Organized Colorectal Cancer Screening in Integrated Health Care Systems

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Colorectal cancer (CRC) is an ideal target for early detection and prevention through screening. Noninvasive screening options are the guaiac fecal occult blood test and the fecal immunochemical test. Organized screening offers the promise of uniformly delivering screening to all members of a population who are eligible and due. Organized screening is defined as an explicit policy with defined age categories, method, and interval for screening in a defined target population with a defined implementation and quality assurance structure, and tracking of cancer in the population. The UK National Health Service; the Ontario, Canada Ministry of Health and Long-Term Care; and the US Veteran's Health Administration have used varied organized approaches to deliver guaiac fecal occult blood test screening to their populations. Kaiser Permanente Northern California began CRC screening in the 1960s, initially using flexible sigmoidoscopy. Implementation of organized fecal immunochemical test outreach was associated with improved Healthcare Effectiveness Data and Information Set CRC screening rates between 2005 and 2010 from 37% to 69% and from 41% to 78% in the commercial and Medicare populations, respectively. Organized fecal immunochemical test screening has been associated with an increase in annually detected CRCs, almost entirely because of increased detection of localized-stage cancers.

Abbreviations: CRC, colorectal cancer; FIT, fecal immunochemical test; FOBT, fecal occult blood test; KPNC, Kaiser Permanente Northern California.
remained larger in the distal than the proximal colon (18). Randomized trials comparing colonoscopy with sensitive fecal blood tests are ongoing but may not be large enough to settle the question of proximal colon efficacy. Fecal DNA testing and computed tomographic colonography are 2 additional methods of CRC screening that have been in development over the last several years, but neither is currently available for widespread use. The Centers for Medicare and Medicaid Services decided not to cover computed tomographic colonography out of concern regarding the strength of evidence supporting its use (19). In addition, the US Food and Drug Administration has required a premarket review of the fecal DNA test prior to allowing sale in the United States, which has led the Centers for Medicare and Medicaid Services to deny coverage for this service as well (20). Neither test is recommended by the U.S. Preventive Services Task Force as an appropriate screening tool for average-risk adults (7).

ORGANIZED VERSUS OPPORTUNISTIC SCREENING

The International Agency for Research on Cancer defines an organized screening program as one that has the following features: 1) an explicit policy with specified age categories, method, and interval for screening; 2) a defined target population; 3) a management team responsible for implementation; 4) a health care team for decisions and care; 5) a quality assurance structure; and 6) a method for identifying cancer occurrence in the population (21). In contrast, opportunistic screening is conducted outside of an organized screening program, often delivered through fee-for-service reimbursement of physicians. Compared with opportunistic screening, organized screening focuses much greater attention on the quality of the screening process, including follow-up of participants (22). Thus, a key advantage of organized screening is that it provides greater protection against the harms of screening—including overscreening, poor quality, and complications of screening—and poor follow-up of those who test positive (22).

Organized screening offers the promise of uniformly delivering screening to all members of a population who are eligible and due. Empirical evidence that organized screening is superior to opportunistic screening is lacking (23). It makes logical sense, however, to consider it an important option to improve screening rates in a population. Regular physician visits is one of the strongest predictors of being screened in the United States (24). An organized approach separates the screening process from dependence on regular office visits. It also helps minimize the chance of overscreening, which is important on a patient level to minimize risk of screening and also important because colonoscopy resources are limited (25).

Organized CRC screening is more common in Europe than in the United States, which has facilitated the development of quality assurance programs (26). However, earlier adoption of opportunistic screening in the United States, and generous reimbursement for colonoscopy, has led to nearly 60% of the US population reporting having been screened for CRC (27), higher rates than have been reported in Europe (26). However, underuse, overuse, and misuse of CRC screening remain significant problems in the United States (28), and an organized approach to screening provides a way to address each of these problems.

