ARTICLE TITLE: Population-Based Programs for Increasing Colorectal Cancer Screening in the United States

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After reading the article “Population-Based Programs for Increasing Colorectal Cancer” the learner should be able to:
1. Discuss population-based programs designed to increase colorectal cancer screening in the United States
2. Describe important elements of effective colorectal cancer screening programs

ACTIVITY DISCLOSURES:
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Screening to detect polyps or cancer at an early stage has been shown to produce better outcomes in colorectal cancer (CRC). Programs with a population-based approach can reach a large majority of the eligible population and can offer cost-effective interventions with the potential benefit of maximizing early cancer detection and prevention using a complete follow-up plan. The purpose of this review was to summarize the key features of population-based programs to increase CRC screening in the United States. A search was conducted in the SCOPUS, OvidSP, and PubMed databases. The authors selected published reports of population-based programs that met at least 5 of the 6 International Agency for Research on Cancer (IARC) criteria for cancer prevention and were known to the National Colorectal Cancer Roundtable. Interventions at the level of individual practices were not included in this review. IARC cancer prevention criteria served as a framework to assess the effective processes and elements of a population-based program. Eight programs were included in this review. Half of the programs met all IARC criteria, and all programs led to improvements in screening rates. The rate of colonoscopy after a positive stool test was heterogeneous among programs. Different population-based strategies were used to promote these screening programs, including system-based, provider-based, patient-based, and media-based strategies. Treatment of identified cancer cases was not included explicitly in 4 programs but was offered through routine medical care. Evidence-based methods for promoting CRC screening at a population level can guide the development of future approaches in health care prevention. The key elements of a successful population-based approach include adherence to the 6 IARC criteria and 4 additional elements (an identified external funding source, a structured policy for positive fecal occult blood test results and confirmed cancer cases, outreach activities for recruitment and patient education, and an established rescreening process). CA Cancer J Clin 2015;65:496-510. © 2015 American Cancer Society.

Keywords: colorectal cancer screening, mass screening, organized screening program, prevention program, population management

Introduction

Colorectal cancer (CRC) screening has been proven to reduce incidence rates and both disease-specific and overall mortality rates, and it is recommended by all relevant major organizational guidelines.1-4 CRC meets the requirements of the World Health Organization for large-scale screening of a whole population.5,6 While United States (US) screening rates are rising and incidence and mortality are declining, CRC remains the leading cause of cancer mortality in nonsmokers and the second leading cause of cancer-related death overall when men and women are combined.7,8 According to the National Institutes of Health (NIH) state-of-the-science statement, CRC screening is still underused,9 and disparities in screening rates are apparent.4,10-13 Efforts to increase screening rates can be facilitated by reviewing successful screening programs in a variety of settings.14

Increases in screening have resulted from implementing 3 different models, either individually or in combination: 1) screening at the point of care; 2) a population-based approach organized by a single practice, group practice, or health care delivery system; and 3) a public health approach in which screening invitations are extended to the regional public outside
the context of medical delivery.\textsuperscript{15-17} Each of these methods has worked in different settings and programs. Several tools have been developed by the National Colorectal Cancer Roundtable (NCCRT) to guide increased screening at the point of care and across a delivery system.\textsuperscript{18,19} The NCCRT commissioned our team to analyze the third model—population-based programs—with the objective of delineating the elements and processes associated with successfully increasing screening. This review is a result of that work and has 2 goals: 1) to provide an overview of a select group of population-based screening programs with effective processes in the US, and 2) to propose a framework based on key elements of these model programs that can be used to develop a population-based approach to CRC screening.

Although most screening in the US is offered at the point of care, which means that the health care seeker must have access to a provider to be offered screening, in the population-based approaches described here, the programs reach out to target populations and are responsible for ensuring that every aspect of screening, including referral for treatment, is completed.\textsuperscript{20-22} These programs have approached their target patients as a population to be managed by an administrative structure and have created system components to address the steps and interfaces that provide a continuum of care. Potter has categorized such CRC interventions as operational at 3 levels of the socioecologic framework: the point of care, the health care organization, and the public health system.\textsuperscript{23}

A 2012 summary of 20 established CRC screening programs described the strategies for contacting patients, the screening modalities used, and screening participation rates.\textsuperscript{24} It did not discuss the operations, management, or evaluation methods used by these programs. Only 2 of the 20 programs reviewed were in the US: the Veterans Hospital Administration (VHA) program and Kaiser Permanente in California. Benson et al described 35 population-based initiatives in 17 countries, 4 of which were national programs.\textsuperscript{25} Each country’s program was adapted to its individual population, health care system, and funding support (like Germany, the United Kingdom, Italy, and Japan). The current review is focused on US programs only; an additional review evaluating the international programs based on the International Agency for Research on Cancer (IARC) cancer prevention framework is needed.

