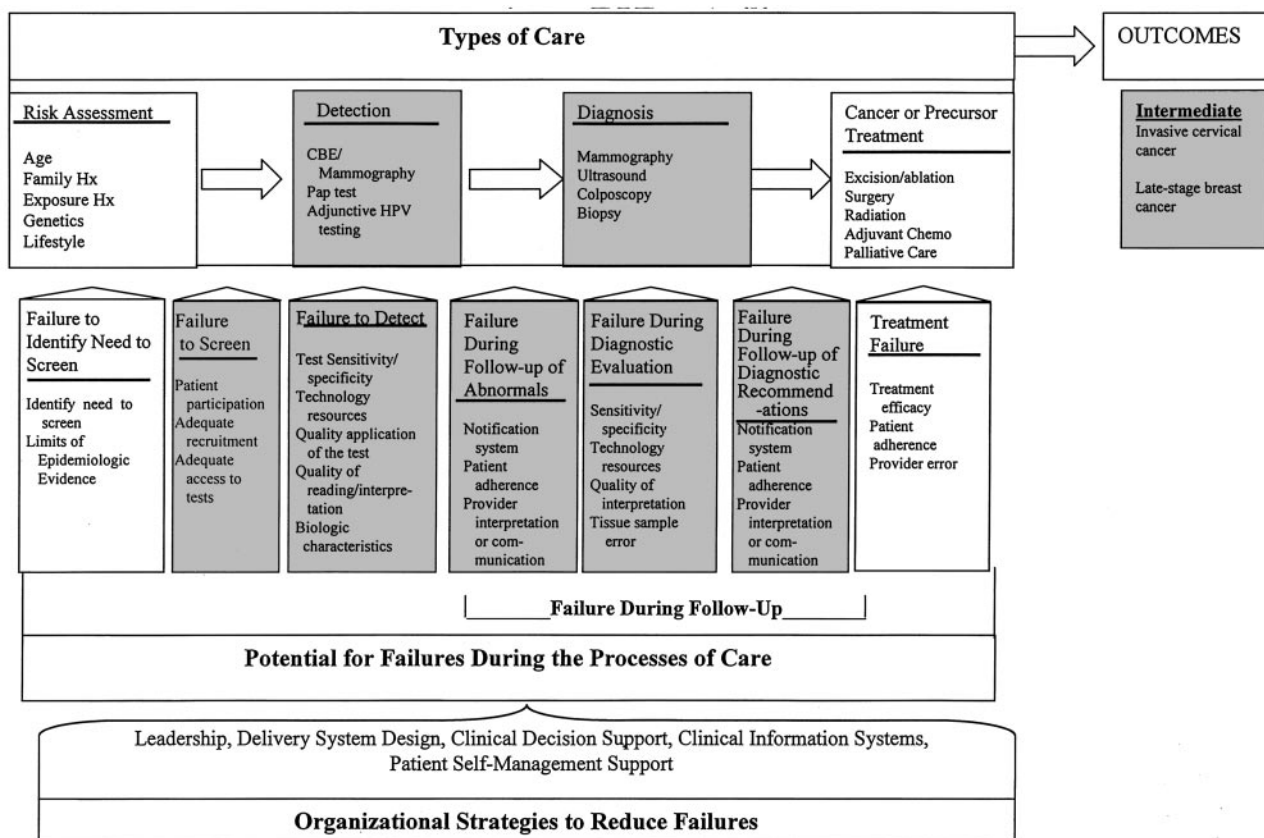


Fig. 4. QCCC application to breast and cervical cancer: the DETECT study.

to a *failure in detection*. Under these circumstances, improvement in quality depends upon improving test interpretations and developing new tests with better case-finding ability. Substantial activity is under way to find better ways of reviewing cervical cytology and improve the quality of mammographic interpretation (107–109).

If a test is abnormal, follow-up is necessary to evaluate whether cancer or a precancerous lesion exists. As shown in Fig. 4, two transitions and one type of care encompass factors that could go wrong during follow-up of an abnormal test. Within DETECT, we call this entire collection of possibilities potential *failures during follow-up*. For example, a provider could misinterpret the meaning of the screening results and not communicate the need for additional evaluation. The diagnostic work-up could incorrectly conclude that no cancer is present and give inappropriate reassurance. Finally, a patient could choose not to pursue a biopsy that is recommended. Improvements in the quality of care could result from improved communication of the results of tests between providers and patients, better diagnostic techniques, and systematic tracking of adherence to recommendations.