Fecal occult blood tests

The fecal occult blood test (FOBT) is the most commonly used method of CRC screening throughout the world (6). The only tests supported by randomized controlled trials are flexible sigmoidoscopy (29) and the FOBT. Depending on whether the tests were performed biennially or annually, and whether the tests were or were not rehydrated, fecal occult blood testing is associated with a 15%–33% reduction in CRC mortality (9–11, 13) and a 17%–20% reduction in CRC incidence (12). Fecal blood testing offers the advantage of being noninvasive and convenient for patients. FOBTs are ideally suited for organized CRC screening programs. Tests can be sent through the mail directly to patients. Samples are collected at home and can be returned by mail to a central processing laboratory.

The randomized trials of fecal blood testing used the standard guaiac test, the only FOBT available at the time. Since then, newer FOBTs have become available, including a high-sensitivity guaiac test (Hemoccult SENSA, Beckman Coulter, Brea, California) and the fecal immunochemical test (FIT), which uses an antibody specific for human hemoglobin. The high-sensitivity guaiac test is the test of choice for the Israeli national CRC screening program, which has used it for population screening for the last decade (30).

Key advantages of the FIT over guaiac test are improved patient acceptance and improved specificity. The FIT is specific for human hemoglobin and is not affected by diet and medications. FITs generally require fewer samples than guaiac tests, with better sensitivity. Since hemoglobin is frequently degraded as it passes through the gastrointestinal tract, the FIT is more specific for colonic bleeding. As a result, FIT specificity is not affected by anticoagulant or nonsteroidal medications (31). Aspirin use also increases sensitivity, with only minimal effect on specificity (32). A randomized trial reported that patients invited to screen with FIT are more likely to adhere to screening, compared with the guaiac test, in part because of improved collection devices, fewer required samples, and no dietary restrictions (33). Concerns have recently been raised, however, about the use of mailed FIT screening during warm-weather months of the year. Under current buffering conditions, it has been noted that FIT is less sensitive during summer, perhaps because of denaturation of the hemoglobin molecule at high temperature (34), leading the Israeli program to favor the highly sensitive guaiac test over FIT (35). There is one report of reduced sensitivity of FIT in women compared with men, although the men in the study population had higher rates of nonsteroidal antiinflammatory drug use compared with the women (36).

The performance characteristics of FIT have been studied in a variety of settings, with somewhat varying results. In a preventive health appraisal population at KPNC, Allison et al. (37) used 3 samples of the HemeSelect FIT (SmithKline Diagnostics, Inc., San Jose, California) compared with the highly sensitive guaiac test and standard guaiac test, and they
reported sensitivity for cancer of 68.8% with FIT and 79% with the highly sensitive guaiac test using 2-year follow-up for clinical cancer incidence. Specificity of the highly sensitive guaiac test was substantially lower, however, than that of the FIT (86.7% vs. 94.4%) (37). Both tests were more sensitive than the standard guaiac test, which had 37.1% sensitivity, but was much more specific, with 97.7% specificity (37). In another study using a different FIT (FlexSure OBT (SmithKline Diagnostics, Inc.), also a 3-sample FIT), with combined flexible sigmoidoscopy and 2-year clinical follow-up of patients testing negative on FIT, Allison et al. reported FIT sensitivity for CRC of 81.8% compared with 64% for the sensitive guaiac test. Specificity was also higher for FIT, with specificity of 96.9% compared with 90.1% for the sensitive guaiac test (38). In a large screening colonoscopy cohort from Japan, Morikawa et al. (39) reported sensitivity of 65.8% and specificity of 95.5% using a single application of the Magstream 1000 test (Fujirebio, Inc., Tokyo, Japan).

Varying the numbers of samples, and the target concentration of hemoglobin, was explicitly evaluated by Levi et al. (40) in a high-risk colonoscopy population and in a screening population by Park et al. (41). Increasing the number of specimens increases the sensitivity for cancer detection from 64.7% to 82.4% to 88.2% for 1, 2, or 3 specimens, respectively. Specificity declines with the addition of each sample, from a corresponding 94.3% to 91.9% to 89.7%. Lowering the hemoglobin cutoff from 100 to 75 increases sensitivity by 0%–6%, depending on the number of specimens, and decreases specificity by 2% (42). In a Korean study of 770 screening colonoscopy patients, the cancer sensitivity FIT using 2 or 3 samples was 84.6%, with a 100-ng/mL threshold for positivity and 92.2% specificity. When a 75-ng/mL threshold was used, the cancer sensitivity was 92.3%, with 91.4% specificity. In this study, there was no cancer detection advantage to collecting the third sample (40) (Table 1).