Methods

The research team completed a literature search for descriptions of US population-based programs and solicited lists of programs from organizations that were members of the NCCRT. Searches were conducted in the Scopus, OvidSP, and PubMed databases for articles that were published from 1995 to 2014. The search terms included colorectal cancer screening, population health, mass screening, health care system, health plan, insurance, veterans program, and state program. All articles were screened, and only those that were about established programs were included for more details. The majority of the articles discussed interventions conducted to identify barriers/facilitators of screening and ways to increase adherence to screening, and those articles were not included in this review. Of the 19 programs identified, 8 were selected based on the scope of the program reach, its overall effectiveness, and details available in the literature. In addition to a review of published articles, phone interviews were conducted with leaders of 3 of the programs (Maryland, Kaiser Permanente, and Independence Blue Cross [IBC]). Five other program leaders were not contacted because sufficient information was available in the literature for adequate review. Each interview lasted approximately 30 to 40 minutes. The interviews were conducted by 2 authors (Manisha Verma and Mona Sarfaty) and were tailored to individual programs to collect information that was not found in the available publications. Written notes were taken during the interviews, which were used in conjunction with published information to develop the descriptions below. The literature and the leaders of the programs provided details on program structure, policies, and administration. Each candidate program was evaluated by comparing program elements with criteria established by the IARC cancer prevention framework.

IARC Cancer Prevention Framework

The program descriptions below are based on the 6 criteria offered by the IARC cancer prevention framework.\textsuperscript{26} These serve as a structure for implementing and assessing effective processes and elements of population-based cancer screening programs. These 6 criteria are: 1) an explicit screening policy with specified age categories, screening methods, and intervals; 2) a defined population; 3) a management team responsible for implementation; 4) a health care team responsible for decisions and care; 5) a quality-assurance structure; and 6) a method for identifying cancer occurrence in the population. Each criterion has a distinct role in the overall program success or failure. A screening policy and a defined population determine which tests should be offered and who should participate in the program. A management team responsible for implementation has responsibility for program oversight and direction. Most management teams for successful programs included administrative, clinical, and public health leaders. Some are the result of collaborative efforts between the health care setting(s) and public health department(s). A health care team ideally should be comprised of 2 elements: one responsible for offering screening tests and the other offering cancer treatment. A quality-
assurance structure maintains the quality of the program through regularly occurring data audits and reports. Overall program success is measured to a large degree by the percentage change in screening rates.

Review of Model Programs

Eight US programs met at least 5 of the 6 IARC criteria and were selected for this review article. Seven of those programs have published descriptions in medical journals, and one provided a description that has not yet been published. The program descriptions below are divided into 4 categories:

1. National demonstration program (a federally funded and organized, multistate demonstration project supported by the US Centers for Disease Control and Prevention [CDC]);
2. State and city programs (state and city initiatives in Delaware, Maryland, and New York City);
3. Integrated health systems (programs of integrated health systems, including Kaiser Permanente of Northern California [KPNC], Group Health Cooperative of Puget Sound [Group Health], and the VHA); and
4. Insurer program (an insurance company-based program conducted by IBC in Philadelphia).

Table 1 outlines the overall structure and salient features of each of the programs. Table 2 outlines the population demographics, population-based strategies, and changes in screening rates for each program included in this review. The population-based strategies to enhance recruitment in each of the programs include: 1) system-based, 2) provider-based, 3) patient-based, and 4) media-based strategies. System-based strategies include collaborative efforts between medical and public health professionals as well as automated systems for sending information to potential participants and offering care management and navigation services; provider-based strategies offer assistance to providers in the form of automated reminders and gap reports; patient-based strategies mainly target direct patient education; and media-based strategies include using social media to educate the public and increase recruitment.

National Demonstration Program (CDC)

The CDC Colorectal Cancer Screening Demonstration Program began in 2005.27 This demonstration program was conducted at 5 sites selected by the CDC as part of a 5-year feasibility study for a national program. The 5 sites were Baltimore City, Maryland; Suffolk County, New York; St. Louis, Missouri; Seattle, Washington; and the state of Nebraska.28 Uninsured, low-income populations were the primary target of the program. Descriptions and evaluations of the CDC demonstration program were published in 2013.29-40 DeGroff et al identified facilitating and challenging factors for the initiation and launch of this program through interviews and document review.41 The facilitating factors included: 1) preexisting program infrastructure, 2) collaboration and partnerships, 3) clinical expertise of the central control office, and 4) commitment of program champions at individual sites. The challenges were: 1) setting up individual contracts with endoscopists for colonoscopy (CS) services, 2) resource alignment for positive test results and unanticipated complications, 3) administrative hurdles, and 4) resource constraints. Tangka et al identified the startup costs for this program using an “ingredient approach” and observed that labor accounted for 67% of initial costs, followed by management, database development, administrative costs, and quality assurance.42

Patients were recruited from community health centers, federally qualified health centers, and other local providers. Every program was mandated to have a medical advisory board, which was responsible for implementation and helped determine eligibility standards, patient flow patterns, and data collection standards.33 Although the focus of the CDC program was the average-risk population, individual sites could offer services to patients at increased risk, as specified by a family history of adenomatous polyps or CRC and other established criteria,44,45 at their discretion. Three sites (St. Louis, Nebraska, and Seattle) initially chose guaiac fecal occult blood testing (gFOBT) as the screening test of choice (with follow-up CS for any positive result); the remaining sites (Baltimore and Suffolk County) chose CS as the primary screening method. The 5 sites drew on existing delivery systems, especially those that already were organized to deliver services supported by the CDC-funded National Breast and Cervical Cancer Early Detection Program.33,34 An example of this is using a shared outreach or in-reach system or tailoring program components to be integrated into clinical structures that were already in place. Local public health departments contracted with hospitals to enhance recruitment into the program through direct access to enrollment services. All sites defined a specific approach to securing cancer care after diagnosis for individuals who lacked health insurance through reimbursement from Medicaid or uncompensated care from local institutions. Federal funds were not used for cancer treatment or complications incurred as a result of screening.

