# DELIVERING CLINICAL PREVENTIVE SERVICES IS A SYSTEMS PROBLEM[1,2]

**Leif I. Solberg, M.D.**
Group Health Foundation/HealthPartners

**Thomas E. Kottke, M.D.**
Mayo Clinic and Foundation

**Shirley A. Conn, R.N., M.S.N.**
Blue Plus

**Milo L. Brekke, Ph.D.**
Brekke Associates

**Carolyn A. Calomeni, R.N., M.P.A. and Kathleen S. Conboy, R.N., B.S.N.**
Group Health Foundation/HealthPartners

## ABSTRACT

*A steadily increasing number of research trials and prevention advocates are identifying the practice environment as the main source of both problems and solutions to the improved delivery of clinical preventive services. Although these sources are correctly focusing on office systems as solutions, there is a tendency to focus on only parts of a system and to relate this to just one or a few related preventive services.*

*However, the effort required to set up and maintain an office system makes it difficult to justify doing so for a single clinical activity. The process and system thinking of Continuous Quality Improvement (CQI) theory suggests that there may be both efficiency and effectiveness advantages to the concept of all clinical preventive services being served by a single system with many interrelated component processes. Such a system should be usable for all age groups. This system and its literature base are described. The feasibility of applying this concept is being tested in a randomized controlled trial in 44 primary care clinics in Minnesota and Wisconsin.*

(**Ann Behav Med** 1997, *19*(3):271–278)

## INTRODUCTION

It is widely recognized that nearly all of the clinical preventive services identified by the U.S. Preventive Services Task Force (1) as having good evidence of efficacy and by Healthy People 2000 (2) as being important are still being provided at unacceptably low rates (3–9). Although there has been significant improvement toward the Healthy People 2000 targets in many areas (10), some of these targets are themselves rather low and represent a compromise between what is desirable and what was thought to be achievable by the year 2000.

Because of the widespread belief that prevention is important and needs more emphasis, there has been extensive research over the past 15 years on how to improve the delivery of clinical preventive services. This research has identified a wide variety of concepts and techniques that have been demonstrated to improve specific services or specific aspects of those services in medical practice. Although there is some evidence that incentives (11,12), social influence-based methods (13,14), selective feedback (13,15), and training (13) have a place in improvement efforts, organizing the office environment to support the consistent delivery of preventive services has been the most effective way to do this (13,14,16–26).

This evidence and the concept of an office system for preventive care has been best summarized by the American Cancer Society Advisory Group on Preventive Health Care Reminder Systems (24) and by McPhee (27) and exemplified for cardiovascular disease prevention by Solberg and Kottke (18). However, these articles don't focus on the system's component processes in a way that might clarify both their interrelationships and the change process required for developing and maintaining them. Elford may have put it best in saying, "An ounce of prevention requires a pound of office system change" (26).

Unfortunately, few of the office system changes demonstrated to be capable of improving service rates are in use in any medical practices. Where they do exist, it is often only a few processes for a few preventive services. Clinicians continue to struggle with the conflict between their desire to deliver preventive services (28) and the realities of medical practice that prevent this from occurring consistently (16,24,29–33).

An important reason for the lack of organized approaches to clinical preventive care is the tendency to think of these ap-

[1] Preparation of this manuscript was funded in part by the Agency for Health Care Policy and Research Grant R01 HS 08091.

[2] We are grateful for the experience with the development and implementation of the processes described in this article that has been provided by working with 24 clinics in the IMPROVE Project over the past two years. This includes the two demonstration clinics for the study, HealthPartners St. Paul Clinic and Kasson Mayo Family Practice Clinic, as well as the following intervention group clinics: Apple Valley Medical Center, Aspen Medical Group-W. St. Paul, Aspen Medical Group-W. Suburban, Chanhassen Medical Center, Chisago Medical Center, Creekside Family Practice, Douglas Drive Family Physicians, Eagle Medical, Fridley Medical Center, Hastings Family Practice, Hopkins Family Practice, Interstate Medical Center, Metropolitan Internists, Mork Clinic-Anoka, North St. Paul Medical Center, Ramsey Clinic-Amery, Ramsey Clinic-Baldwin, River Valley Clinic-Farmington, River Valley Clinic-Northfield, Southdale Family Practice, Stillwater Clinic, United Family Medical Center.

*Reprint Address:* L. I. Solberg, M.D., Group Health Foundation, 8100 34 Avenue South, P.O. Box 1309, Minneapolis, MN 55440.

