PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY

CDC Colorectal Cancer Control Program

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GUEST EDITORIAL

The CDC Colorectal Cancer Control Program, 2009–2015

Djenaba A. Joseph, MD, MPH[1]; Amy DeGroff, PhD, MPH[1]

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Colorectal cancer (CRC) is the second leading cause of cancer deaths in the United States among cancers that affect both men and women (1). In 2016, the most recent year for which data are available, more than 141,000 new cases of CRC were reported, and more than 52,000 people died of the disease (1). The public health impact of CRC due to years of potential life lost, the economic burden of lost productivity, and the costs associated with illness and treatment are substantial. In 2015, an estimated 766,000 person-years of life lost and $9.4 billion in lost earnings were attributed to CRC deaths, second only to lung cancer (2). Strong evidence indicates that screening can decrease CRC incidence and mortality by identifying and removing precancerous polyps and by detecting CRC early when treatment is more effective (3). If CRC is detected early, the 5-year survival rate (90%) is much higher than when it is detected late (14%) (1).

The US Preventive Services Task Force (USPSTF) recommends CRC screening for average-risk people aged 50 to 75 by fecal occult blood test (FOBT), fecal immunochemical test (FIT), a combination stool DNA and FIT test (FIT–DNA), computed tomographic colonography (CTC, or virtual colonoscopy), flexible sigmoidoscopy, or colonoscopy (3). Despite strong evidence for its effectiveness, too few eligible adults are screened for CRC. In 2016, 67% of adults aged 50 to 75 reported that they were up-to-date with CRC screening, whereas 26%, or approximately 22 million adults, reported that they had never been screened (4). Screening rates are lower among people who have a low annual household income, have no health insurance, have no regular health care provider, identify as a racial or ethnic minority, or have low levels of educational attainment (5).

The high public health burden of CRC indicates a need for population-level interventions to improve its prevention and control (2). Although large health systems have implemented programs and initiatives to improve the quality of CRC screening and treatment in their populations, coordinated, population-level public health efforts that reach most, or all, of the US population to address the burden of CRC have been limited (6). Examples of national or multistate efforts to increase CRC screening include programs or campaigns implemented by organizations such as the Centers for Disease Control and Prevention (CDC) and the American Cancer Society (ACS). CDC's Screen for Life: National Colorectal Cancer Action Campaign is a national mass media and small media campaign that informs adults about the importance of getting screened for CRC (7). In 2014, the National Colorectal Cancer Roundtable, an organization founded by CDC and ACS to bring organizations together to coordinate efforts to address the burden of CRC, launched the 80% by 2018 campaign, which asked organizations of all types to pledge resources toward interventions to increase CRC screening rates (8). More than 1,500 organizations signed the pledge to participate (9). From 2013 through 2016, ACS implemented the Community Health Advocates Implementing Nationwide Grants for Empowerment and Equity (CHANGE) program, which funded primary care systems, faith-based organizations, and community-based organizations that partnered with federally qualified health centers to implement evidence-based interventions to increase breast and CRC screening with technical assistance from ACS field staff members (10). Finally, CDC's National Comprehensive Cancer Control Program supports the development and implementation of cancer control plans, and partners with state, tribal, and territorial cancer coalitions to leverage resources to address cancer prevention and control, including efforts to increase use of CRC screening tests (11). Literature describing program design, implementation, or evaluation of these efforts is limited, suggesting the need for additional information about best practices to design, implement, and evaluate national or multistate efforts to increase CRC screening (6,8,10,11).

A collection of 5 articles published in 2019 in *Preventing Chronic Disease* describes the evaluation of CDC's 2009–2015 Colorectal Cancer Control Program (CRCCP), including its implementation, outcomes, and costs. These articles contribute to the limited body of peer-reviewed literature about programmatic design ap-

proaches and best practices for large, multistate, population-level public health interventions to increase use of CRC screening tests.