During the 4 years of the demonstration program, in total, 5233 individuals were screened: 44% underwent gFOBT, and 56% underwent CS. The overall FOBT positivity rate was 10%.31 Eighty-two percent of patients who had positive FOBT results received a follow-up CS (approximately 20% within 60 days, and two-thirds within 120 days).32 Seventy-five percent of CS results were normal,
TABLE 1. International Agency for Research on Cancer (IARC) Criteria Met Through Different Population-Based Programs

| IARC CRITERIA | SCREENING POLICY | DEFINED POPULATION | MANAGEMENT TEAM | HEALTH CARE TEAM | QUALITY ASSURANCE | IDENTIFYING CANCER |
|---------------|------------------|--------------------|-----------------|------------------|-------------------|-------------------|
| 1. National Demonstration Program, Centers for Disease Control and Prevention (CDC) | FOBT annually with CS for positive results or CS every 10 y | Low-income, underinsured individuals ages 50-64 y | Medical advisory board: CDC members, local health departments | Individual screening sites have a team for offering screening | Reported quality measures: Client population, screening rates, timeliness of follow-up, CS quality reporting | Diagnosed cancer cases were linked to the state cancer registry |
| 2. Delaware Statewide Cancer Control Program | CS every 10 y | State residents age 50 y and older | State Advisory Committee of 5 large local health systems | A central and local team offering screening tests and a cancer care team | Delaware cancer registry | Internal cancer treatment program tracked cancer patients |
| 3. Cancer Prevention, Education, Screening, and Treatment Program, Maryland | FOBT annually, FS every 5 y, or CS every 10 y | Low-income, underinsured individuals ages 50-64 y | Department of Health and Mental Hygiene and local health departments | Screening team, including nurse navigators | Centralized registry; Liberman CoRADS checklist for documenting colonoscopy findings | Patients identified with cancer were referred for usual medical care |
| 4. New York City program | CS every 10 y | Low-income, underinsured individuals ages 50-64 y | Department of Health and Mental Hygiene, local hospitals and endoscopy centers | Individual screening sites have a team for offering screening | GIQuic registry; Colonoscopy Quality Benchmarking Group | Diagnosed cancer cases were linked to the state cancer registry (a part of CDC’s national registry) |
| 5. Kaiser Permanente of Northern California (KPNC) | FIT annually, FS every 5 y, or CS every 10 y | Enrolled KPNC members | Centralized and decentralized medical providers and executive leads | Both screening and cancer care offered as a part of the program within the integrated system | Quality reports: Regional KPNC registry and California SEER registry | Centers of Excellence use the registry for cancer care using interdisciplinary care teams |
| 6. Group Health Cooperative of Puget Sound | FIT annually or CS every 10 y | Group Health members ages 50-79 y | Committee on Prevention, physicians, care managers/educators, information systems personnel, and researchers | Both screening and cancer care offered as a part of the program within the integrated system | Group Health information infrastructure with advanced tracking population management | Centralized registry tracks cancer care |
| 7. Veterans Health Administration (VHA) | FOBT annually, FS every 5 y with or without FOBT, or CS every 10 y | Veterans older than 50 y | Central administrative offices with regional leaders | Both screening and cancer care offered as a part of the program within the integrated system | Centralized electronic health records with advanced tracking | Centralized medical records facilitate cancer care for diagnosed patients within the system |
| 8. Independence Blue Cross (IBC) | Individual policies by the member health care organizations | Enrolled members older than 50 y | Clinical management team at IBC | Individual member health care organizations or providers | Quality data metrics and gap reports | Claims data and CS reports are used to track positive cases |

CS indicates colonoscopy; FIT, fecal immunochemical test; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy. aThe cancer care team is not implicitly included in the program; rather, it is offered through routine medical care (public or private sector).

16% identified low-risk adenomas, 8% detected high-risk adenomas, and invasive cancer was diagnosed in 0.6%.33 Building on the success of this demonstration program, in 2009, the CDC funded new a CRC awareness and screening program in 25 states and 4 tribes (the Colorectal Cancer Control Program [CRCCP]).46 Much of the funding support for this program is committed to promoting population-based approaches rather than paying directly for...
screening services. One example of the use of evidence-based methods to enhance screening comes from a community health center in Georgia. That center works with the state Cancer Coalition to identify at-risk but unscreened patients in their population through chart audits, then stimulates screening and appropriate follow-up through the use of patient reminder calls and letters, physician reminders, and screening navigation services. Another example comes from Maryland, where the CRCCP works with the state’s Medicaid program to send reminder postcards (from the CDC’s Screen for Life campaign) to all Medicaid enrollees age 50 years and older. These efforts have led to almost 50,000 screenings across CRCCP-funded states and tribal territories between 2009 and 2013, leading to the diagnosis of 141 CRCs and the removal of 6838 precancerous adenomatous polyps.