Although numerous strategies have potential for improvement in screening, detection, and follow-up, there is usually not enough time or money to do them all simultaneously. DETECT therefore set out to evaluate the processes of care and the healthcare system in which the care occurs, to identify the high priority areas for improvement. Each component of DETECT is briefly described below.

Cervical Cancer Evaluation. Invasive cervical cancer is considered a preventable disease due to the effectiveness of periodic Pap screening, the existence of defined precancerous lesions, and the typically slow progression of cervical neoplasia. Furthermore, the treatment of precancerous lesions (and early-stage cancers) is highly curative. This component of the DETECT study is investigating the prediagnostic period, defined as 4–36 months before the invasive cervical cancer diagnosis of health plan members diagnosed 1995–2000. For women with no Pap screening during that period, the cancer occurrence is attributed to a failure to screen. Women who did undergo Pap screening in the study period but received normal Pap results are categorized as failures in detection, *i.e.*, the underlying abnormality was not detected by the screening test. Such failures in detection are further investigated by reviewing all available cytology slides to describe the sources of failure such as insufficient sampling, poor sample preservation, or misinterpretation. A failure during follow-up is attributed when the prediagnostic period includes an initial abnormal screening Pap test. These cases are further investigated to understand where an error may have occurred, for example, in patient notification, in patient compliance, or in interpreting a diagnostic test such as a biopsy.

Breast Cancer Evaluation. Late-stage breast cancer is also considered preventable. Regular screening is recommended every 1–2 years and has been shown to reduce mortality when offered as infrequently as every 3 years among women ages 50

and above (97). This component is investigating processes of care up to 3 years before the date of diagnosis of a breast cancer. The diagnostic period is defined as 1 year before diagnosis, and it is assumed that any tests done during that period could not influence the stage of disease. The focus is therefore the 2-year period before the year of diagnosis. Clinical charts are audited for information on clinical breast examination and mammography occurrence. With the information from the audit on test occurrence, indication, and patient symptoms, tests are classified as screening or diagnostic. Analysis will first consider the most stringent definition of screening exposure. Cases without any screening mammography during the first 2 years of the observation period are classified as failures in screening. Among cases with a screening examination during the first 2 years, those without a positive screening test are defined as failures in detection. The remaining cases are classified as potential failures during follow-up. For each type of failure (screening, detection, and follow-up), evidence to help explain it will be collected. Examples are whether any recommendation for screening is evident, and whether patients were contacted after an abnormal test but refused evaluation.

Organizational. This component explores selected factors from the B and C levels of influence illustrated in Fig. 2. It consists of three substudies, whose data provide insight into the adoption and implementation of strategies to improve the quality of screening services. The first substudy is an organizational assessment of policies and procedures. Recent reviews have underscored the need to better understand implementation strategies (110, 111). Questions of interest include the range and variation in strategies used by the seven DETECT plans, the range and variation in strategies used for breast *versus* cervical cancer, and what gaps exist between the efforts of these seven plans and the literature on organizational strategies. However, because all DETECT plans have above-average performance rates for these preventive services, the purpose of the assessment is not to determine which strategies produce the best outcomes but to illustrate types of strategies and variation among successful plans and between approaches to different cancers. In the second substudy, a written survey of primary and specialist clinicians gathered data on awareness of, agreement with, training in, and utility of plan guidelines; awareness of incentives, systems, and quality improvement efforts; ratings of plan leadership; and the implementation performance of the organizational strategies broadly defined in the bottom band of Fig. 4. The third substudy describes women's reports of the HMOs' performance in implementing follow-up of suspicious screening exams. A telephone survey of women with an abnormal mammogram or Pap test result gathers data on utilization, patient reports of the processes of care and patient self-management strategies outlined in Fig. 4, knowledge and attitudes, and satisfaction.

By examining invasive cervical and late-stage breast cancers, we can identify the proportion of these poor outcomes associated with breakdowns in screening, detection, or during follow-up. We will also be able to describe how the policies and systems in place in the healthcare environment may or may not contribute to the failures. This classification and description will identify priority areas for improvement in the processes of secondary detection.