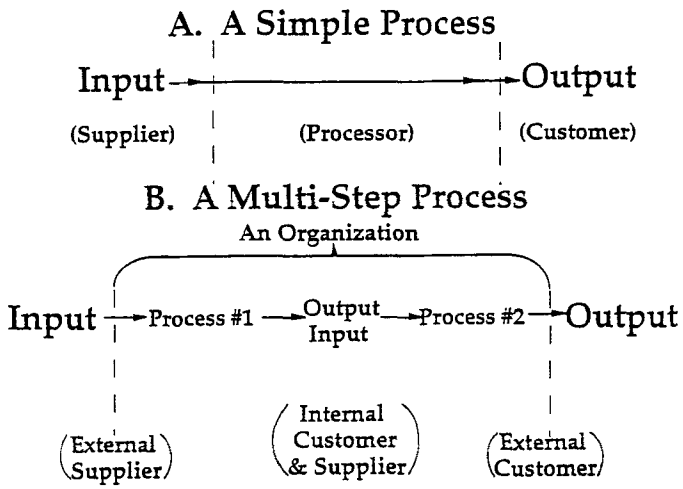


**FIGURE 1: Any process.**

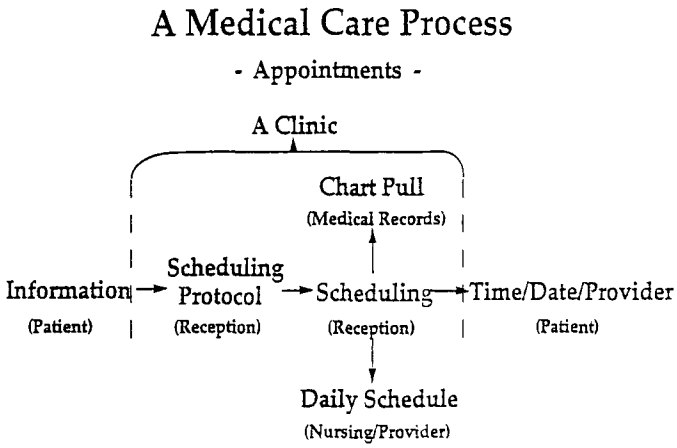


**FIGURE 2: The appointment-scheduling process.**

proaches in a fragmented way. For example, a clinic may have set up an effective way to consistently inform women of the results of their Pap smears while continuing to rely on a hit or miss reporting of other test results. Similarly, another clinic may have special shot days and patient reminders for flu shots, but nothing is done to make it more likely that these same patients will get pneumococcal immunizations or tobacco cessation support.

There are many reasons for this fragmentation, including tradition, economics, and the difficulty that many clinicians have with the concept of a population-based approach to medical care. In addition, advocates of specialty areas (e.g. cardiovascular disease or cancer prevention) usually focus on a few services of interest to them while ignoring the wide range of preventive services that could be served by the same system. However, another barrier is undoubtedly the amount of time and effort it takes to set up and maintain a separate organized approach to each service.

If it were possible to set up one system to support all clinical preventive services and if such a system were efficient to operate, then it might be worthwhile to invest considerable time and resources to develop, implement, and maintain this system. This article describes the concepts and background for understanding such a systematic approach to prevention in clinical practice.

## SYSTEMS AND PROCESS THINKING

Regardless of what one may think of the recent enthusiasm for Continuous Quality Improvement (CQI) or Total Quality Management (TQM), this movement has provided an important conceptual leap in its focus on all work as process (34). This concept means that everything a person or an organization does involves processes that take an input from a supplier and transform it into an output for a customer (see Figure 1). Although some processes are very simple (A), most involve many interrelated steps (B). Using this approach helps a clinic focus clearly on the decisions to be made and the activities to be organized.

This concept of work as process is the source of most of the fundamental 14 management points of quality expert W. Edwards Deming (35,36) and related approaches to the improvement of organizational function and efficiency. This concept of work as process also provides a valuable new way to think about organizing preventive services in a medical practice, especially when multiple processes are linked in a system.

This potential can be clarified by applying process thinking to a medical practice activity that is usually fairly well organized as well as being familiar to most clinicians, even if they don't know the details of how it works in their office. That process involves the arrangements to get a patient and a physician together at the same time and place (i.e. scheduling an appointment). In Figure 2, this process is shown with the supplier (patient) calling a clinic with input (information) about some health care need. The clinic receptionist makes use of a set of scheduling rules and an organizing book or computer in order to match the patient's desires/needs with an available clinician (hopefully the one the patient prefers to see) at a particular day and time. This process results in an output (appointment information) to a customer (patient who a moment before was the supplier).

However, this same output also becomes an input to other processes—to the medical records staff to pull the right chart on the right day, to nurses and physicians so they know what their work needs are for a particular day, and to whomever will greet and sign in the patient on arrival. Each of these other processes as well as the rooming process, billing process, and other processes must be integrated or there will be chaos. These interconnected processes collectively make up one very large process focused on organizing medical services to each patient. When many processes are integrated, they become one system.

## THE PREVENTION SYSTEM

In the same way that all of the separate processes are integrated into one system to organize a medical care episode (no matter what the patient's problem might be), the provision of clinical preventive services is a similar system of integrated processes. In fact, if that system could be applied to all preventive services, it might be possible to be more efficient while providing more services. For example, except during an appointment for a general exam, most patients do not ask for preventive services during their office visits. If an effective prevention system was in place, the research findings about the value of reminders could be applied to take advantage of missed opportunities to bring up and provide preventive services during other contacts.

This concept of prevention as one system of integrated processes is fundamental to the intervention in a randomized controlled prevention trial that we are conducting in private primary care clinics called Improving Prevention through Organization, Vision, and Empowerment (IMPROVE) (37). Over the past two years we have been training and consulting with 22 clinics as

they work on designing, implementing, and improving this prevention system uniquely at each site. The following description of the processes that make up this generic prevention system derives from that experience as well as from a growing research literature and efforts to improve prevention in a wide variety of primary care settings. While the IMPROVE trial results are not yet available, the model is instructive in itself and is summarized below.

Most of the processes that make up this prevention system are based on research evidence of potential efficacy, although usually they have only been tested for a few specific services. The processes are also based on some general principles that are becoming increasingly recognized as important to improved care.

### Taking Advantage of Missed Opportunities

Since many people (including those who are at higher risk) seek care infrequently, if at all, in medical care sites for a periodic health examination, it is becoming increasingly apparent that it is important to take advantage of other clinic visits or other contacts to update preventive services. The Canadian Task Force on the Periodic Health Examination emphasizes this strategy (38). In both its latest guide (1) and in its implementation program called Put Prevention into Practice (22), the U.S. Preventive Services Task Force also relies heavily on this approach.