State and City Programs

Delaware statewide cancer control program

The state of Delaware established the state cancer control program in 2001 supported by the state legislature with...
funds it received from the Tobacco Master Settlement Agreement. This agreement was established between more than 20 state Attorneys General and the tobacco industry in 1999, allocating funds to states to promote preventive care and to offset the health care costs because of tobacco.\(^49\)\(^50\) Delaware’s Governor created an advisory council to direct the program and to delineate measurable 4-year goals.\(^51\) This advisory council transformed into the Delaware Cancer Consortium, with 7 distinct committees, managed by a central office and reporting directly to the Governor, taking responsibility for the following: insurance, quality, increasing knowledge and information, environment, and disparities. The consortium was focused on CRC screening. The 3 key elements of the program were: creating a population-based CRC screening program, establishing a CRC treatment program focused on the uninsured, and reducing CRC disparities for the African American population.\(^52\) Uninsured individuals diagnosed with CRC had access to no-cost cancer treatment and surveillance for up to 2 years.\(^52\) Extensive use of cancer screening nurse navigators was employed in 5 hospitals statewide; these services were available for both uninsured and underinsured individuals. Approximately 90% of the screenings were by CS,\(^53\) with the remainder primarily through flexible sigmoidoscopy (FS). The program demonstrated not only an improvement in screening rates but significant decreases in CRC incidence and mortality. The statewide screening rate increased from 57% in 2002 to 74% in 2009. The decline in the CRC mortality rate in Delaware during the same period was 28.3%, compared with a 22.6% decline nationally.\(^53\) In addition, during the same period, the rate of screening for African Americans increased from 48% to 72%, while the diagnosis at advanced or regional stages for African Americans declined from 79% to 40%, and diagnosis at local stages increased from 15% to 50%.\(^53\) The CRC mortality rate for African Americans decreased by 51.8%, nearly eliminating the disparity gap.\(^54\) According to a 2014 report by Delaware Health and Social Services, in 2012, Delaware ranked fourth in the US in CRC screening, with 75% of the risk-eligible population undergoing gFOBT, CS (either as a screening test or after a positive FOBT), or FS.\(^54\)\(^56\) The reported cost for the Delaware CRC program is about $1 million annually ($1.15 per resident), with savings estimated at $8.5 million annually from reduced burden because of CRC.\(^53\) This state model has the potential to be replicated across other states in the US, although geographic and local factors may require additional resources.

**Cancer prevention, education, screening, and treatment program, Maryland**

Maryland’s cancer program started in 2001 with funding from the Tobacco Master Settlement Agreement, as in Delaware.\(^50\) The program’s vision was to reduce mortality from and racial disparities in cancer-related outcomes in Maryland. The Maryland Department of Health and Mental Hygiene led the creation of a statewide cancer control program with decentralized administration through local health departments.\(^57\) Nearly all local health departments (23 of 24) chose CRC screening as their primary cancer prevention intervention in addition to their routine work related to infections, tobacco control, etc. Activating this statewide plan required considerable collaboration and CRC education at multiple levels of the state coalition through learning sessions and meetings; the state coalition included policy makers, employers, health educators, outreach workers, case managers/navigators, the general public, third-party payers, primary care providers, medical specialists, treatment teams, and a group of researchers to add an evaluation component to the program.\(^58\) The funding was allocated to the state health department and was then distributed to the 23 participating local health departments. The requirements for local health departments included: 1) creating local coalitions with health care providers and representatives of all population groups within the county, 2) delineating local CRC comprehensive cancer plans, and 3) implementing plans that included educating the local population, screening the uninsured or underinsured low-income population, and linking to treatment centers. The funding was not mandated to support treatment costs, and local health departments were given flexibility with regard to eligibility criteria, methods, logistics, and outreach activities. From 2001 to 2013, more than 40,000 sessions were conducted by the program, providing education about CRC to 813,122 individuals, including 750,200 individuals from the general public, 57,848 health care professionals, and 5074 trainers.\(^59\) In line with the program’s goals of decreasing disparities, 51% of those educated were minorities. In 2009, Maryland leveraged the accomplishments of the state-funded program, and the state was awarded funds from the CDC to enhance this work (see a description of the CRCCP above in the section on the CDC’s National Demonstration Program).

From 2001 to 2013, the program screened more than 31,000 Maryland residents: 22,696 underwent CS (72.5%), 8353 underwent FOBT (27%), and 187 underwent sigmoidoscopy (0.5%).\(^59\) From 2001 to 2008, Maryland had the largest decline in CRC incidence (6.5% per year) of any state in the US.\(^60\) The statewide screening rate rose by 23% during the same period, accompanied by an overall 24% decline in the incidence of CRC (29% in African Americans) and an 18% reduction in CRC mortality.\(^56\) As of 2010, 72% of the risk-eligible population in Maryland was up to date with CRC screening.\(^27\)
The Citywide Colon Cancer Control Coalition, New York City

The New York City Department of Health and Mental Hygiene (NYC DOHMH) launched the Citywide Colon Cancer Control Coalition (C5) in 2003 with the aim of improving CRC screening rates in New York City through targeted advocacy, resource enhancement, and policy actions. The consortium created productive new relationships between gastroenterologists, primary care physicians, hospitals, city health officials, advocacy institutions, and the communities of New York City. The C5 initiative focused on increasing screening with CS in underscreened groups. The NYC DOHMH recruited medical institutions to participate, including 40 of the city’s 49 hospitals and 16 of 17 full-time endoscopy centers or ambulatory surgery centers. The New York Health and Hospital Corporation (the City’s public hospital system) expanded its CS capacity and developed a direct endoscopy referral system. The primary care provider offices were provided a CS referral desk-pad (similar to a prescription pad) listing a direct referral line to facilitate patient throughput. Screening was promoted through marketing campaigns in poor neighborhoods.