Summary

The QCCC model has application for many quality improvement and health services research studies beyond cancer screening; it represents a framework that is necessary to move the

field to a new level of rigor and accountability. The framework also provokes attention to those elements that can really improve quality. Because of limited resources, we need a way to think about issues and prioritize interventions and changes that we know can make a difference. By identifying the steps and transitions in care, it allows us to consider the spectrum of cancer care and the relationship of services and processes of care to outcomes. The model also illustrates the potential for failure in and between key processes of care, explicates environmental factors at several levels that impact care, and outlines groups of strategies available to health plans, organized health systems, and medical practices to improve care. Although we have used the model to help guide quality improvement research related to screening (3), the approach can be used to rigorously evaluate other areas of cancer care and to show that identification of the limitations in care leads to improvements. It provides the kind of knowledge that allows the system to move beyond HEDIS-type measures, which are nominal markers of quality, to detailed process measures likely to be associated with real differences in health outcomes. To move forward in the improvement of quality, the priorities for change need to be clarified through critical evaluation and research, and the funding for quality over quantity needs to become more clearly integrated into policy decisions at the national, community, organizational, and practice levels.

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References

- Hewitt, M., and Simone, J. (eds.). The Institute of Medicine Report, Ensuring Quality Cancer Care, p. 246. Washington, DC: National Academy Press, 1999.
- Curry, S. J. Organizational interventions to encourage guideline implementation. *Chest*, 118 (Suppl.): 40S–46S, 2000.
- Hiatt, R. A., and Rimer, B. K. A new strategy for cancer control research. *Cancer Epidemiol. Biomark. Prev.*, 8: 957–964, 1999.
- Donabedian, A. The quality of care. How can it be assessed? *J. Am. Med. Assoc.*, 260: 1743–1748, 1988.
- Berwick, D. M. Developing and testing changes in delivery of care. *Ann. Intern. Med.*, 128: 651–656, 1998.
- Schottenfeld, D., and Fraumeni, J. (eds.). *Cancer Epidemiology and Prevention*, 2nd ed. New York: Oxford University Press, 1996.
- Woolf, S. H. Principles of risk assessment. In: S. H. Woolf, S. Jonas, and R. S. Lawrence (eds.), *Health Promotion and Disease Prevention in Clinical Practice*, pp. 3–19. Baltimore, MD: Williams & Wilkins, 1996.
- Ockene, J., Zapka, J., Pbert, L., Brodney, S., and Lemon, S. Background paper, "Provider, system and policy strategies to enhance the delivery of cancer prevention and control activities in primary care." For: The Institute of Medicine Report, Fulfilling the Promise of Cancer Prevention and Early Detection. Washington, DC: National Academy Press, in press.
- United States Preventive Services Task Force. *Guide to Clinical Preventive Services*, 2nd ed. Baltimore, MD: Williams & Wilkins, 1996.
- Sawaya, G. F., Brown, A. D., Washington, A. E., and Garber, A. M. Clinical practice: current approaches to cervical-cancer screening. *N. Engl. J. Med.*, 344: 1603–1607, 2001.
- Edington, M. (ed.). The Institute of Medicine Report, Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC: National Academy Press, 2001.
- National Coalition for Cancer Survivorship. *Imperatives for Quality Cancer Care: Access, Advocacy, Action and Accountability*. 1996. Accessed at www.cansurvivorship.org/policy/imperatives.html on November 29, 2001.
- Field, M., and Cassel, C. (eds.) The Institute of Medicine Report, Approaching Death: Improving Care at the End of Life, p. 437. Washington, DC: National Academy Press, 1997.
- Foley, K., and Gelband, H. (eds.). The Institute of Medicine Report, Improving Palliative Care for Cancer, p. 64. Washington, DC: National Academy Press, 2001.