### Extensive Use of Delegation for Tasks That Physicians Have Traditionally Performed on Their Own

Physicians are typically the rate-limiting factor in medical practices and most are primarily oriented toward diagnostic and therapeutic decision-making rather than the routine and educational aspects of care that constitute most preventive services. They are also usually short of time. Therefore, once guidelines and standing orders have been established for a practice, it is much more efficient and effective to delegate them to non-physicians while maintaining the important agenda setting and reinforcement roles of the physician (13,39–44).

### Emphasis on Population Medicine and Standardization

It is becoming widely recognized by those working to improve medical care delivery that it is necessary to move beyond the traditional one-at-a-time response to the complaints brought by individual patients. While preserving the beneficial aspects of that individualized care model, it is important to add ways to address the needs of all of the people for whom a clinic is responsible, whether they are in the clinic or not. Simultaneously, it is necessary to address all of their health needs. Some have called this community oriented primary care (45) and O'Connor (46) believes that managed care is much more likely to achieve it.

In order to accomplish this broader approach, it will be necessary for medicine to adopt a degree of the standardization that has helped other businesses become more efficient and effective. Thus, physicians need to learn that they can actually do a better job for the patient in front of them if they develop common systems to assure quality for all patients with similar needs. If each clinic or medical group could agree to develop and use approaches that are similar whenever possible, they could increase delegation and build support systems that provide a way to take advantage of their currently missed opportunities.

## COMPONENT PROCESSES OF THE PREVENTION SYSTEM

We have divided the interrelated processes of a clinic prevention system into ten components that incorporate the general principles above. Although this categorization is somewhat arbitrary and others might conceive of a slightly different way of grouping these activities, it is a way of organizing both the tasks and the thought processes. This approach has also seemed to work well for the IMPROVE clinics where they have sought to establish their own prevention systems. Our experience with these clinics has caused us to make some modifications in our original description of this system (37), primarily in clarifying the language and concepts.

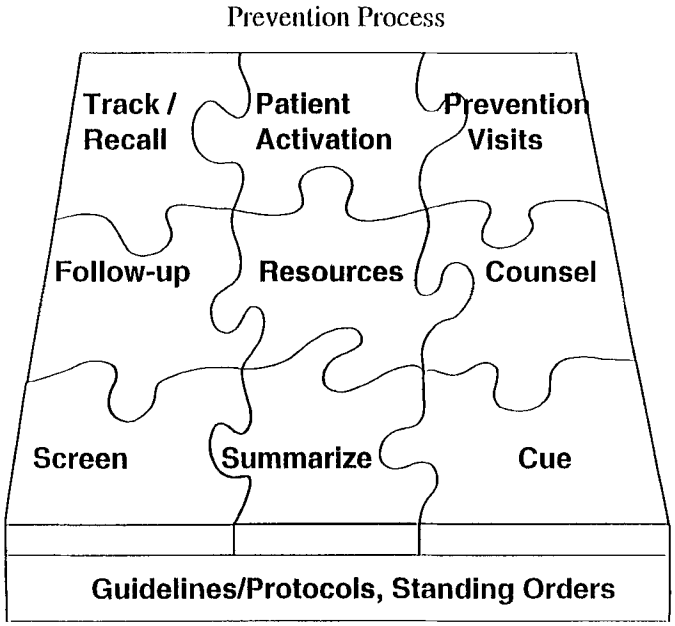


**FIGURE 3: The prevention system.**


It has been helpful to visualize the prevention system as a jigsaw puzzle. One advantage of the puzzle is that it illustrates both the forest (whole system picture) and the trees (individual process pieces). This image has facilitated understanding and helped many primary care providers develop both a vision and a specific plan for what they need to do to improve. In the current version of this puzzle (Figure 3), the nine interlocking operational processes are resting on a firm base of the foundation process of guidelines. But before considering the important interrelationships between the processes, it is necessary to understand each individual process, many of which have a substantial research base and literature of their own. The key to understanding each of these pieces is to view it as describing a series of steps or actions rather than as a specific product. In other words, these are verbs rather than nouns.

### Provide Guidelines: The Process by Which a Clinical Organization Develops, Obtains Broad Buy-In, and Updates a Specific Set of Preventive Services for Defined Age/Gender/Risk Groups

Although a document containing the specific guidelines is an important result of this process, the document is ineffective unless it represents true agreement from at least the clinicians in a medical group. Moreover, without genuine agreement, it is impossible to develop or implement a systematic way to provide the services. That is why Figure 3 shows the guideline process as a table underlying and supporting all of the other processes. Repeated review and updating of both the document and the buy-in are equally important.

There has been an enormous amount of attention to medical guidelines in the past five years. Nearly every professional association has been busily crafting them as a way to define their own role in care, while most hospitals, large care systems, and national health institutions have done the same, hoping that guidelines are the solution to cost and quality needs. As an increasing number of studies suggest that they have little effect on care patterns (47–51), the focus is now turning to the much bigger and tougher issue of guideline implementation (14,16,19,20,24,43,52–54). This is where the other nine processes come in.

### Screen: The Process of Obtaining Information in a Standard Way About All Patients of a Clinic in Order to Identify the Specific Prevention Needs of Each One

This information should ideally include both the health risks of each individual and the last time they received screening tests or some intervention. Such information must be collected in part from the patient through questionnaires, computers, or interviews and in part from a review of existing or outside medical records. This process needs to include a mechanism to keep the information current through periodic recollection and addition of ongoing preventive services information. Other names could be applied to this process (e.g. data base collection, information gathering) since the term "screening" might be confused with the screening tests that are so much a part of preventive services.