Program Overview

In 2004, CDC funded 5 sites to implement the Colorectal Cancer Screening Demonstration Program to assess the feasibility of public health approaches to address the burden of CRC and the low uptake of CRC screening tests among populations that traditionally have had limited access to health care services (12). This demonstration program was modeled after the long-standing National Breast and Cervical Cancer Early Detection Program (NBCCEDP), authorized by Congress to provide breast and cervical cancer screening and diagnostic services to low-income, uninsured, and underinsured women. The NBCCEDP demonstrated success in working with provider networks, community partners, professional organizations, and other partners to provide access to high-quality cancer screening and diagnostic services. On the basis of the success of the Colorectal Cancer Screening Demonstration Program and lessons learned from both the demonstration program and the NBCCEDP, in 2009 CDC launched the 5-year CRCCP to provide CRC screening tests to low-income, uninsured, and underinsured populations and to promote the importance of screening with the ambitious goal of increasing screening rates to 80%.

Through a competitive application process, CDC funded 22 states and 4 tribal organizations to implement the CRCCP. In July 2010, CDC funded an additional 3 states, bringing the total number of grantees to 29 (13). The CRCCP comprised 2 program components: 1) screening provision, which provided CRC screening tests for people with low incomes and no or limited health insurance, and 2) screening promotion, which involved activities to increase awareness and uptake of CRC screening on a population level.

For the screening provision component, grantees used a portion of their awards to fund clinical screening services. Grantees established contracts with health care providers to deliver screening to the priority population: asymptomatic people aged 50 to 64 who had an annual household income less than or equal to 250% of the federal poverty level and were uninsured or underinsured for CRC screening services. "Underinsured" was defined in various ways across grantees, but in general it referred to people who did not have insurance coverage for preventive services (eg, they had catastrophic health care coverage only) or could not afford copays or deductibles. People aged 65 or older were excluded from receiving these screening services because they were covered by Medicare. Grantees had the option to fund any CRC screening test indicated in the 2008 USPSTF recommendations (FOBT, FIT, flexible sigmoidoscopy, or colonoscopy). Additional program activities to support screening included patient outreach and awareness, patient navigation, provider education, quality assurance, and data management.

For the screening promotion component, grantees implemented evidence-based interventions (EBIs) identified in *The Community Guide* (14) to increase population-level use of CRC screening. At the time of program initiation, EBIs included client and provider reminders, provider assessment and feedback, reduction of structural barriers, and small media (15).

Evaluation Design

CDC undertook an evaluation of the CRCCP to assess implementation, outcomes, and costs. Grantees also conducted local evaluations. CDC designed its evaluation on the basis of CDC's Framework for Program Evaluation (16) and identified these goals:

- Describe how CRCCP grantees implement the program.
- Assess changes in key outcomes, including population-level CRC screening prevalence.
- Describe the costs of implementing the CRCCP for both screening provision and screening promotion.

Three unique data collection methods were used. To evaluate screening provision, a patient-level data set was developed (CRC clinical data elements, or CCDEs). To assess implementation of EBIs, CDC conducted an annual grantee survey, and to assess cost, grantees completed a cost assessment tool (Table).

CRCCP Evaluation Findings

In this collection, 5 articles address aspects of 4 evaluation questions: 1) Is complete and timely screening delivered, and what are the screening outcomes? 2) What strategies are grantees implementing? 3) Are state-level colorectal cancer screening rates increasing? and 4) What is the cost of delivering the CRCCP? Nadal et al assessed the quality of screening services provided through the screening provision component of the program (17). On the basis of accepted standard practices, they analyzed CCDE data collected by CDC on the timing and results of all screening and diagnostic tests provided and the quality of colonoscopies provided. Researchers found that most positive results for FOBTs and FITs were appropriately followed up with colonoscopy to complete the screening process, and most of the colonoscopies were completed within the time frame of 180 days recommended by CDC. Additionally, the authors found that most colonoscopies performed met national quality standards. Although most quality

indicators were met by grantees, quality varied substantially across grantees. The article discusses the challenges of modifying the behaviors of health care providers to improve the quality of services provided.