15. Phillips, K. A., Morrison, K. R., Andersen, R., and Aday, L. A. Understanding the context of healthcare utilization: assessing environmental and provider-related variables in the behavioral model of utilization. *Health Serv. Res.*, 33: 571–596, 1998.
16. Croyle, R. (ed.). *Psychosocial Effects of Screening for Disease Prevention and Detection*. New York: Oxford University Press, 1995.
17. Lerman, C., and Rimer, B. Psychosocial impact of cancer screening. *Oncology (Basel)*, 7: 67–72, 1993.
18. Litwin, M. S., Hays, R. D., Fink, A., Ganz, P. A., Leake, B., Leach, G. E., and Brook, R. H. Quality-of-life outcomes in men treated for localized prostate cancer. *J. Am. Med. Assoc.*, 273: 129–135, 1995.
19. Ganz, P. A., Schag, C. A., Lee, J. J., and Sim, M. S. The CARES: a generic measure of health-related quality of life for patients with cancer. *Qual. Life Res.*, 1: 19–29, 1992.
20. Aharony, L., and Strasser, S. Patient satisfaction: what we know about and what we still need to explore. *Med. Care Rev.*, 50: 49–79, 1993.
21. Aday, L., and Andersen, R. A framework for the study of access to medical care. *Health Serv. Res.*, 9: 208–220, 1974.
22. Anderson, R., and Davidson, P. Measuring access and trends. In: R. Andersen, T. Rice, and G. Kominski (eds.), *Changing the U.S. Health Care System*. San Francisco: Jossey-Bass, 55–57, 1996.
23. Green, L., and Kreuter, M. *Health Promotion and Planning: An Educational and Ecological Approach*, 3rd ed. Mountain View, CA: Mayfield Publishing Co., 1999.
24. Aday, L., Begley, C., Lairson, D., and Slater, C. *Evaluating the Medical Care System. Effectiveness, Efficiency, and Equity*. Ann Arbor, MI: Health Administration Press, 1998.
25. Mandelblatt, J., Andrews, H., Kao, R., Wallace, R., and Kerner, J. Impact of access and social context on breast cancer stage at diagnosis. *J. Health Care Poor Underserved*, 6: 342–351, 1995.
26. Thompson, R., Woolf, S., Taplin, S., Davis, B., Payne, T., Stuart, M., and Wagner, E. How to organize a practice for the development and delivery of preventive services. In: S. Woolf, S. Jonas, and R. Lawrence, (eds.), *Health Promotion and Disease Prevention in Clinical Practice*. Baltimore, MD: Williams & Wilkins, 1996.
27. Landon, B. E., Wilson, I. B., and Cleary, P. D. A conceptual model of the effects of health care organizations on the quality of medical care. *J. Am. Med. Assoc.*, 279: 1377–1382, 1998.
28. Kiefe, C., McKay, S., Halevy, A., and Brody, B. Is cost a barrier to screening mammography for low-income women receiving Medicare benefits? A randomized trial. *Arch. Intern. Med.*, 154: 1217–1224, 1994.
29. Bernstein, A. B., Thompson, G. B., and Harlan, L. C. Differences in rates of cancer screening by usual source of medical care. Data from the 1987 National Health Interview Survey. *Med. Care*, 29: 196–209, 1991.
30. NCQA. *HEDIS 3.0 Narrative: What's In It and Why It Matters*. Washington, DC: National Committee for Quality Assurance, 1997.
31. Brach, C., Sanches, L., Young, D., Rodgers, J., Harvey, H., McLemore, T., and Fraser, I. Wrestling with typology: penetrating the “black box” of managed care by focusing on health care system characteristics. *Med. Care Res. Rev.*, 57 (Suppl. 2): 93–115, 2000.
32. Solberg, L., Kottke, T., Brekke, M., and Magnan, S. Improving prevention is difficult. *Eff. Clin. Pract.*, 3: 153–155, 2000.
33. Kaluzny, A. D., Konrad, T. R., and McLaughlin, C. P. Organizational strategies for implementing clinical guidelines. *Jt. Comm. J. Qual. Improv.*, 21: 347–351, 1995.
34. Weiner, J. P., and de Lissovoy, G. Razing a Tower of Babel: a taxonomy for managed care and health insurance plans. *J. Health Polit. Policy Law*, 18: 75–103; discussion 105–112, 1993.
35. Shortell, S. M., Alexander, J., Budetti, P., Burns, L., Gillies, R., Waters, T., and Zuckerman, H. Physician-system alignment: introductory overview. *Med. Care*, 39: 1–1–1–8, 2001.
36. Wagner, E. Chronic disease management: what will it take to improve care for chronic illness? *Effective Clin. Pract.*, 1: 2–4, 1998.
37. Wagner, E. Managed care and chronic illness: health services research needs. *Health Serv. Res.*, 32: 702–714, 1997.
38. Yabroff, K. R., Kerner, J. F., and Mandelblatt, J. S. Effectiveness of interventions to improve follow-up after abnormal cervical cancer screening. *Prev. Med.*, 31: 429–439, 2000.
39. Malin, J. L., Kahn, K., Dulai, G., Farmer, M. M., Rideout, J., Simon, L. P., and Ganz, P. A. Organizational systems used by California capitated medical groups and independent practice associations to increase cancer screening. *Cancer (Phila.)*, 88: 2824–2831, 2000.
40. Wan, T. T., Pai, C. W., and Wan, G. J. Organizational and market determinants of HMOs' performance of preventive practices. *J. Healthc. Qual.*, 20: 14–19; quiz 52, 1998.