Most descriptions of office systems seem to assume that the information will be collected, so they focus primarily on the next process—summarizing (16,19,20,43,44,55,56). Frame (52) and McPhee (57) used a separate chart review for computerization of the screening information, and Hahn (53) planned on the physician collecting the information during visits based upon the reminder of a blank flow sheet in the chart. Hahn also took the important practical step of measuring the time it took to collect this information during office visits. He found it took an average of 2.1 minutes and never more than 4 minutes.

### Summarize: The Process of Organizing and Updating the Information Obtained in the Screening Process So That It Is All in One Place and Easily Reviewable By Those Needing to Know the Current Prevention Status of a Particular Patient

Someday this organizing and updating of existing information will be done via computer in an automated medical record, but for the time being, most clinics will need to establish a paper form for this purpose and design reliable processes to update the information as it is collected through a screening process and a test-reporting or follow-up process.

Many reports describe the use of such flow sheet summaries as part of an approach to improving preventive services (13,14,18–20,23,24,52,53,55,58–60), but they have also been studied separately to prove their value in increasing the rates of services provided (56,57,61–63). Of course, it is not possible to separate completely the value of a summary sheet for the information it contains from its value as a reminder or cue (see below).

### Cue: The Process of Reminding Clinic Staff and Clinicians About Their Need to Undertake Some Prevention System Task

This process includes anything that makes it more likely that clinic personnel will undertake a prevention task, whether that cue involves putting a form in the chart, starting a status summary sheet (above), or attaching chart stickers or flags. In practice, the chart summary form used for dates of preventive services information is probably the best cue to a nurse or clinician to address a preventive service, at least if it is in color and placed in a highly visible location. However, it may be even more helpful to attach a separate Post-it® or flag for needed services to get the attention of a clinician focused on the immediate needs of a patient during a busy visit.

This process of reminding or cueing probably has the greatest research evidence base of any of the processes, beginning with the classic study of McDonald et al. in 1984 (64). Since then, there have been many confirming studies (15,43,56,57,63–68). Interestingly, the McDonald group has recently demonstrated that prevention reminders do not seem to have the same effectiveness when used in hospitalized patient charts as when used in the ambulatory setting (69).

### Follow-Up: The Process of Communicating to Patients the Results of Preventive Services Along with the Appropriate Information and Recommendations

Providing patients with follow-up will most obviously be needed for lab test or x-ray results. However, it is also an important part of facilitating behavior change for patients who have expressed an intention to quit smoking or initiate some new activity on a particular future date. Following up with a telephone call or letter simply reinforces the behavior change, although the counseling process may also become involved here. It is helpful to inform the patient that the follow-up intent is to see if additional help is needed (rather than as a verification of patient action) and to ask for permission beforehand to do the follow-up. Follow-up will be most consistently and efficiently performed if it is delegated to an appropriate staff person, with clinician action only in the case of abnormal results or unusual problems. The key point, however, is to ensure that a common process is used for all clinic patients rather than a different process by each clinician.

Follow-up of all test results (not just abnormals) is increasingly recognized as not only desired by most patients but also required for medicolegal protection. Thus, the lack of scientific studies of its value may not be a detriment to encouragement of implementing this process. However, it has been an important part of studies of smoking cessation and other cardiovascular risk factors and is implicitly necessary to any plan to facilitate change in established habits (23,58,59,70–72). For example, all studies of the effectiveness of nicotine replacement therapy in smoking cessation have built in extensive follow-up after the quit date. Similarly, the Hypertension Detection and Follow-up Program trial included regularly scheduled follow-up of patients delegated to non-physicians and found that the degree of control correlated with follow-up (73). Wagner's review of chronic illness care suggests that "the assurance of regular follow-up seems to be a hallmark in the design of successful programs and practices" (74).

### Resources: The Process of Selecting, Gathering, Organizing, and Maintaining Patient Education and Referral Information Needed by Both Patients and Clinic Personnel

It is particularly important not to confuse this process with the materials and learning aids themselves. Most practices already have patient education materials on hand. Although some have this material organized, most don't and almost none have it set up so that it is easy to access this material when it is needed. Thus, it is rarely used. Similarly, most practices haven't established any internal personnel to provide patient education or any readily available information about externally provided classes, etc. Thus,

this process requires a new effort to integrate information and resources into the care process in such a way that it is easy and time efficient to provide them to patients.

Like follow-up, there have been few controlled trials of the benefits of this process. However, virtually all trials of better management of risk factors or chronic diseases as well as descriptions of organized systems for prevention automatically address this process as a necessary part of better care (16,23,59,74). Whether the information provided through these resources leads directly to better patient self-management of needed behavior changes or whether it occurs indirectly through increasing self-efficacy is neither clear nor as important as the fact that the change appears to occur (74).

### Counseling: The Process of Assisting Patients and Their Families to Make Needed Changes in Their Behavior

This process is closely linked with those for resources and follow-up. It assumes that change in chronic behaviors (e.g. tobacco use, nutrition, and exercise patterns) requires considerable time and effort on the part of the individual and that this can be facilitated by various health care professionals and not necessarily physicians. In fact, while all clinicians must be supportive, non-physicians are frequently both more effective and less costly counselors. Since we know that patients will rarely go to external sources for this help, it is important to provide it onsite if possible. Again, the issue is how to set up such assistance in a way that makes it very easy for the clinician to delegate to a counselor while maintaining ongoing involvement.