Hannon et al analyzed data from grantee surveys to examine use of EBIs and facilitators and barriers to implementation (18). The authors found that most grantees implemented and maintained client-oriented EBIs such as client reminders and small media. Grantees considered these EBIs easier to implement than provider-oriented EBIs or reduction of structural barriers. Unexpectedly, implementation of EBIs did not become easier over time, possibly because of the need to build and sustain partnerships over time with health care providers and organizations.

Three articles evaluated the cost of delivering the CRCCP. Hoover et al described the development of a web-based cost-assessment tool to collect cost data and evaluate the quality of the data collected by the tool (19). The authors found that most grantees were able to use the tool to allocate at least 95% of the funds they received to program activities. Keys to successful implementation of the tool were solicitation of grantee input during the development and design phases and staff members dedicated to providing technical assistance to grantees. Subramanian et al described the clinical and nonclinical costs of the direct screening services provided (ie, screening provision) by grantees (20). Although the authors found that direct clinical costs were higher for colonoscopy-only screening programs than for FOBT/FIT-only programs, nonclinical costs did not vary by screening test type, suggesting that these programs have substantial fixed costs. Finally, Tangka et al examined differences in grantees' expenditures for screening promotion (21). Researchers found that grantees allocated nearly one-third of their funding to screening promotion activities that had insufficient evidence of effectiveness (eg, mass media) as determined by *The Community Guide* (14) and smaller amounts were allocated toward recommended interventions (eg, small media, provider assessment and feedback, client and provider reminders).

The 2009–2015 CRCCP was the first public health program focused solely on increasing use of CRC screening tests at the population level in multiple states by supporting both direct CRC screening services and CRC promotion through implementation of EBIs. The findings from the articles in this collection provide important information that can inform future programs of the type and scope of the CRCCP. First, although grantees were successful in providing high-quality screening services directly to more than 50,000 people who had limited or no health insurance, the cost of program infrastructure was high, and the number of people screened was much lower than the number of people who were eligible for the program. This finding led CDC to decrease funding for direct screening services in the current CRCCP (2015–2020) and focus on implementation of EBIs in primary care clinics to reduce program infrastructure costs while potentially increasing program reach. Second, we found that most programs did not have state-wide reach and most were unable to measure changes in uptake of CRC screening tests by using a population measure such as the Behavioral Risk Factor Surveillance System. As a result, the 2015–2020 CRCCP requires grantees to partner directly with health systems and primary care clinics that serve populations known to have low CRC screening test use (eg, federally qualified health centers) to implement EBIs and to report clinic-level CRC screening data to measure success. This change also allows grantees to narrow the scope of their programs by focusing on high-need populations while still potentially expanding their overall reach. Third, we found that grantees allocated a disproportionate amount of their awards toward interventions with limited evidence for their effectiveness (eg, mass media), and grantees found client-oriented interventions, such as client reminders and small media, easier to implement. The 2015–2020 CRCCP now requires that grantees choose at least 2 of 4 priority EBIs (client reminders, provider assessment and feedback, provider reminders, and reduction of structural barriers) that have sufficient or strong evidence of effectiveness in increasing CRC screening. The 2015–2020 CRCCP grantees are strongly encouraged to partner with various organizations, such as primary care associations, ACS, and entities with expertise in health information technology, to facilitate the implementation of both client-oriented and provider-oriented EBIs in primary care clinics.

The evaluation findings from the 2009–2015 CRCCP were critical to inform the design and implementation of the 2015–2020 CRCCP (22). The usefulness of the findings demonstrates the importance of a well-designed and executed evaluation plan. Although the 2009–2015 CRCCP was unique in its design, size, and scope, these evaluation findings can be useful to other public health organizations planning or implementing similar population-level interventions to increase CRC screening. Program planners should carefully consider the potential reach and infrastructure costs of direct CRC screening services given available sources of funding, the size of the potential target population relative to the capacity and funding of program implementers, the selection of EBIs that maximize program effects while minimizing costs, and the ability of program implementers to leverage the resources of other public and nonpublic health organizations to facilitate implementation. Evaluation should be an integral part of program planning and should answer questions about how the program was implemented and its effectiveness. Evaluation findings from programs such as the CRCCP are vital to demonstrate the effectiveness of public health programs in addressing the burden of CRC in the United States.