41. Solberg, L., Kottke, T., Brekke, M., Conn, S., Magnan, S., and Amundson, G. The case of the missing clinical preventive services systems. *Effective Clin. Pract.*, 1: 33–38, 1998.
42. Solberg, L., Kottke, T., Conn, S., Brekke, M., Calomeni, C., and Conboy, K. Delivering clinical preventive services is a systems problem. *Ann. Behav. Med.*, 19: 271–278, 1997.
43. Bero, L. A., Grilli, R., Grimshaw, J. M., Harvey, E., Oxman, A. D., and Thomson, M. A. Closing the gap between research and practice: an overview of systematic reviews of interventions to promote the implementation of research findings. *The Cochrane Effective Practice and Organization of Care Review Group. Br. Med. J.*, 317: 465–468, 1998.
44. Mandelblatt, J. S., and Yabroff, K. R. Effectiveness of interventions designed to increase mammography use: a meta-analysis of provider-targeted strategies. *Cancer Epidemiol. Biomark. Prev.*, 8: 759–767, 1999.
45. Solberg, L. I. Guideline implementation: what the literature doesn't tell us. *Jt. Comm. J. Qual. Improv.*, 26: 525–537, 2000.
46. Solberg, L., Brekke, M., Fazio, C., Fowles, J., Jacobsen, D., Kottke, T., Mosser, G., O'Connor, P., Ohnsorg, K., and Rolnick, S. Lessons from experienced guideline implementers: attend to many factors and use multiple strategies. *Jt. Comm. J. Qual. Improv.*, 26: 171–188, 2000.
47. Wagner, E. H., Davis, C., Schaefer, J., Von Korff, M., and Austin, B. A survey of leading chronic disease management programs: are they consistent with the literature? *Manag. Care Q.*, 7: 56–66, 1999.
48. Shortell, S. M., Zazzali, J., Burns, L., Alexander, J., Gillies, R., Budetti, P., Waters, T., and Zuckerman, H. Implementing evidence-based medicine: the role of market pressures, compensation incentives, and culture in physician organizations. *Med. Care*, 39: 1–62–1–76, 2001.
49. Waters, T., Budetti, P., Reynolds, K., Gillies, R., Zuckerman, H., Alexander, J., Burns, L., and Shortell, S. M. Factors associated with physician involvement in care management. *Med. Care*, 39: 1–79–1–91, 2001.
50. Crabtree, B. F., Miller, W. L., Aita, V. A., Flocke, S. A., and Stange, K. C. Primary care practice organization and preventive services delivery: a qualitative analysis. *J. Fam. Pract.*, 46: 403–409, 1998.
51. Berwick, D. M. From measuring to managing the improvement of prevention. *Am. J. Prev. Med.*, 11: 385–387, 1995.
52. Savitz, L. A., Kaluzny, A. D., and Kelly, D. L. A life cycle model of continuous clinical process innovation. *J. Healthc. Manag.*, 45: 307–315; discussion 315–316, 2000.
53. Shortell, S., Bennett, C., and Byck, G. Assessing the impact of continuous quality improvement on clinical practice: what it will take to accelerate progress. *Milbank Q.*, 76: 593–624, 1998.
54. Rimer, B. K., Resch, N., King, E., Ross, E., Lerman, C., Boyce, A., Kessler, H., and Engstrom, P. F. Multistrategy health education program to increase mammography use among women ages 65 and older. *Public Health Rep.*, 107: 369–380, 1992.
55. Palitz, A. M., Selby, J. V., Grossman, S., Finkler, L. J., Bevc, M., Kehr, C., and Conell, C. A. The Colon Cancer Prevention Program (CoCaP): rationale, implementation, and preliminary results. *HMO Pract.*, 11: 5–12, 1997.
56. Thompson, R. S., Taplin, S. H., McAfee, T. A., Mandelson, M. T., and Smith, A. E. Primary and secondary prevention services in clinical practice. Twenty years' experience in development, implementation, and evaluation. *J. Am. Med. Assoc.*, 273: 1130–1135, 1995.
57. Schroy, P. C., Heeren, T., Bliss, C. M., Pincus, J., Wilson, S., and Prout, M. Implementation of on-site screening sigmoidoscopy positively influences utilization by primary care providers. *Gastroenterology*, 117: 304–311, 1999.
58. Wagner, E. H. The role of patient care teams in chronic disease management. *Br. Med. J.*, 320: 569–572, 2000.
59. McCarthy, B. D., Yood, M. U., Bolton, M. B., Boohaker, E. A., MacWilliam, C. H., and Young, M. J. Redesigning primary care processes to improve the offering of mammography. The use of clinic protocols by nonphysicians. *J. Gen. Intern. Med.*, 12: 357–363, 1997.
60. Logan-Young, W. The breast imaging center. Successful management in today's environment. *Radiol. Clin. N. Am.*, 38: 853–860, 2000.
61. Cargill, V., Conti, M., Neuhauser, D., and McClish, D. Improving the effectiveness of screening for colorectal cancer by involving nurse clinicians. *Med. Care*, 29: 1–5, 1991.
62. Schoenfeld, P. S., Cash, B., Kita, J., Piorowski, M., Cruess, D., and Ransohoff, D. Effectiveness and patient satisfaction with screening flexible sigmoidoscopy performed by registered nurses. *Gastrointest. Endosc.*, 49: 158–162, 1999.
63. Schoenfeld, P., Lipscomb, S., Crook, J., Dominguez, J., Butler, J., Holmes, L., Cruess, D., and Rex, D. Accuracy of polyp detection by gastroenterologists