There are a wide variety of models for this that have been demonstrated in normal primary care settings, both in this country and in others (13,18,24,59,74–76). The most promising ones make use of nursing personnel and the readiness to change stages of Prochaska and DiClemente (77).

### Track and Recall: The Process of Reminding Patients About Their Ongoing Needs for Specific Preventive Services

This process may involve a registry of those needing particular attention for follow-up (e.g., adults with hyperlipidemia or hypertension or childhood immunizations). However, it may involve nothing more complex than a card file or calendar as a tickler to send a reminder card to patients at the time of their next needed screening test or immunization. The hardest part of this process is to keep up-to-date, so that patient reminders are not sent out when the service was received before the tickler interval. However, an occasionally inappropriate reminder is far better than no reminder at all.

Just as in the clinician/staff reminders or cues, there is a fairly extensive body of studies demonstrating the value of this process and its acceptance by patients (24,27,62,78–83). Some studies have even shown the synergistic effect of combining clinician and patient reminders (5,84,85). However, the effects have been relatively small in most cases.

### Patient Activation: The Process of Encouraging Patients to Take Greater Responsibility for Their Own Preventive Services and Behavior Changes

Implementing this process typically involves ways to inform patients of the guideline recommendations of their clinic, as well as encouraging them to act on their own needs without requiring individualized reminders or advice from clinic staff. Thus, it includes posters or brochures as well as mini-records kept by the patients of their own needs and latest services. The pediatric immunization card is probably the best known example of this mini-record.

Although there have been few separate studies of just this feature, most general recommendations or clinical trials of organized systems to improve preventive services include this process (14,16,19,20,24,27,43,52,53,78,86,87). However, Dickey and others have demonstrated both the effectiveness and the acceptability of the patient mini-record (79,88–93). A 1991 U.S. Gallup poll found that 85% of respondents reported that they would find a pocket-sized preventive health information and recording booklet useful (46% very useful and 39% somewhat useful) (94).

### Prevention Visits: The Process of Providing All the Preventive Services Needed by a Patient During a Single Visit Designed and Organized for That Purpose

The traditional complete physical exam grew from the exam devised to establish a diagnosis on a patient in the hospital, so it is not surprising that it has never been focused on preventive services. Even when evidence-based prevention activities are incorporated into normal visits as much as possible, it may still be necessary to provide a periodic opportunity to address preventive needs in a comprehensive way in a visit designed for that purpose. Since nearly all of these activities are readily definable and primarily involve risk assessment and educational interventions, such a prevention visit is well suited to questionnaires and delegation to nurses or other non-physician personnel. It can thus become both more useful and less costly than the current approach. However, the prevention visit will need to have a much larger emphasis on life-style counseling and a few tests rather than on the physical exam.

Since the current interest in evidence-based prevention has grown largely out of an effort to counter the traditional routine exam that lacks a clearly defined purpose, it is interesting that very little has been written by any reformers about redesigning that exam into a prevention visit. Moreover, there have been no trials of either the process, outcome, or acceptability of such visits. Nevertheless, they seem to offer an important opportunity to improve care and accomplish the goals of a modern prevention system, at least for those people who are still interested in such an exam.

## TYING IT ALL TOGETHER

Just as a car engine is more than the sum of its parts, the prevention system is much more that the sum of its component processes. That is why developing finely-tuned guidelines alone is so useless. Similarly, a finely-tuned screening process is of little value without the summary process, and neither is very useful unless the processes of follow-up, counseling, and resources assure that identified needs are reported and addressed. Only when all of the processes are working well, both separately and together, will a clinic become renowned for its prevention approach.

Although most of the research on these processes has been performed for adult preventive services, there is no reason to believe that they should be any less effective or less necessary for children. Similarly, although a system can be limited to the preventive services needed for cardiovascular disease prevention, it is important that the system be set up to be capable of including all services if it is to become both feasible and valuable.

Nevertheless, developing, implementing, and maintaining such a system is no small task. Therefore, it may be wise to begin with the basic processes like guidelines, screening, summarizing, cueing, resources, and follow-up. That is what most of the clinics

in the IMPROVE Project have chosen to do before adding the others (37).

Since the process of establishing a complete prevention system is so much effort, it is especially important to make use of an organized improvement process such as CQI in order to undertake the organizational changes in the most effective way. Our experience thus far suggests that this approach can work well while adding important organizational change skills to clinics that use it.

## REFERENCES


(1) U.S. Preventive Services Task Force: *Guide to Clinical Preventive Services* (2nd Ed.). Baltimore, MD: Williams & Wilkins, 1996.

(2) U.S. Department of Health and Human Services: *Healthy People 2000: National Health Promotion and Disease Prevention Objectives,* DHHS Publication No. (PHS) 91-50212. Washington, DC: U.S. Department of Health and Human Services, 1990.

(3) Woo B, Woo B, Cook EF, Weisberg M, Goldman L: Screening procedures in the asymptomatic adult: Comparison of physicians' recommendations, patients' desires, published guidelines, and actual practice. *Journal of the American Medical Association.* 1985, *254:*1480–1484.

(4) Lurie N: Preventive care: Do we practice what we preach? *American Journal of Public Health.* 1987, *77:*801–804.

(5) Payne T, Kanvik S, Seward R, et al: Development and validation of an immunization tracking system in a large health maintenance organization. *American Journal of Preventive Medicine.* 1993, *9:*96–100.