The NYC DOHMH, C5, and local collaborators worked together to launch 3 major subprograms to overcome local screening barriers:

1. The NYC DOHMH Colonoscopy Navigation Program was created in 2011 to address health disparities, provide navigators to enhance patient understanding of the procedure, and reduce no-show rates and poor bowel preps, thereby eliminating several barriers to the participation of gastroenterologists (GIs) in the program.

2. The New York City Colonoscopy Quality Initiative was launched in 2011. Through partnership with a GI Quality Improvement Consortium registry (GIQuIc), which was created to track endoscopy data from a performance-assessment perspective, the NYC DOHMH and C5 worked with endoscopists, New York City hospitals, and endoscopy centers to form the Colonoscopy Quality Benchmarking Group with the objective of targeting the reporting of CS quality measures (Table 3). Endoscopy centers uploaded their individual data to a registry, which was stored in the central database and was accessible to individual sites (for their own reports), and to the NYC DOHMH to create benchmarking quality reports. For this effort, 228 endoscopists, including 16 endoscopy sites (11 ambulatory surgery centers, 4 hospitals, and one office-based practice), submitted quality data regarding about 80,000 total CS procedures from 2011 to 2013.

3. In response to continued low rates of screening in the city’s uninsured population, the New York City Community CARES Project was developed in 2013. This program links community health centers with endoscopy centers, creating access to no-cost CS procedures for uninsured patients. During the first year of this program, approximately 380 CS procedures were provided to uninsured New York City patients. Funds for the program were provided by the Colon Cancer Challenge Foundation.

The cumulative effect of outreach and education, increased availability of endoscopy at city hospitals, increased primary care referrals to screening, and navigators who work with targeted patients throughout the screening process has led to a striking increase in CRC screening rates and the elimination of many of the racial and ethnic screening disparities that existed before program implementation. New York City’s citywide screening rate improved from 42% in 2003 to 69% in 2012. In 2003, 36% of African Americans, 38% of Latinos, and 48% of Caucasians reported being up-to-date with CRC screening; the rates in 2012 were 71% of African Americans, 69% of Latinos, and 68% of Caucasians. Disparities by insurance status have also been greatly reduced. CRC screening rates among the insured and uninsured increased from 63% to 71% and from 42% to 51%, respectively, between 2007 and 2012.

Integrated Health System Programs

Kaiser Permanente Northern California (KPNC)

Kaiser is a nonprofit integrated group model health maintenance organization (HMO) that was launched in 1945. KPNC is the pioneer in leading initiatives to launch population-based approaches for CRC screening, followed by similar efforts by Kaiser in Southern California. Here, we are describing the efforts of Kaiser in Northern California (referred to as KPNC). It has close to 1,000,000 members between ages 50 and 75 years who are served by a network of 19 medical centers located in several northern California cities. The organization has been invested in the CRC screening initiative since the 1970s, when it implemented a region-wide clinical screening program with FS as the primary screening method. This initiative did not have any outreach component and relied entirely on physician referrals, like an opportunistic system. Later, with the implementation of a Health Care Effectiveness Data and Information Set (HEDIS) measure for CRC screening in 2003 and the

| TABLE 3. Colonoscopy Quality Measures |
|--------------------------------------|
| 1. Preprocedure: Informed consent documentation, ASA category |
| 2. During procedure: Adenoma detection rate (females, \( \geq 15\% \); males, \( \geq 25\% \)), cecal intubation rate with photodocumentation (target = 90%), percentage adequate bowel preparation (target = 90%) |
| 3. Postprocedure: Same-day complications documented, written discharge instructions provided |

ASA indicates American Society of Anesthesiologists.
inclusion of CRC screening scores as a quality measure of US health insurance plans, the Kaiser clinical leadership launched an organized, population-based CRC screening program in 2006 using standard screening algorithms. The approach included outreach with phone and mail and fecal immunochemical test (FIT)/FOBT as the prime method of screening. Furthermore, in 2007, Kaiser enhanced the utilization of its electronic medical records to create automated alerts to health care providers and to suggest population management strategies to send FIT screening kits through mailed outreach efforts. By 2009, FIT completely replaced FOBT. In addition, Kaiser was one of the earliest adopters of the innovative FluFIT program (developed and tested by M. Potter at a San Francisco hospital and later expanded to KPNC), which combines CRC screening education and FIT kit distribution with annual influenza vaccinations, thus eliminating barriers of scheduling and access. These approaches boosted the CRC screening rates at KPNC and informed the development of screening guidelines for the implementation of a FluFOBT program in primary care practices.

Management of the screening program is both centralized and decentralized. The individual leaders of the core management team for Kaiser’s CRC screening program include the lead physicians at the medical centers; the heads of gastroenterology, adult and family medicine, as well as of the laboratory; and the executive director of Permanente Medical Group. Expanding capacity for CS to follow-up positive FITs and as the primary screening method for high-risk patients was a responsibility of the management team. They worked on full scheduling and minimal procedure room turnover time, the use of midlevel practitioners for preprocedural and postprocedure assessments, and anesthesia with propofol delivered by nurse anesthetists. Mosen et al reported that comprehensive discussions between patients and their primary care providers at Kaiser led to improved screening rates, as assessed for comprehensiveness using a patient survey of 7 questions based on the informed decision-making work of Braddock and colleagues.