- and nurse endoscopists during flexible sigmoidoscopy: a randomized trial. *Gastroenterology*, 117: 312–318, 1999.
64. Pacala, J., Boulton, C., Hepburn, K., Kane, R., Kane, R., Malone, J., Morishita, L., and Reed, R. Case management of older adults in health maintenance organizations. *J. Am. Geriatr. Soc.*, 43: 538–542, 1995.
 65. Glisson, C., and Hemmelgarn, A. The effects of organizational climate and interorganizational coordination on the quality and outcomes of children's service systems. *Child Abuse Neglect*, 22: 401–421, 1998.
 66. Alter, C., and Hage, J. *Organizations Working Together*. Newbury Park, CA: Sage, 1993.
 67. Grimshaw, J. M., Shirran, L., Thomas, R., Mowatt, G., Fraser, C., Bero, L., Grilli, R., Harvey, E., Oxman, A., and O'Brien, M. Changing provider behavior: an overview of systematic reviews of interventions. *Med. Care*, 39: II-2–II-45, 2001.
 68. Davis, D. A., Thomson, M. A., Oxman, A. D., and Haynes, R. B. Changing physician performance. A systematic review of the effect of continuing medical education strategies. *J. Am. Med. Assoc.*, 274: 700–705, 1995.
 69. Grimshaw, J. M., and Russell, I. T. Achieving health gain through clinical guidelines. II. Ensuring guidelines change medical practice. *Qual. Health Care*, 3: 45–52, 1994.
 70. Fiore, M., Jorenby, D., Schensky, A., Smith, S., Bauer, R., and Baker, T. Smoking status as the new vital sign: effect on assessment and intervention in patients who smoke. *Mayo Clin. Proc.*, 70: 209–213, 1995.
 71. Mandelblatt, J., and Kanetsky, P. Effectiveness of interventions to enhance physician screening for breast cancer. *J. Fam. Pract.*, 40: 162–171, 1995.
 72. Tierney, W. M., Dexter, P. R., Gramelspacher, G. P., Perkins, A. J., Zhou, X. H., and Wolinsky, F. D. The effect of discussions about advance directives on patients' satisfaction with primary care. *J. Gen. Intern. Med.*, 16: 32–40, 2001.
 73. Madlon-Kay, D. Improving the periodic health examination: use of a screening flow chart for patients and physicians. *J. Fam. Pract.*, 25: 470–473, 1987.
 74. van Wersch, A., Bonnema, J., Prinsen, B., Pruy, J., Wiggers, T., and van Geel, A. N. Continuity of information for breast cancer patients: the development, use and evaluation of a multidisciplinary care-protocol. *Patient Educ. Couns.*, 30: 175–186, 1997.
 75. Geiger, W., Neuberger, M., and Bell, G. Implementing the US preventive services guidelines in a family practice residency. *Fam. Med.*, 25: 447–451, 1993.
 76. McDonald, C., Hui, S., Smith, D., Tierney, W., Cohen, S., Weinberger, M., and McCabe, G. Reminders to physicians from an introspective computer medical record: a two-year randomized trial. *Ann. Intern. Med.*, 100: 130–138, 1984.
 77. Glasgow, R. E., Orleans, C. T., and Wagner, E. H. Does the chronic care model serve also as a template for improving prevention? *Milbank Q.*, 79: 579–612, 2001.
 78. Yarnall, K. S., Rimer, B. K., Hynes, D., Watson, G., Lyna, P. R., Woods-Powell, C. T., Terrenoire, J., and Barber, L. T. Computerized prompts for cancer screening in a community health center. *J. Am. Board Fam. Pract.*, 11: 96–104, 1998.
 79. Cooley, K. A., Frame, P. S., and Eberly, S. W. After the grant runs out. Long-term provider health maintenance compliance using a computer-based tracking system. *Arch. Fam. Med.*, 8: 13–17, 1999.