Author Information

Corresponding Author: Djenaba A. Joseph, MD, MPH, Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Hwy, S107-4, Atlanta, GA 30341. Telephone: 770-488-3157. Email: dajoseph@cdc.gov.

Author Affiliations: [1]Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Cancer Prevention and Control, Atlanta, Georgia.

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Table

Table. Evaluation Questions and Data Collection for CDC's 2009–2015 Colorectal Cancer Control Program (CRCCP)

Evaluation Question	Data Collection Tool	Reporting Frequency	Unit of Measurement	Constructs or Variables
Is complete and timely screening delivered, and what are the screening outcomes?	Colorectal cancer clinical data elements (CCDEs)	Semi-annually	Patient	• Patient demographics • Dates and results of screening and diagnostic tests • Final diagnosis
What strategies are grantees implementing?	Grantee survey	Annually	Grantee	• Grantee characteristics • Implementation of evidence-based interventions • Partnerships
Are state-level colorectal cancer screening rates increasing?	Behavioral Risk Factor Surveillance System	Every 2 years	State	CRC screening rate
What is the cost of delivering the CRCCP?	Cost assessment tool	Annually	Grantee	• Costs of screening provision • Costs of screening promotion

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ORIGINAL RESEARCH

Variations in Screening Quality in a Federal Colorectal Cancer Screening Program for the Uninsured

Marion R. Nadel, PhD, MPH[1]; Janet Royalty, MS[1]; Djenaba Joseph, MD, MPH[1]; Tanner Rockwell, BA[2]; William Helsel, MS[2]; William Kammerer, BS[2]; Simone C. Gray, PhD[1]; Jean A. Shapiro, PhD[1]

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PEER REVIEWED

Summary

What is already known on this topic?

Colorectal cancer screening can be of little value if performed poorly. Problems with screening implementation are well documented, and quality indicators have been defined for routine monitoring in clinical practice.

What is added by this report?

In the Center for Disease Control and Prevention's Colorectal Cancer Control Program, overall screening quality was good. However, even with the funding and oversight provided by this federal program, we found that quality indicators varied and some grantees fell short of desired levels.

What are the implications for public health practice?

Ongoing quality monitoring to identify performance problems is essential. Efforts to increase screening uptake need to be accompanied by efforts to assess and improve quality.

Abstract

Introduction

Screening can decrease colorectal cancer incidence and mortality and is recommended in clinical practice guidelines. Poor quality of colorectal cancer screening can negate the benefit of screening. The objective of this study was to assess the quality of screening services provided by the Centers for Disease Control and Prevention's Colorectal Cancer Control Program from July 2009 through June 2015.

Methods

We collected data from the program's 29 grantees, funded to provide colorectal cancer screening and diagnostic services to asymptomatic, low-income, and underinsured or uninsured adults aged 50 to 64. We collected data on the dates and results of all screening and diagnostic tests and, for colonoscopies, on whether the cecum was reached, whether bowel preparation was adequate, and endoscopists' recommendations for the next test.

Results

Overall, 82.9% (range among grantees, 50.0%–97.2%) of positive FOBTs/FITs were followed up by colonoscopy; 95.2% of colonoscopies occurred within 180 days of the positive stool test. Cecal intubation rates ranged among grantees from 94.2% to 100%. Adenoma detection rates met recommended threshold levels for almost all grantees. Recommendations for rescreening and surveillance intervals deviated from guidelines in both directions. Of clients with normal colonoscopies, 85.3% (range, 37.7%–99.7%) were told to return in 10 years, as recommended in national guidelines. Of clients with advanced adenomas, 55.2% (range, 20.0%–84.6%) were told to return in 3 years as recommended, 25.4% (range, 3.8%–56.6%) in 5 or more years, and 18.6% (range, 0%–47.2%) in less than 3 years.