There are several different brands of FIT available in the US market, but, because of a lack of direct comparison, it is not possible to say that one brand is clearly superior (20). Studies are conducted to evaluate a one-time application of the FIT, but FIT is recommended to be used in a program of screening over a long period of annual use. It is expected that repeated applications will provide additional opportunities to detect the lesions missed on the initial application, but the exact benefit of repeated applications of FIT is unknown. A subset of CRCs may never bleed prior to becoming invasive and spreading locally or distantly. Sensitivity and specificity point estimates have varied across studies because of differences in populations and the criterion standard used to determine the true incidence of cancer. In population screening, practical considerations such as patient acceptance and reliability of results reporting become as important as pure test operating characteristics. This point was recently demonstrated in Holland, where higher acceptance of FIT resulted in higher neoplasia detection compared with a sensitive guaiac test (33). In mass screening, the automated test processing available with the FIT offers an important advantage of improved test reliability. Repetitive strain is also a concern with the manual processing of multiple sample guaiac cards.

### EXAMPLES OF ORGANIZED CRC SCREENING PROGRAMS

A main focus of this review is the Kaiser Permanente Northern California (KPNC)–organized CRC screening program. A thoroughly comprehensive assessment of all organized CRC screening programs worldwide is beyond the scope of this review. However, several programs point up the key aspects of successful CRC screening programs that may be useful for those considering a CRC screening initiative.

### United Kingdom

The organized United Kingdom CRC screening program uses mailed outreach with the guaiac test. Randomized trial data in the United Kingdom demonstrated the efficacy of CRC screening (9). Questions persisted, however, about the effectiveness of CRC screening in usual clinical practice without the support of highly motivated research teams, and a formal pilot evaluation was published in 2004 to determine the degree to which a clinical program could duplicate the results of a trial (43). In that pilot, patients aged 50–69 years from 2 regions in England and 3 regions in Scotland received a mailed

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**Table 1.** Cancer Detection Performance Characteristics of Fecal Immunochemical Tests at Varying Hemoglobin Thresholds for a Positive Test and Numbers of Samples Collected

<table>
<thead>
<tr>
<th>First Author (Reference No.)</th>
<th>Setting/Patients</th>
<th>No.</th>
<th>100 ng/mL</th>
<th>75 ng/mL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sensitivity</td>
<td>Specificity</td>
</tr>
<tr>
<td>Park (41)</td>
<td>Korea/screening</td>
<td>770</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 sample</td>
<td></td>
<td></td>
<td>69.2</td>
<td>93.7</td>
</tr>
<tr>
<td>2 samples</td>
<td></td>
<td></td>
<td>84.6</td>
<td>92.2</td>
</tr>
<tr>
<td>3 samples</td>
<td></td>
<td></td>
<td>84.6</td>
<td>89.8</td>
</tr>
<tr>
<td>Levi (40)</td>
<td>Israel/high risk</td>
<td>1,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 sample</td>
<td></td>
<td></td>
<td>64.7</td>
<td>94.3</td>
</tr>
<tr>
<td>2 samples</td>
<td></td>
<td></td>
<td>82.4</td>
<td>91.9</td>
</tr>
<tr>
<td>3 samples</td>
<td></td>
<td></td>
<td>88.2</td>
<td>89.7</td>
</tr>
</tbody>
</table>
invitation for a nonrehydrated standard guaiac FOBT. Patients testing positive were referred for colonoscopy. All endoscopists had an initial assessment by expert evaluators and then agreed to submit their examinations to a central database for ongoing quality assurance evaluation. Key areas of ongoing evaluation have included the psychosocial and ethnicity issues related to acceptability and uptake of screening, the impact of screening on routine services, stakeholders’ attitudes on screening, and the health economics of screening (43). In the first round of the pilot, 478,250 mailed FOBTs were sent and 271,646 (57%) were completed, closely mirroring the results of the United Kingdom randomized trial. Nearly 2% of tests were positive, and the positive predictive value was 11% for invasive cancer and 35% for adenomas. Results of the second round of screening tests sent 2 years after the first round were similar to those of the initial pilot (44). This program is now fully implemented through the National Health Service in England (http://www.cancerscreening.nhs.uk/bowel/) and in Scotland (http://www.bowelscreening.scot.nhs.uk/). Both programs use mailed invitations of 3-sample, nonrehydrated guaiac tests in a target population aged 60–75 years.