Kaiser is reimbursed by insurance entities, including Medicare, the health care exchange in California/Medical, and other private insurance offered through employer or individual plans, based on a negotiated agreement with the medical group. The Kaiser Regional Cancer Registry receives reports of CRCs with stage and location (proximal vs distal). All data are also incorporated into the California Surveillance, Epidemiology, and End Results Program registry, a program of the National Cancer Institute that captures cancer statistics. This registry is used extensively for disease management and tracking follow-up and outcomes at the population level. Kaiser facilitates the joint work and functioning of decisions about cancer care by building team-based expertise in local medical centers. KPNC has provided more than 540,000 FOBTs, 130,000 FS procedures, and 100,000 CS procedures to its members between 1980 and 2005. The multiyear, institutional, population-based approach has raised screening rates from 37% in 2005 to 79% in 2012. The increase has been even greater for the Medicare population within the Kaiser system, rising from 41% to 91% during the same period.

**Group Health Cooperative of Puget Sound, Seattle**

Group Health is a community-based, nonprofit integrated system in which coverage and care are combined in one organization. This HMO is focused on a high standard for preventive services, like most other HMOs. Currently, there are approximately 600,000 patients who receive care from 1000 physicians in Washington State and Idaho. Care is delivered in the offices of the practitioners in the local communities and in 29 regional clinics. In 1997, this system developed its first CRC screening guidelines with follow-up recommendations for positive results. In 1998, an automated CRC screening follow-up registry was put into place to send alerts to providers for patients with positive FOBTs who did not complete their follow-up within 4 months (they either did not attend follow-up appointments or failed to schedule a CS). In 2003, this automated registry was enhanced with a manual audit system, which further improved the efficacy of the screening program. It is noteworthy that this program used some elements of the chronic care model: clinical information system (advanced health informatics), decision support (provider alerts), and self-management support (direct patient education). These were key strengths of its algorithmic-based screening and treatment approach. The 2014 CRC screening guidelines at Group Health suggest direct CS for high-risk patients and annual FIT for others at average or low risk.

Recent research at Group Health shows that centralized electronic health record-linked data can be used effectively to identify the target population for CRC screening and deliver low-cost interventions, including mailed automated letters, gFOBT kits with instructions, and screening reminders. An intervention using a stepped approach (through increasing levels of assistance), including screening navigation, to nonadherent and nonresponding patients produced progressive increases in screening when applied in the patient-centered medical home (PCMH) model in 21 Group Health primary care practices. In addition, nurse navigators targeting patients with a positive FOBT led to improved rates of follow-up CS. Longitudinal predictors of repeat CRC screening identified increased self-efficacy as important in usual care, but it may have been less contributory when system interventions to make the screening process easier were applied (including facilitated access and
navigation), thereby showing the ways through which systems can produce positive impacts on CRC screening.93 Between 2003 and 2005, Group Health’s CRC screening rates increased from 45% to 53% in the commercially insured population and from 58% to 63% in their Medicare population. The rate of complete diagnostic evaluation within 1 year for those with a positive FOBT improved from 57% (in 1993) to 86% (in 2005).85

**VHA**

The VHA is a government-supported integrated health system that serves more than 5 million US military veterans in 163 hospitals and more than 800 clinics nationwide. The VHA underwent system-wide reengineering during late 1990s, expanding their use of information technology and increasing their focus on quality of care provided throughout the VHA system.94 In 2005, several divisions within the VHA system, including quality, research, systems redesign, patient services, and management, formed a collaborative focused on CRC screening and treatment.95 This collaborative was called the Colorectal Cancer Care Collaborative (C4) and had 2 specific aims: 1) to improve the quality of CRC screening and 2) to improve the quality of CRC treatment.96

The program used a chronic care model approach for improving care through the use of multidisciplinary practice teams and informed, activated patients.86 The CRC screening initiative, which was implemented in 21 regional Veterans Integrated Service Networks, was designed to improve both screening rates and follow-up. The Office of Quality and Performance within the VHA is responsible for data collection from each facility, including CRC screening. Metrics included the proportion of FOBT-positive patients who received a CS within 60 days and within 1 year as well as the number of days from the positive FOBT result to CS.57 Every facility had its own management team of clinicians, administrators, and information technology staff, which was overseen by a central administrative team from C4. Plan–do–study–act cycles were used as a mechanism to track progress in each facility and to standardize the process for CRC screening flow.96 These individualized processes allowed adjustments according to local assets and needs. Trivedi and Grebla demonstrated that the VHA outperformed the Medicare Advantage plans in CRC screening rates and in other quality indicators measured from 2001 to 2007.99

Powell et al observed that several factors were associated with improved screening and outcomes, including better tracking and follow-up of patients and test results, improved communication processes between primary care and gastroenterology, and revisions to protocols on no-shows and bowel preps.100 Organizational care factors that contributed to better CRC screening rates were primary care practice organizations with: 1) small sizes (P < .001), 2) increased autonomy over the internal structure of care delivery (P < .04), and 3) clinical support arrangement (P < .03).101,102 The term small size refers to practices that see fewer patients. The autonomous features included authority for primary care practices to create and lead their own interdisciplinary primary care division, separate budgetary control for each program, presumption that cost savings achieved through primary care performance could be recovered by the practice, human resource management, and direct control over relationships outside of their offices (like contracted services with laboratories, communities, referral systems, and other established procedures). The clinical support arrangement refers to the availability of support staff and advanced electronic records with the ability to use automated reminders. Limited gastroenterology capacity was reported as the most common barrier to increasing screening rates.101,103