Conclusion

Although overall screening quality was good, it varied considerably. Ongoing monitoring to identify performance problems is essential for all colorectal cancer screening activities, so that efforts designed to improve performance can be targeted to individual clinicians.

Introduction

Screening can decrease colorectal cancer (CRC) incidence and mortality and is recommended in clinical practice guidelines (1). However, only two-thirds of adults aged 50 to 75 were up-to-date

with CRC screening in 2016, well below the target set by the National Colorectal Cancer Roundtable's initiative,"80% by 2018" (2,3). Screening can be of little value, however, if performed poorly. Because of well-documented variability in the quality of screening implementation (4–7), efforts to assess and improve screening quality need to accompany efforts to increase screening uptake. Common implementation problems include failure to follow up positive stool tests with colonoscopy, wide variation in the ability of endoscopists to detect adenomas, and recommended rescreening or surveillance intervals that do not comply with national guidelines. Improved colonoscopy quality has become a priority of professional societies. Quality indicators were defined for routine monitoring in clinical practice, and colonoscopy registries were developed to facilitate the process (5,8). Payment to providers increasingly incorporates quality assessment (9). Monitoring quality can lead to targeted improvement activities.

In 2005, the Centers for Disease Control and Prevention (CDC) launched the Colorectal Cancer Screening Demonstration Program (CRCSDP) at 5 sites to assess the feasibility of providing CRC screening, diagnostic, and surveillance services to low-income persons (10). An assessment of screening quality in the CRCSDP showed the need for improvement in several areas, such as the follow-up of positive stool tests and recommendations for rescreening and surveillance intervals (11).

After the CRCSDP, CDC established the Colorectal Cancer Control Program (CRCCP) at 29 sites in the United States (12). The objective of this study was to assess the quality of services provided in this expanded program from July 2009 through June 2015.

Methods

From 2009 to 2015, CDC provided CRCCP funding to grantees in 25 states and 4 tribal organizations for CRC screening, surveillance, and diagnostic services to asymptomatic, low-income, and underinsured or uninsured adults aged 50 to 64 (Figure 1). Details on the CRCCP are provided elsewhere (12). Our analyses consisted of data collected from 28 grantees, identified herein by randomly assigned numbers; we excluded 1 grantee from our analyses because a high percentage of its client records had missing information.

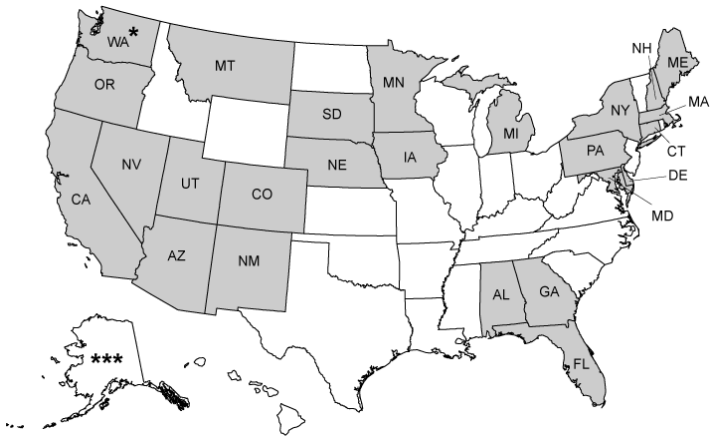

Figure 1. Twenty-nine grantees in the Centers for Disease Control and Prevention's Colorectal Cancer Control Program, 2009–2015. Shading indicates a grantee state. An asterisk indicates a tribal grantee.