(6) Schwartz JS, Lewis CE, Clancy C, et al: Internists practices in health promotion and disease prevention: A survey. *Archives of Internal Medicine.* 1991, *114:*46–53.

(7) Osborn EH, Bird JA, McPhee SJ, Rodnick JE, Fordham D: Cancer screening by primary care physicians: Can we explain the differences? *Journal of Family Practice.* 1991, *32:*465–471.

(8) Lewis CE: Disease prevention and health promotion practices of primary care physicians in the United States. *American Journal of Preventive Medicine.* 1988, *4*(Suppl.):9–16.

(9) Ornstein SM, Garr DR, Jenkins RG, et al: Compliance with five health promotion recommendations in a university-based family practice. *Journal of Family Practice.* 1989, *29:*163–168.

(10) McGinnis JM, Lee PR: Healthy People 2000 at mid decade. *Journal of the American Medical Association.* 1995, *273:*1123–1129.

(11) Davis K, Bialek R, Parkinson M, Smith J, Vellozi C: Paying for preventive care: Moving the debate forward. *American Journal of Preventive Medicine.* 1990, *6*(Suppl.):7–30.

(12) *INSURE. Final Report of the INSURE Project.* Washington, DC: Health Insurance Association of America, 1988.

(13) Yano EM, Fink A, Hirsch SH, Robbins AS, Rubenstein LV: Helping practices reach primary care goals: Lessons from the literature. *Archives of Internal Medicine.* 1995, *155:*1146–1156.

(14) Cohen SJ, Halvorson HW, Gosseling CA: Changing physician behavior to improve disease prevention. *Preventive Medicine.* 1994, *23:*284–291.

(15) Tierney WM, Hui SL, McDonald CJ: Delayed feedback of physician performance versus immediate reminders to perform preventive care: Effects on physician compliance. *Medical Care.* 1986, *24:*659–667.

(16) Thompson RS, Taplin SH, McAfee TA, Mandelson MT, Smith AE: Primary and secondary prevention services in clinical practice: Twenty years' experience in development, implementation, and evaluation. *Journal of the American Medical Association.* 1995, *273:*1130–1135.

(17) Pommerenke FA, Weed DL: Physician compliance: Review and application to cancer detection and prevention. *American Family Physician.* 1991, *43:*560–568.

(18) Solberg LI, Kottke TE: The prevention-oriented practice. In Ockene IS, Ockene JK (eds), *Prevention of Coronary Heart Disease: A Skill-Based Approach.* Boston, MA: Little, Brown and Co., 1992, 468–490.

(19) Carney PA, Dietrich AJ, Keller A, Landgraf J, O'Connor GT: Tools, teamwork, and tenacity: An office system for cancer prevention. *Journal of Family Practice.* 1992, *35:*388–394.

(20) Dietrich AJ, O'Connor GT, Keller A, et al: Cancer: Improving early detection and prevention. A community practice randomised trial. *British Medical Journal.* 1992, *304:*687–691.

(21) McPhee SJ, Bird JA, Fordham D, Rodnick JE, Osborn EH: Promoting cancer prevention activities by primary care physicians. *Journal of the American Medical Association.* 1991, *266:*538–544.

(22) Dickey LL, Kamerow DB: The put prevention into practice campaign: Office tools and beyond. *Journal of Family Practice.* 1994, *39:*321–323.

(23) Kottke TE, Solberg LI, Brekke ML, et al: Doctors helping smokers: Development of a clinic-based smoking intervention system. In Shopland DR, Burns DM, Cohen SI, Gritz E, Kottke TE (eds), *Tobacco and the Clinician: Interventions for Medical and Dental Practice.* Washington, DC: National Cancer Institute, 1994, 69–91.

(24) Leininger LS, Finn L, Dickey L, et al: An office system for organizing preventive services. *Archives of Family Medicine.* 1996, *5:*108–115.

(25) Davis JE, McBride PE, Bobula JA: Improving prevention in primary care: Physicians, patients, and process. *Journal of Family Practice.* 1992, *35:*385–387.

(26) Elford RW, Jennett P, Bell N, Szafran O, Meadows L: Putting prevention into practice. *Health Reports.* 1994, *6:*142–153.

(27) McPhee SJ, Detmer WM: Office-based interventions to improve delivery of cancer prevention services by primary care physicians. *Cancer.* 1993, *72*(3):1100–1112.

(28) Wechsler H, Levine S, Idelson RK, Schor EL, Coakley E: The physician's role in health promotion revisited—A survey of primary care practitioners. *New England Journal of Medicine.* 1996, *334:*996–998.

(29) Kottke TE, Brekke ML, Solberg LI: Making "time" for preventive services. *Mayo Clinic Proceedings.* 1993, *68:*785–791.

(30) Jaen CR, Stange KC, Nutting PA: Competing demands of primary care: A model for the delivery of clinical preventive services. *Journal of Family Practice.* 1994, *38:*166–171.

(31) Kottke TE, Wilms DG, Solberg LI, Brekke ML: Physician-delivered smoking cessation advice: Issues identified during ethnographic interviews. *Tobacco Control.* 1994, *3:*46–49.

(32) McPhee SJ, Richard RJ, Solkowitz SN: Performance of cancer screening in a university internal medicine practice: Comparison with the 1980 American Cancer Society guidelines. *Journal of General Internal Medicine.* 1986, *1:*275–281.

(33) McPhee SJ, Bird JA: Implementation of cancer prevention guidelines in clinical practice. *Journal of General Internal Medicine.* 1990, *5*(Suppl.):116–122.