The Cancer Care Quality Measurement System was launched as a part of the electronic medical records abstraction tool to evaluate the C4 quality–improvement collaborative in 2007.103 The purpose was to collect data on CRC care, from diagnosis to treatment, and to enhance focus on improving the complete screening process, ie, if FOBT is a first screening step, then getting a CS after a positive FOBT should be part of the standard screening process. Reports from specific hospitals demonstrated an improvement in diagnosis of early stage CRC.104,105 The screening rates markedly improved from 31% (2001) to 80% (2009).106 Seventy-seven percent of patients with positive FOBTs underwent CS within 60 days after the C4 implementation, with an average decrease in the time from positive screening to follow-up CS of 25 days.107

**Insurer Program**

**IBC**

IBC is the leading health insurer (based on market share) in southeastern Pennsylvania, with 2.5 million individuals in the region served by IBC and its affiliates. From an insurer’s perspective, IBC identified 3 key motivators for enhancing preventive care: 1) members’ health (improving the health of the members it serves), 2) financial (the costs of treating CRC and other cancers are steadily increasing and may be higher than the costs of preventing them), and 3) accreditation (National Committee for Quality Assurance [NCQA] standards require all participating health plans to report outcomes on preventive care services, including cancer screening).

IBC has invested in various programs and services to identify gaps in care regarding CRC as well as breast and cervical cancer screenings. Through its Clinical Quality Management Department, members receive annual reminders to schedule and receive recommended screenings based on their individual risk factors, while network practitioners are encouraged to work closely with members to ensure they receive recommended screenings.
Employer groups are encouraged to use IBC health promotion programs to increase CRC screenings among their employees. Navinet is an online system that helps provider organizations simplify health care administration through several resources, like determining the patient’s plan type, copayments, accessing claims data, clinical alerts (specifically preventive care reminders), and accessing clinical reports for a population. Member-directed preventive health outreaches are delivered via automated telephonic and text message reminders, social media, and direct mailings, as appropriate. Network providers receive continuous clinical alert outreaches via Navinet as well as annual gap report mailings and newsletter publications. The plan also has an integrated nurse model, in which about 240 outreach nurses follow standardized algorithms and work on closing all care gaps, disease management, lifestyle changes, as well as decision support.

One of the key innovations supporting IBC’s prevention work is their decision to pay for primary care practices to acquire Patient Centered Medical Home (PCMH) recognition and shift the locus of payments to pay for performance starting in 2008. The NCQA offers PCMH recognition to primary care practices that meet certain criteria (access and continuity, manage patient populations, plan and manage care, self-care support and community resources, track and coordinate care, and measure and improve performance). As a part of the PCMH model, in-reach and outreach activities are conducted within primary care practices to increase utilization of preventive services, including CRC screening. This effort has led to a significant increase in the proportion of IBC-contracted practices that have received PCMH certification and that have performance-based payment incentives tied to CRC screening rates and other preventive services. The NCQA’s Statement of Health Care Quality Report indicates that, between 2008 and 2013, CRC screening rates among IBC beneficiaries increased from 59% to 75% for individuals in the plan’s Medicare preferred provider organization and from 55% to 68% for commercial preferred provider organization members (data from e-mail communication). This time frame corresponds directly to the time when IBC started investing in the medical home model.

**Discussion**

Population-based approaches that conduct outreach to a defined population, provide screening and treatment services through a well-established infrastructure, and monitor quality have demonstrated significant success in improving CRC screening rates in a wide range of settings. Which screening tests is offered seems to be of limited importance; tests used in the programs reviewed here varied from gFOBT/FIT annually, to CS every 10 years, to FS every 5 years.

Four of 8 programs in this review have included all 6 of the IARC elements. Three of the 4 programs (Kaiser, Group Health, and VHA) are integrated health systems, suggesting that integrated health systems are well positioned to provide all of the key elements necessary to implement population-based screening. Delaware’s screening program also meets all 6 criteria. The remaining programs (CDC, Maryland, New York City, and IBC) had 5 of 6 IARC elements within the program, lacking only the inclusion of a treatment program. Cancer treatment in these programs was made available through local institutions or providers as part of routine medical care.

In addition to the 6 elements of the IARC cancer prevention framework, this review has identified 4 additional elements that were commonly found in successful population-based screening programs (Table 4). Two authors (MV and MS) came up with these elements as a result of the literature review, and these were agreeable to the other coauthors through mutual consensus. These 4 additional elements are: 1) a dedicated funding source, 2) a structured policy for positive FOBT results and confirmed cancer cases, 3) outreach activities for recruitment and patient education, and 4) an established rescreening process. These are described below.