Ontario, Canada

The Ontario Ministry of Health and Long-Term Care, in collaboration with Cancer Care Ontario, launched a province-wide CRC screening program, called ColonCancerCheck, in January 2007 aimed at reducing deaths from CRC by increasing early detection using a 3-sample guaiac test. The program uses mass advertising to promote CRC screening to all citizens of Ontario. FOBT kits are available through primary care offices; for patients without primary care physicians, kits are available from pharmacies or through a telephone service called TeleHealth Ontario. Mailed outreach is not part of this program. An important initiative of this program was to streamline the process of referring patients for screening and follow-up colonoscopies. Colonoscopy quality assurance is also a part of this program (http://www.health.gov.on.ca/en/ms/coloncancercheck/). The program has provided additional funding for hospital-based colonoscopies based on initial quality assurance research in Ontario demonstrating that hospital-based colonoscopies had higher completion rates compared with office-based colonoscopies (45). In the 3 years after the program was launched, population screening rates doubled from 14.7% to 29.7%.

US Veteran’s Health Administration

The US Veteran’s Health Administration achieved a 68% CRC screening rate in 2001, with substantial increases since then (46). This program uses the Veteran’s Health Administration electronic health record system to allow for sophisticated interactive reminders in use at several medical centers throughout the United States. An important lesson from this program was identifying the need to monitor access to follow-up colonoscopies for patients being screened using noncolonoscopy screening tests. Initial wait times were long, and patients often were inappropriate can-

didates for colonoscopy because of reduced life expectancy or comorbid conditions (46). The Veteran’s Health Administration has undertaken a formal collaborative process to address the timeliness and quality of colonoscopy follow-up in their health system, using generally accepted quality improvement techniques (47). Although constraints on gastroenterology capacity were often cited as a key barrier, implementation of strategies to address this issue was unassociated with improvements in timely follow-up of positive fecal blood tests (48).

KAISER PERMANENTE NORTHERN CALIFORNIA

KPNC is an integrated health care delivery system with 3.2 million members, approximately 900,000 of whom are aged 50–80 years. Nearly all outpatient care is delivered by the 7,000 physicians of The Permanente Medical Group, Inc., through a network of 19 medical centers located in an area between Fresno, Santa Rosa, and Sacramento, California. As a mostly prepaid, group model health maintenance organization, KPNC has emphasized preventive care since its inception in 1945.

CRC screening has been an important part of clinical care at KPNC since the 1960s (49), when several KPNC medical centers began offering screening sigmoidoscopy as part of multiphasic health checkups. The Permanente Medical Group, Inc. began an active, regionwide clinical program of CRC screening using flexible sigmoidoscopy starting in 1994 (50). This program was based on a case-control study of sigmoidoscopy demonstrating a 60% reduction in distal CRC mortality associated with screening sigmoidoscopy exposure (51). The algorithm for colonoscopy referral after flexible sigmoidoscopy was based on the long-term cancer incidence predicted by distal colon findings in a United Kingdom follow-up study, demonstrating a low incidence of subsequent CRC when only small adenomas were found at sigmoidoscopy (52). A cross-sectional study of the first 2 years of the program confirmed that only large distal adenomas, multiple distal adenomas, or distal adenomas with advanced histologic features were predictors of advanced proximal neoplasia (CRC and advanced adenomas) (53).

The KPNC flexible sigmoidoscopy program was more opportunistic than organized. It relied on physician referrals for flexible sigmoidoscopy at the time of an office visit for another unrelated condition. Population monitoring of screening rates was primarily through a triennial mailed survey to a weighted sample of members from each KPNC medical center, depending on self-reported screening rates. The KPNC electronic health record had an automated prompt based on prior exposure to flexible sigmoidoscopy any time in the prior 10 years, but there was no direct outreach to members who did not come in for office visits.