 80. McPhee, S., Bird, J., Fordham, D., Rodnick, J., and Osborn, E. Promoting cancer prevention activities by primary care physicians. Results of a randomized, controlled trial. *J. Am. Med. Assoc.*, 266: 538–544, 1991.
 81. Laine, C., and Davidoff, F. Patient-centered medicine. A professional evolution. *J. Am. Med. Assoc.*, 275: 152–156, 1996.
 82. Kaplan, S., Greenfield, S., and Ware, J. Assessing the effects of physician-patient interactions on the outcomes of chronic disease. *Med. Care*, 27 (Suppl.): S110–S127, 1989.
 83. Somkin, C., Hiatt, R., Hurley, L., Gruskin, E., Ackerson, L., and Larson, P. The effect of patient and provider reminders on mammography and Papanicolaou smear screening in a large health maintenance organization. *Arch. Intern. Med.*, 157: 1658–1664, 1997.
 84. Binstock, M. A., Geiger, A. M., Hackett, J. R., and Yao, J. F. Pap smear outreach: a randomized controlled trial in an HMO. *Am. J. Prev. Med.*, 13: 425–426, 1997.
 85. Yabroff, K. R., and Mandelblatt, J. S. Interventions targeted toward patients to increase mammography use. *Cancer Epidemiol. Biomark. Prev.*, 8: 749–757, 1999.
 86. Marcus, A., and Crane, L. A review of cervical cancer screening intervention research: implications for public health programs and future research. *Prev. Med.*, 27: 13–31, 1998.
 87. McBride, C. M., and Rimer, B. K. Using the telephone to improve health behavior and health service delivery. *Patient Educ. Couns.*, 37: 3–18, 1999.
 88. Lipkus, I. M., Rimer, B. K., Halabi, S., and Strigo, T. S. Can tailored interventions increase mammography use among HMO women? *Am. J. Prev. Med.*, 18: 1–10, 2000.
 89. Gemson, D. H., and Sloan, R. P. Efficacy of computerized health risk appraisal as part of a periodic health examination at the worksite. *Am. J. Health Promot.*, 9: 462–466, 1995.
 90. Rogers, E. M. Lessons for guidelines from the diffusion of innovations. *Jt. Comm. J. Qual. Improv.*, 21: 324–328, 1995.
 91. Magnan, S., Solberg, L., Giles, K., Kottke, T., and Wheeler, J. Primary care, process improvement, and turmoil. *J. Ambulatory Care Manage.*, 20: 32–38, 1997.
 92. Greer, A. L. The shape of resistance the shapers of change. *Jt. Comm. J. Qual. Improv.*, 21: 328–332, 1995.
 93. Miller, W. L., Crabtree, B. F., McDaniel, R., and Stange, K. C. Understanding change in primary care practice using complexity theory. *J. Fam. Pract.*, 46: 369–376, 1998.
 94. American Cancer Society. *Cancer Facts and Figures*. Report No. 96-300M-No. 5008.96. Atlanta, GA: American Cancer Society, 1996.
 95. Nystrom, L., Larsson, L. G., Wall, S., Rutqvist, L. E., Andersson, I., Bjurstam, N., Fagerberg, G., Frisell, J., and Tabar, L. An overview of the Swedish randomised mammography trials: total mortality pattern and the representivity of the study cohorts. *J. Med. Screen.*, 3: 85–87, 1996.
 96. Shapiro, S., Venet, W., Strax, P., Venet, L., and Roeser, R. Ten to fourteen year effect of screening on breast cancer mortality. *J. Natl. Cancer Inst. (Bethesda)*, 69: 349–355, 1982.
 97. Kerlikowske, K., Grady, D., Rubin, S. M., Sandrock, C., and Ernster, V. L. Efficacy of screening mammography. A meta-analysis. *J. Am. Med. Assoc.*, 273: 149–154, 1995.