1. **A dedicated funding source:** Several of the programs described here had an external funding source, while organizational dollars and other resources were committed to initiate and support programs within integrated systems and IBC. Although some of the 6 IARC elements do not necessarily require funding, some clearly do. IARC criteria, including management team, health care team, and quality-assurance structure, create a requirement for funding to protect the time of key clinical and

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**TABLE 4. Framework for a Population-Based Program**

| IARC criteria                                                                 | Additional elements                                      |
|-------------------------------------------------------------------------------|----------------------------------------------------------|
| 1. Create a screening policy                                                  | 7. Identify the funding source                           |
| 2. Define a target population                                                  | 8. A structured policy for positive FOBT results and confirmed cancer cases |
| 3. Identify the management team                                               | 9. Outreach activities for recruitment and patient education |
| 4. Identify the health care team                                               | 10. Establish a rescreening process                       |
| 5. Establish a quality-assurance algorithm                                      |                                                          |
| 6. Identify cancer occurrence                                                  |                                                          |

FOBT, Fecal Occult Blood Test; IARC, International Agency for Research on Cancer.
nonclinical employees to develop and implement screening and follow-up systems. In addition, resources are needed to establish and integrate technology-aided systems to automate information flow about the screening process and ease the burden of documenting the quality of work and outcomes. Care navigators have contributed to the success of some of these programs (Delaware, Maryland, and New York City), validating their value in population-based programs; these specialists also require an investment of resources.

The screening programs provided by integrated health delivery systems supported essential elements through the redirection of operational dollars (like Kaiser, Group Health, and VHA). A key and innovative element of the IBC program was implementation of a new method to reimburse primary care practices. Linking substantial payment to certification as a patient-centered medical home and providing increased payment for achievement of quality outcomes facilitated the realignment of operational resources toward preventive care. The creation of a substantial financial incentive to boost screening rates, combined with the other programmatic elements provided directly by IBC, resulted in an increase in CRC screening rates.

2. A structured policy to address positive FOBT/FIT results and confirmed cancer cases is also an essential element of population-based CRC screening programs. FOBT and FIT are highly effective screening methods; however, screening guidelines consistently mandate that all positive FOBT/FITs be followed with a CS. Although there are no standard guidelines for the time between a positive FOBT and a CS, a CS within 60 days is considered a target, and a CS at least within 6 months is the requirement to complete the screening process. CS rates after positive stool testing varied between programs. The quality-assurance program in most programs worked on maintaining an algorithm to be followed for individual positive test results, but deficiencies in completion of the screening process were high. Most of the programs did have a defined process for recommending the appropriate follow-up of individuals with abnormal findings at CS. The results were communicated to the primary care clinicians in addition to their gastroenterologists in the Delaware, Maryland, Kaiser, Group Health, and VHA programs. Completion of the necessary CS was more likely in integrated systems, as they have defined clinical teams that share common information systems. In addition, Group Health offered patient education materials specifically for individuals with positive FOBT/FIT results, which improved the follow-up rates.

3. Outreach activities for recruitment and patient education: This element is necessary to improve program participation rates. The Maryland program hired outreach workers to promote program awareness among the community and enhance population education. The CDC program used the outreach activities of existing national screening programs for breast and cervical cancer. Kaiser used mailed outreach to send invitation letters and screening test kits to promote participation. IBC also used mailing letters and educational information about the tests and the importance of screening outreach to reach target populations. Other outreach methods included social and public media campaigns to raise awareness about the programs. In addition, IBC provides incentives to primary care practices that are responsible for developing and implementing outreach to their local patient population.

4. Establish a rescreening process: The CRC rescreening rates are continually low in the US. Adherence to recommended rescreening for negative stool tests requires a system to track this population and offer reminders to providers and patients at the time of rescreening. The integrated health systems have somewhat well-defined rescreening policy (Kaiser, Group Health, and VHA) through their electronic records. Kaiser enhanced the utility of electronic records further through automated systems to create alerts for annual stool tests. Following evidence-based guidelines for intervals to conduct the next screening test constitutes an important part of any screening program and needs to be considered strongly in a population-based program. In addition, the standard guidelines for postpolypectomy CS surveillance are not always followed, and these surveillance rates are not often reported in the population-based programs. Rapuri et al mention some of the strategies to improve postpolypectomy screening, like dispensing information at initial presentation, providing endoscopy pictures to patients, reminder letters, adding to active problem list, and alert messages from electronic medical records.

Population strategies should use evidence-based methods to promote screening with the best initial contact strategy, effective ways to encourage repeat screening, and methods to promote physician commitment toward population improvement activities. We observed that different kinds of population-based strategies worked in different settings (Table 2). System-based approaches are the predominant strategic methods and can be supplemented with patient-based, provider-based, and media-based techniques.

Programs that follow all 6 IARC criteria as well as some or all of the added elements have the highest likelihood of substantially improving screening rates. Medical homes and accountable care organizations in the US may offer venues for designing and implementing population-based strategies to improve screening rates. These new care delivery
models will be responsible for offering care to a well-defined population they serve; and, with the availability of integrated health care services, a population-based program can be applied with the potential for success in preventive care, including CRC screening.

Limitations

This review provides information on some successful population-based CRC screening programs in the US, but there are a few limitations. Some programs within the US that have not yet been published may have been missed in this review. In addition, there are population-based programs in countries, such as Canada, Australia, the United Kingdom, Germany, Japan, Israel, and Italy, that were outside the scope of this review. An additional review describing the international programs that use the 6 IARC criteria will be required to fully understand the applicability of these criteria to other cultures and diversities.

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