In 2004, the Healthcare Effectiveness Data and Information Set began measuring the CRC screening performance of US health insurance plans (54). The CRC screening measure is a hybrid, relying on both electronic administrative data and chart review to detect evidence of CRC screening with fecal blood testing within 1 year, flexible sigmoidoscopy
within 5 years, colonoscopy within 10 years, or double contrast barium enema within 5 years. After 2009, double contrast barium enema was dropped as a qualifying screening test. With this new measure, there is now a standard, agreed-upon method of tracking population performance. The denominator population consists of men and women between the ages of 50 and 75 years who had been continuously enrolled in the KPNC health plan for 2 years without

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**Figure 1.** Healthcare Effectiveness Data and Information Set (HEDIS)–reported colorectal cancer screening rates reflecting Kaiser Permanente Northern California publicly reported HEDIS performance from 2004 until 2010. Each reporting year reflects performance up to the end of the prior year. Gray bars: performance in the Medicare population; black bars: performance in the commercially insured population.

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**Figure 2.** The overall colorectal cancer (CRC) screening approach at Kaiser Permanente Northern California: a combination of organized and opportunistic screening. FIT, fecal immunochemical test.

*Epidemiol Rev* 2011;33:101–110
Table 2. Features of Organized Screening and the KPNC Approach to Colorectal Cancer Screening

<table>
<thead>
<tr>
<th>Organized Screening</th>
<th>KPNC Organized Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>A quality assurance structure</td>
<td>Local follow-up to increase adherence. Monitoring, tracking, and reporting of colonoscopy follow-up of a positive FIT. Organized effort to build colonoscopy capacity.</td>
</tr>
<tr>
<td>Defined target population</td>
<td>Population-based outreach, with explicit inclusion and exclusion criteria.</td>
</tr>
<tr>
<td>Explicit policy with specified age categories, method, and screening interval</td>
<td>Screening test of choice is the FIT, performed annually, follow-up of positive tests with colonoscopy, and adherence with screening and policies tracked by using regional electronic data.</td>
</tr>
<tr>
<td>Management team responsible for implementation</td>
<td>Financial allocations to medical centers tied to performance, and performance tracked through regional electronic data with feedback to medical centers on performance. Best practices identified and disseminated across medical centers using regular communication.</td>
</tr>
<tr>
<td>Health care team for decisions and care</td>
<td>Clinical stakeholders, including primary care, gastroenterology, and medical center population care managers, are informed of developments regularly, and feedback is used to improve the program.</td>
</tr>
<tr>
<td>Method for identifying cancer occurrence in the population</td>
<td>Colorectal cancer incidence and stage and colorectal subsite location tracked annually using the KPNC Regional Cancer Registry.</td>
</tr>
</tbody>
</table>

Abbreviations: FIT, fecal immunochemical test; KPNC, Kaiser Permanente Northern California.

evidence of CRC or a total colectomy. Public reporting of CRC screening rates has led to measurable changes in CRC screening rates among insured populations in many US health systems (55).

Between 2004 and 2010, KPNC demonstrated substantial improvement in its reported CRC screening rates. The commercial population rate doubled, from 34% to 69% (Figure 1). The Medicare rate increased from 46% to 78% over this same time period. This increase was the result of a concerted effort by The Permanente Medical Group, Inc. leadership and physicians to implement an organized CRC screening program and to closely monitor performance. The KPNC screening program is a combination of organized FIT and opportunistic referrals for screening colonoscopy and flexible sigmoidoscopy (Figure 2). The features of this program are outlined below, and they meet many criteria of an organized screening program (Table 2).

Leadership alignment and clear goal setting

The important stakeholders include the executive director of The Permanente Medical Group, Inc., as well as all physicians-in-chief at each of 19 medical centers; chiefs of gastroenterology, adult medicine, and family practice; and the director of the regional laboratory. Annual performance goals and targets are established by executive leaders and approved by The Permanente Medical Group, Inc. Board of Directors. Performance is closely monitored and updated monthly, with reports distributed widely throughout the medical group. Leaders are aligned behind the goal of CRC screening and provide regular feedback to all physicians on group CRC screening performance.