(34) Berwick DM: The clinical process and the quality process. *Quality Management in Health Care.* 1992, *1:*1–8.

(35) Walton M: *The Deming Management Method.* New York: Perigee, 1986.

(36) Berwick DM, Godfrey AB, Roessner J: *Curing Health Care.* San Francisco, CA: Jossey-Bass, 1990.

(37) Solberg LI, Kottke TE, Brekke ML, et al: Using CQI to increase preventive services in clinical practice—Going beyond guidelines. *Preventive Medicine.* 1996, *25:*259–267.

(38) Canadian Task Force on the Periodic Health Examination: *The Canadian Guide to Clinical Preventive Health Care.* Ottawa, Canada: The Minister of Supply and Services Canada, 1994.

(39) Cargill VA, Conti M, Neuhauser D, McClish D: Improving the effectiveness of screening for colorectal cancer by involving nurse clinicians. *Medical Care.* 1991, *29:*1–5.

(40) Goldberg HI, Mullen M, Ries RK, Psaty BM, Ruch BP: Alcohol counseling in a general medicine clinic. *Medical Care.* 1991, *29:*49–56.

(41) Wasson J, Gaudette C, Whaley F, et al: Telephone care as a substitute for routine clinic follow-up. *Journal of the American Medical Association.* 1992, *267:*1788–1793.
(42) Davidson RA, Fletcher SW, Retchin S, Duh S: A nurse-initiated reminder system for the periodic health examination: Implementation and evaluation. *Archives of Internal Medicine.* 1984, *144:*2167–2170.
(43) Foley EC, D'Amico F, Merenstein JH: Improving mammography recommendation: A nurse-initiated intervention. *Journal of the American Board of Family Practice.* 1990, *3:*87–92.
(44) Demmler RW, Bakht FR, DeSilva P: Improving measles vaccination rates in previously vaccinated adults. *Journal of Family Practice.* 1992, *35:*180–184.
(45) Wright RA: Community-oriented primary care: The cornerstone of health care reform. *Journal of the American Medical Association.* 1993, *269:*2544–2547.
(46) O'Connor PJ: Community-oriented primary care in a brave new world. *Archives of Family Medicine.* 1994, *3:*493–494.
(47) Greco PJ, Eisenberg JM: Changing physicians' practices. *New England Journal of Medicine.* 1993, *329:*1271–1274.
(48) Brook RH: Implementing medical guidelines. *The Lancet.* 1995, *346:*132.
(49) Wall EM: Practice guidelines: Promise or panacea? *Journal of Family Practice.* 1993, *37:*17–19.
(50) Kibbe DC, Kaluzny AD, McLaughlin CP: Integrating guidelines with continuous quality improvement: Doing the right thing the right way to achieve the right goals. *Joint Commission Journal on Quality Improvement.* 1994, *20:*181–191.
(51) Grimshaw JM, Russell IT: Effect of clinical guidelines on medical practice: A systematic review of rigorous evaluations. *The Lancet.* 1993, *342:*1317–1322.
(52) Frame PS: Health maintenance in clinical practice: Strategies and barriers. *American Family Physician.* 1992, *45:*1192–1200.
(53) Hahn DL, Berger MG: Implementation of a systematic health maintenance protocol in a private practice. *Journal of Family Practice.* 1990, *31:* 492–504.
(54) Mittman BS, Tonesk X, Jacobson PD: Implementing clinical practice guidelines: Social influence strategies and practitioner behavior change. *Quality Review Bulletin.* 1992, 18(12):413–422.
(55) Sangster JF: The impact of an organized approach to prevention. *Canadian Family Physician.* 1983, *29:*2369–2374.
(56) Cheney C, Ramsdell JW: Effect of medical records' checklists on implementation of periodic health measures. *American Journal of Medicine.* 1987, *83:*129.
(57) McPhee SJ, Bird JA, Jenkins CNH, Fordham D: Promoting cancer screening: A randomized, controlled trial of three interventions. *Archives of Internal Medicine.* 1989, *149:*1866–1872.
(58) Kottke TE, Solberg LI, Brekke ML, et al: A controlled trial to integrate smoking cessation advice into primary care practice. *Journal of Family Practice.* 1992, *34:*701–708.
(59) Solberg LI, Maxwell PL, Kottke TE, Gepner GH, Brekke ML: A systematic primary care office-based smoking cessation program. *Journal of Family Practice.* 1990, *30:*647–654.
(60) Rodney WM, Copiusky P, Quan M: Adult immunizations: The medical record design. *Journal of Medical Education.* 1983, *58:*576–580.
(61) Prislin MD, Vanderbark MS, Clarkson QD: The impact of a health screening flowsheet on the performance and documentation of health screening procedures. *Family Medicine.* 1986, *18:*290–292.
(62) Frame PS, Zimmer JG, Werth PL, Hall WJ, Eberly SW: Computer-based vs manual health maintenance tracking. A controlled trial. *Archives of Family Medicine.* 1994, *3:*581–588.
(63) Prislin MD, Vandenbark MS, Clarkson QD: The impact of a health screening flow sheet on the performance and documentation of health screening procedures. *Family Medicine.* 1986, *18:*290–292.
(64) McDonald CJ, Hui SL, Smith DM, et al: Reminders to physicians from an introspective computer medical record. *Archives of Internal Medicine.* 1984, *100:*130–138.
(65) Cowan JA, Heckerling PS, Parker JB: Effect of a fact sheet reminder on performance of the periodic health examination: A randomized controlled trial. *American Journal of Preventive Medicine.* 1992, *8:*104–109.
(66) McDowell I, Newell C, Rosser W: Computerized reminders to encourage cervical screening in family practice. *Journal of Family Practice.* 1989, *28:*420–424.
(67) Harris RP, O'Mallory MS, Fletcher SW, Knight BP: Prompting physicians for preventive procedures: A five-year study of manual and computer reminders. *American Journal of Preventive Medicine.* 1990, *6:*145–152.
(68) Litzelman DK, Dittus RS, Miller ME, Tierney WM: Requiring physicians to respond to computerized reminders improves their compliance with preventive care protocols. *Journal of General Internal Medicine.* 1993, *8:*311–317.
(69) Overhage JM, Tierney WM, McDonald CJ: Computer reminders to implement preventive care guidelines for hospitalized patients. *Archives of Internal Medicine.* 1996, *156:*1551–1556.
(70) Kottke TE, Battista R, DeFriese G, Breek M: Attributes of successful smoking cessation interventions in medical practice. A meta-analysis of 39 controlled trials. *Journal of the American Medical Association.* 1988, *259:*2882–2889.
(71) Hollis JF, Lichtenstein E, Mount K, Vogt TM, Stevens VJ: Nurse-assisted smoking counseling in medical settings: Minimizing demands on physicians. *Preventive Medicine.* 1991, *20:*497–507.
(72) Hollis JF, Vogt TM, Stevens V, et al: The Tobacco Reduction and Cancer Control (TRACC) Program: Team approaches to counseling in medical and dental settings. In Shopland DR, Burns DM (eds), *Tobacco and the Clinician: Interventions for Medical and Dental Practice.* Washington, DC: National Institutes of Health, 1994, 143–167.
(73) Shulman N, Cutter G, Daugherty R, et al: Correlates of attendance and compliance in the hypertension detection and follow-up program. *Controlled Clinical Trials.* 1982, *3:*13–27.
(74) Wagner EH, Austin BT, Von Korff M: Improving outcomes in chronic illness. *Managed Care Quarterly.* 1996, *4:*12–25.
(75) MacKinon M: General practice diabetes care: The past, the present, and the future. *Diabetic Medicine.* 1990, *7:*171–172.
(76) Mulhauser I: Evaluation of a structured treatment and teaching programme on hypertension in general practice. *Clinical and Experimental Hypertension.* 1993, *15:*125–142.
(77) Prochaska JO, Velicer WF, Rossi JS, et al: Stages of change and decisional balance for twelve problem behaviors. *Health Psychology.* 1994, *13:*39–46.
(78) Halvorson H, Brekke K, Reed F, Cohen SJ, McClatchey MW: Process evaluation of a systems approach to prevention oriented primary care services. *STFM Research News.* 1992, *December:* 9–14.
(79) Dietrich AJ, Duhamel M: Improving geriatric preventive care through a patient-held checklist. *Family Medicine.* 1989, *21:*195–198.
(80) Becker DM, Gomez EB, Kaiser DL, et al: Improving preventive care at a medical clinic: How can the patient help? *American Journal of Preventive Medicine.* 1989, *5:*353–360.
(81) Taplin SH, Anderman C, Grothaus L, Curry S, Montano D: Using physician correspondence and postcard reminders to promote mammography use. *American Journal of Public Health.* 1994, *84:*571–574.
(82) Grabenstein JD, Smith LJ, Watson RR, Summers RJ: Immunization outreach using individual need assessments of adults at an army hospital. *Public Health Reports.* 1990, *105:*311–316.
(83) Brimberry R: Vaccination of high-risk patients for influenza: A comparison of telephone and mail reminder methods. *Journal of Family Practice.* 1988, *26:*397–400.
(84) Turner RC, Waivers LE: The effect of patient reminder cards on the performance of health maintenance measures. *Clinical Research.* 1989, *37:*802A.