As part of the program, grantees were permitted to use any screening tests recommended by the US Preventive Services Task Force in 2008: colonoscopy, guaiac fecal occult blood tests (FOBT), fecal immunochemical tests (FIT), or flexible sigmoidoscopy (13). For each CRCCP client, grantees collected a standardized set of CRC clinical data elements (CCDEs): age, sex, personal history of colorectal polyps or cancer, self-report of any prior CRC screening before CRCCP enrollment (but not information on which tests they had), and family history of CRC. Each grantee defined its own criteria for increased risk based on available guidelines (14).

For each test, grantees recorded the date of the test, the reason for test (screening, surveillance, or diagnostic), and the results of the test. For each colonoscopy, the CCDEs specified whether the cecum was reached (the **cecum** marks the beginning of the large intestine and a complete examination is one in which the scope progresses all the way to the **cecum**), whether the endoscopist considered the bowel preparation adequate, whether a polypectomy was performed, the number of polyps found, the worst histology among all polyps removed, and the clinician's recommendation for which test the client should have next and when. Because endoscopy reporting was not standardized, grantee staff members occasionally converted the terms found in reports to fit the categories specified in the CCDEs.

Data quality was monitored at multiple steps. Before biannual submission of data to CDC, grantees checked their data with editing software provided by CDC to identify invalid values, missing fields, and cross-field inconsistencies. The data were then checked by CDC, and standard quality reports were produced. Calls were held with grantees to resolve identified discrepancies and discuss problem areas.

We tabulated data from the CCDEs for the period July 2009 through June 2015 on tests received by clients who did not report having CRC symptoms. We considered clients to be at average risk of CRC if they did not report any personal history of CRC or adenomas and were not at increased risk because of reported family history. We classified a colonoscopy as complete if the cecum was reached, bowel preparation was adequate, polyps were completely removed, and the procedure was not terminated early. All other colonoscopies were classified as incomplete. Only complete colonoscopies were included in our analyses of rescreening and surveillance recommendations and of adenoma detection rates (ADRs).

Statistical analysis

We computed several quality indicators related to stool testing (completeness and timeliness of follow-up of positive tests) and to colonoscopy (cecal intubation rate, adequacy of bowel preparation quality, appropriateness of recommendations for rescreening and surveillance intervals after colonoscopy, and ADR). We compared our findings to targets established by CDC for the CRCCP and to targets established by various professional organizations (4,5,14–19).

We computed the ADR as the percentage of colonoscopies in which at least 1 adenoma was reported. An adenoma is a type of polyp that may be a precursor lesion to colorectal cancer. Because adenoma prevalence varies by age and sex, we computed sex-specific ADRs for clients aged 50 years or older to allow comparison with published rates. For ADRs and the clinician's recommendation after colonoscopy, we limited our analysis to data on the first screening colonoscopy received by each client in the CRCCP. We limited our analysis of clinicians' follow-up recommendations to average-risk clients. We computed the cecal intubation rate as the percentage of colonoscopies in which the cecum was reached.

We tabulated combined data on all 28 grantees. In addition, we tabulated data for each grantee separately; for these data, we tabulated data only for grantees with at least 30 data points. We computed ADRs only for grantees that had at least 30 clients in the categories *sex* and *reason for test*. Although the reliability of rates based on small numbers may be low and may not accurately measure performance, we chose to calculate grantee-specific data based on a low cutoff so that we could present data from as many grantees as possible. Rates based on small numbers should be interpreted cautiously.

For all analyses, we used SAS version 9.4 (TS1M5) (SAS Institute Inc).

Results

Some grantees provided colonoscopy as the primary screening test, some provided stool tests (FOBT or FIT), and others used both types of test (Table 1). For tests used for screening, the ratio of stool tests to endoscopy was approximately 3:2.

Stool tests

Positivity rate

Of the 24,983 FITs completed by clients at 21 grantees, 8.7% were positive. Among the 18 grantees with at least 30 tests, positivity rates ranged from 0% to 25.1% (Figure 2A). Of the 13,157 FOBTs completed by clients at 12 grantees, 7.4% were positive. Among the 7 grantees with at least 30 tests, positivity rates ranged from 0.7% to 13.0% (Figure 2B).