Financial alignment

The Permanente Medical Group, Inc. physicians are salaried, but each KPNC medical center operating budget is funded through a regional allocation of resources based on membership population size. A portion of each medical center’s financial allocation is held back and released monthly depending on performance on selected quality measures. Therefore, medical center leaders have an incentive to allocate sufficient resources to reaching quality targets set at the beginning of each fiscal year. CRC screening performance is tracked regularly, and a portion of the allocation is released each month based on the proportion of age-eligible patients who have been screened among those who receive regular care at each medical center.

Organized outreach

Screening colonoscopy is available to all members desiring it through opportunistic referral. In addition, known high-risk patients are referred for colonoscopy based on reminders from the automated Population and Condition Tracking System (Figure 2). FIT is the screening test of choice for organized outreach. KPNC has studied FIT for the last 20 years (37, 38). A sequential pilot study was conducted to compare use of the Quest InSure test (a 2-sample, brush collection, qualitative, manual FIT purchased from Quest Diagnostics, Madison, New Jersey) with the OC Auto Micro 80 (a 1-sample, automated, machine-read, quantitative FIT purchased from Polymedco, Cortlandt Manor, New York) (56). The 2 tests were found to be comparable in terms of patient acceptance and positivity rate, although the machine-read OC Auto FIT provided more consistently reliable positivity results week to week. A comparative sensitivity study using 2-year clinical follow-up of the pilot participants is ongoing. The OC Auto test was chosen because of the possibility of automated machine reading and because it was processed in the internal KPNC regional laboratory, allowing for close quality control.

The outreach begins with identifying the population eligible for CRC screening using KPNC automated electronic medical records (Figure 2). The Healthcare Effectiveness Data and Information Set measure is based on the calendar year, enabling screening for the year to be spread over several months. KPNC members due for screening are identified from the electronic health record, and information for a random sample of members is uploaded each week to a third-party mailing fulfillment vendor. The vendor prints the FIT outreach packets, then assembles and mails them. Each packet includes a standardized letter and preprinted laboratory requisition order form containing the
member’s name, medical record number, and name of the primary care provider ordering the test.

A reminder letter is mailed 6 weeks following the initial outreach. Local medical centers use a variety of personalized reminder systems to encourage members to complete their screening, including automated and support staff phone calls to members who have not responded to the initial mailing or the reminder letter. KPNC has a secure messaging system, allowing members to securely send electronic messages to their physicians. This secure messaging system is used in selected centers to remind patients to screen. In addition to typical text messages, links are provided to a “FIT landing page” containing Internet-based videos that promote FIT screening or provide instructions for how to use the test (http://www.permanente.net/homepage/kaiser/pages/f53425.html). Annual influenza vaccination clinics provide an additional opportunity to bundle CRC screening with other preventive health interventions.

Facilitated in-reach

A preventive health prompt uses automated data to identify members overdue for preventive health services. The CRC screening prompt is reviewed by support staff at the time of visit registration and when patients are checked into rooms for physician visits. Physicians of all specialties may order FIT screening, regardless of the clinical department in which the patient is seen. This way, the entire organization is accountable for CRC screening.

Increasing capacity

Improved performance on CRC screening measures has placed substantial demand on existing colonoscopy resources because of the need to follow up positive FITs and has increased demand for screening colonoscopy. Improvements in colonoscopy capacity have focused on maximizing existing space through full scheduling and minimizing room turnover time, as well as exploring alternative venues for high-throughput colonoscopy centers. It is essential to completely account for all procedure demand (including surveillance and symptomatic evaluation) to ensure an adequate match of supply and demand. Alternative approaches to sedation (including nurse-anesthetist-provided propofol sedation) and preprocedure assessment and postprocedure instruction using midlevel providers have been used to maximize procedure room efficiency.