 98. Johannesson, G., Geirsson, G., and Day, N. The effect of mass screening in Iceland, 1965–74, on the incidence and mortality of cervical carcinoma. *Int. J. Cancer*, 21: 418–425, 1978.
 99. Day, N. Effect of cervical cancer screening in Scandinavia. *Obstet. Gynecol.*, 63: 714–718, 1984.
 100. United States Preventive Services Task Force. *Screening for breast cancer*. In: C. DiGiuseppe, D. Atkins, and S. Woolf (eds.), *Guide to Clinical Preventive Services: Report of the US Preventive Services Task Force*, pp. 73–87. Baltimore, MD: Williams & Wilkins, 1996.
 101. United States Department of Health and Human Services, Office of Disease Prevention and Health Promotion. *Healthy People 2010: Understanding and Improving Health and Objectives for Improving Health*, 2nd ed. Washington, DC: United States Department of Health and Human Services, 2000.
 102. Lawson, H. W., Lee, N. C., Thames, S. F., Henson, R., and Miller, D. S. Cervical cancer screening among low-income women: results of a national screening program, 1991–1995. *Obstet. Gynecol.*, 92: 745–752, 1998.
 103. Prorok, P. C. Epidemiologic approach for cancer screening. Problems in design and analysis of trials. *Am. J. Pediatr. Hematol. Oncol.*, 14: 117–128, 1992.
 104. Day, N. E., Williams, D. R., and Khaw, K. T. Breast cancer screening programmes: the development of a monitoring and evaluation system. *Br. J. Cancer*, 59: 954–958, 1989.
 105. Tichy, N., and Beckhard, R. Organizational development for health care organizations. In: N. Margulis and J. Adams (eds.), *Organizational Development in Health Care Organizations*. Reading, MA: Addison-Wesley, 101–103, 1982.
 106. Hurley, S., Jolley, D., Livingston, P., Reading, D., Cockburn, J., and Flint-Richter, D. Effectiveness, costs, and cost-effectiveness of recruitment strategies for a mammographic screening program to detect breast cancer. *J. Natl. Cancer Inst. (Bethesda)*, 84: 855–863, 1992.
 107. Manos, M. M., Kinney, W. K., Hurley, L. B., Sherman, M. E., Shieh-Ngai, J., Kurman, R. J., Ransley, J. E., Fetterman, B. J., Hartinger, J. S., McIntosh, K. M., Pawlick, G. F., and Hiatt, R. A. Identifying women with cervical neoplasia: using human papillomavirus DNA testing for equivocal Papanicolaou results. *J. Am. Med. Assoc.*, 281: 1605–1610, 1999.
 108. Obwegeser, J. H., and Brack, S. Does liquid-based technology really improve detection of cervical neoplasia? A prospective, randomized trial comparing the ThinPrep Pap Test with the conventional Pap Test, including follow-up of HSIL cases. *Acta Cytol.*, 45: 709–714, 2001.
 109. Berg, W. A., Campassi, C., Langenberg, P., and Sexton, M. J. Breast Imaging Reporting and Data System: inter- and intraobserver variability in feature analysis and final assessment. *Am. J. Roentgenol.*, 174: 1769–1777, 2000.
 110. Gross, P., Greenfield, S., Cretin, S., Ferguson, J., Grimshaw, J. M., Grol, R., Klazinga, N., Lorenz, W., Meyer, G., Riccobono, C., Schoenbaum, S., Schyve, P., and Shaw, C. Optimal methods for guideline implementation. *Med. Care*, 39: II-85–II-92, 2001.
 111. Grol, R. Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Med. Care*, 39: II-46–II-54, 2001.