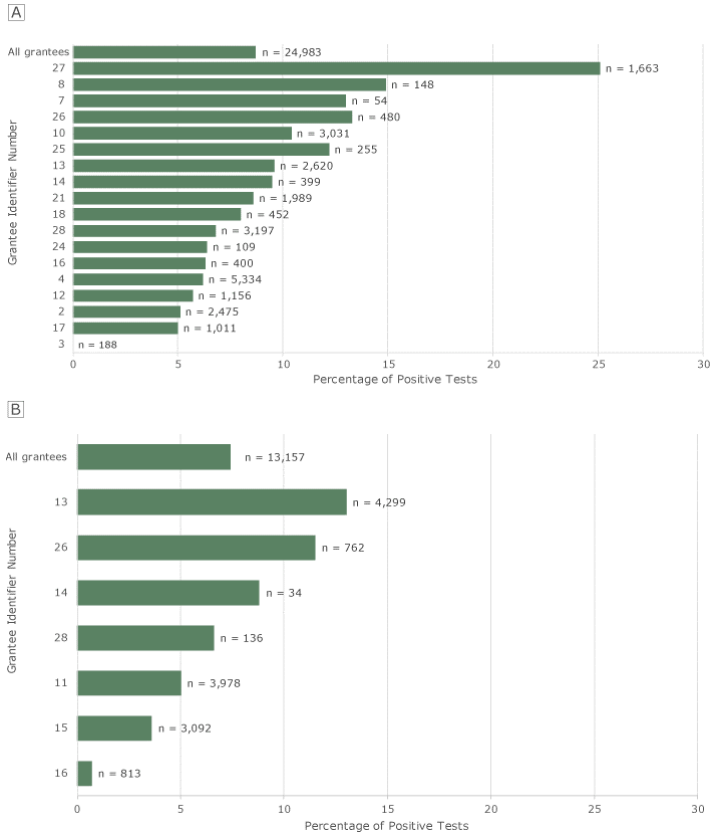

Figure 2. Positivity rates for FITs and FOBTs among clients aged ≥50, by grantee, Colorectal Cancer Control Program, 2009–2015. N's indicate number of tests. A, FIT positivity rates. Only the 18 grantees that recorded ≥30 FITs are shown individually. "All grantees" refers to all grantees, including grantees that had <30 tests. B, FOBT positivity rates. Only the 7 grantees that recorded ≥30 FOBTs are shown individually. "All grantees" refers to all grantees, including the grantees that had <30 tests. Tests for which results were not known were excluded from these analyses. Abbreviations: FIT, fecal immunochemical test; FOBT, fecal occult blood test.

The low positivity rate at grantee no. 3 for FIT and grantee no. 16 for FOBT cannot be explained by frequent rescreening of the same clients. These low rates persisted when we included only first stool tests in the CRCCP and excluded clients who reported screening before the program. The high FIT positivity rate at grantee no. 27 cannot be explained by a high proportion of clients with positive family or personal history of CRC. When these clients were excluded, the FIT positivity rate was nearly unchanged.

Completeness and timeliness of follow-up of positive tests

Overall, 82.9% (range by grantee, 50.0%–97.2%) of the 3,197 positive FOBT/FITs were followed up by diagnostic colonoscopy in the CRCCP; 1 in 6 (17.1%) were not followed up (range, 2.8%–50.0%) (Table 2). Of the 2,649 tests with follow-up, 79.8% had colonoscopy within 90 days of the positive stool test, just below the 80% quality indicator established for the CRCCP, and 15.4% had colonoscopy between 91 and 180 days; 95.2% of colonoscopies occurred within 180 days of the positive stool test. Our 80% quality indicator was not met at 5 of the 16 grantees with ≥30 positive tests.