Quality assurance

The Healthcare Effectiveness Data and Information Set CRC screening quality measure focuses on the proportion of the population screened for CRC during the reporting period. The overall quality of the CRC screening program depends on the quality of the entire screening process. Laboratory personnel and equipment are monitored for variation, and quality control standards are used. The Population and Condition Tracking System ensures that patients with a positive FIT receive timely access to

Figure 3. Kaiser Permanente Northern California (KPNC) age- and gender-adjusted colorectal cancer incidence rates (%). Distal colorectal cancer is defined as affecting the rectum, sigmoid colon, and descending colon. Proximal colorectal cancer includes the splenic flexure, transverse colon, hepatic flexure, and ascending colon. Data were collected by the KPNC Cancer Registry at the Kaiser Permanente Division of Research and reported to the California Cancer Registry and the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute. Cancer registries collect and audit data retrospectively; therefore, 2009 KPNC data were estimated to be 97% complete when this review was written.

Figure 4. Numbers of Kaiser Permanente Northern California (KPNC)-identified new colorectal cancer cases, by stage at diagnosis. Data were collected by the KPNC Cancer Registry at the Kaiser Permanente Division of Research and reported to the California Cancer Registry and the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute. Cancer registries collect and audit data retrospectively; therefore, 2009 KPNC data were estimated to be 97% complete when this review was written. The SEER Summary Staging System was developed by the Surveillance, Epidemiology, and End Results Program of the National Cancer Institute.
colonoscopy. Finally, a colonoscopy quality assurance program focusing on adenoma detection rates has been initiated, since this endpoint has been shown to predict subsequent development of interval cancer following colonoscopy (57).

**Initial effect on CRC incidence**

Based on recent randomized trials of flexible sigmoidoscopy, CRC incidence should not significantly decrease until more than 7 years following commencement of endoscopic CRC screening (29, 58). The adenoma-carcinoma sequence lasts longer than 10 years (59), and cancers may exist in a preclinical form for over 6 years (60). CRC incidence is tracked routinely using the KPNC Cancer Registry. Data were nearly 100% complete through the end of 2008 and estimated to be 97% complete for 2009. Since 2004, when the Healthcare Effectiveness Data and Information Set reported that CRC screening rates have been tracked and have been increasing, the age- and gender-adjusted KPNC CRC incidence rates increased from 43/100,000 in 2004 to 53/100,000 in 2008, with a slight decline in 2009 to 50/100,000 (Figure 3). However, 2009 data will not be complete until routine cancer registry auditing and death clearance processes are completed in 2011. Incidence of proximal CRC appears to be similar to distal CRC, although somewhat more of the decline seen in 2009 appears to be in proximal CRC. The increased CRC incidence is driven in large measure by the increase in detection of localized-stage CRCs in the years since organized FIT outreach was implemented (Figure 4). From 2007 to 2009, an average of nearly 200 more localized cancers were detected annually in the KPNC population compared with the baseline in place from 2006 and before.

**Practice recommendations**

The US Centers for Disease Control and Prevention has set a goal of 80% of the eligible population being screened for CRC by 2014 (http://www.cdc.gov/cancer/crcpp/about.htm). Reaching such an aggressive target will be a challenge for all health care providers. Providers in office-based practice, outside of a large health system, may not be able to offer the same level of organized CRC screening as a large health system. An important first step, however, is to identify the patients for whom the practice is responsible and to track whether those patients’ screening is up to date. Doing so may require documenting screening tests performed by other providers. It is also important to have a way to extend a screening invitation to patients who do not come in regularly for care, and mailed outreach with FIT is an important option for screening. Once screened, patients should be tracked through to completion of colonoscopy.

**ACKNOWLEDGMENTS**

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This work was funded entirely by The Permanente Medical Group, Inc.

The authors thank Drs. Philip Madvig and James Chang for ongoing project support and Zahra Jaffer and Priya Nilekani for ongoing project management. They also thank Melissa Stern and Debra Maurer for initial project management.

Presented in part at the National Institutes of Health State of the Science Conference, “Enhancing Use and Quality of Colorectal Cancer Screening,” February 2–4, 2010, Bethesda, Maryland.

Conflict of interest: none declared.

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