(85) Ornstein SM, Garr DR, Jenkins RG, Rust PF, Arnon A: Computer-generated physician and patient reminders. Tools to improve population adherence to selected preventive services. *Journal of Family Practice.* 1991, *32:*82–90.

(86) McCormick MC, Shapiro S, Starfield BH: The association of patient-held records and completion of immunizations. *Clinical Pediatrics.* 1981, *20:*270–274.

(87) Liaw T, Lawrence M, Rendell J: The effect of a computer-generated patient-held medical record summary and/or a written personal health record on patients' attitudes, knowledge, and behaviour concerning health promotion. *Family Practice.* 1996, *13:*289–293.

(88) Dickey LL, Petitti D: Assessment of a patient-held mini-record for adult health maintenance. *Journal of Family Practice.* 1990, *31:*431–438.

(89) Dickey LL, Petitti D: A patient-held mini-record to promote adult preventive care. *Journal of Family Practice.* 1992, *34:*457–463.

(90) Giglio RJ, Papazian B: Acceptance and use of patient-carried health records. *Medical Care.* 1986, *24:*1084–1092.

(91) Turner RC, Waivers LE, O'Brien K: The effect of patient-carried reminder cards on the performance of health maintenance measures. *Archives of Internal Medicine.* 1990, *150:*645–647.

(92) Schapira DV, Kumar NB, Clark RA, Yag C: Mammography screening credit card and compliance. *Cancer.* 1992, *70*(2):509–512.

(93) Dickey LL: Promoting preventive care with patient-held mini-records: A review. *Patient Education and Counseling.* 1993, *20:*37–47.

(94) Gallup Corporation: *Stay Healthy USA Survey.* Princeton, NJ: Gallup Corporation, 1991.