Only grantee no. 7 provided sigmoidoscopy as the primary screening test to more than 10 clients. Of 492 sigmoidoscopies at this grantee, 96 (19.5%) were positive; of these, 76 (79.2%) were followed by colonoscopy, 63 (82.9%) of them within 90 days.

Colonoscopy

Of the 27,612 colonoscopies performed in asymptomatic clients, the cecum was reached in 98.2%. The grantee-specific cecal intubation rate ranged from 94.2% to 100%, and was above 95% at all but 1 grantee. Bowel preparation quality was adequate in 97.9% of exams. The percentage of adequate preparation ranged from 93.0% to 99.6%.

Rescreening and surveillance recommendations after colonoscopy

A total of 20,928 average-risk clients had complete first colonoscopies in the CRCCP, either for primary screening or to follow up positive FOBTs or FITs. We excluded 853 of 20,928 (4.1%) clients because data on their screening outcome or recommended interval to the next test were incomplete.

Clients with a normal examination. Of 20,075 average-risk clients, 11,192 (55.8%) had a normal outcome (ie, no polyps were found). Of these, 9,542 (85.3%) were told to return in 10 years for another colonoscopy (range among grantees, 37.7%–99.7%) as recommended in national guidelines (15), and another 9.2% (range among grantees, 0.3%–50.4%) were told to return in 5 years (Table 3, Appendix, Table A). A total of 242 (2.2%) of clients with a normal outcome were told to return for a test other than colonoscopy, usually an FOBT or FIT. At the 2 grantees with at least 30 clients who were told to have a stool test, 83% or more were told to have the test in 1 year, earlier than recommended.

Clients with hyperplastic or other nonadenomatous polyps. Of the 3,019 clients whose colonoscopies found only hyperplastic or other nonadenomatous polyps, 65.0% (range among grantees, 18.8%–96.0%) were told to return in 10 years for colonoscopy as recommended in national guidelines (15), 22.4% (range among grantees, 3.4%–51.9%) were told to return in 5 years, and 7.1% (range among grantees, 0%–29.0%) in 3 years or less (Table 3, Appendix, Table B). At the 1 grantee with at least 30 clients who were told to return for a stool test, all were told to have the stool test in 1 year.

Clients with 1 or 2 small tubular adenomas. Of the 2,989 clients who had only 1 or 2 small tubular adenomas, 4.3% (range among grantees, 0%–49.4%) were told to return in 10 years, and 74.1% (range among grantees, 32.1%–100%) in 5 years, both consistent with national guidelines that patients return in 5 to 10 years (15). A total of 20.4% (range among grantees, 0%–66.0%) were told to return in 3 years or less (Table 3, Appendix, Table C).

Clients with advanced adenomas. Of the 2,516 clients with advanced adenomas (3–10 adenomas, ≥1 adenoma ≥1 cm, or ≥1 adenoma with villous histology or high-grade dysplasia), 55.2% (range among grantees, 20.0%–84.6%) were told to return in 3 years as recommended in national guidelines (15), 24.8% (range among grantees, 3.8%–53.3%) in 5 years, and 15.3% (range among grantees, 0%–34.7%) within a year (Table 3, Appendix, Table D).

Adenoma detection rate

Overall, the ADR for average-risk clients who had colonoscopy as their primary screening test was 36.0% (range among grantees, 19.3%–54.5%) for men and 25.7% (range among grantees, 11.7%–43.3%) for women (Table 4). The ADR results were similar after excluding clients who reported prior screening.

The numbers of clients with positive family history who had screening colonoscopy and the numbers who had diagnostic colonoscopy after positive stool tests were small at most grantees, especially for men. Overall, the ADRs for screening colonoscopy for clients with family history of CRC were 42.2% for men and 30.1% for women. The ADRs for clients with diagnostic colonoscopy after positive stool tests or sigmoidoscopy were 47.9% for men and 35.6% for women.

Discussion

Most of the quality indicators examined in our study were met at most grantees. Follow-up of positive stool tests took place within a reasonable amount of time for most grantees. Cecal intubation rates and bowel preparation quality were high at all grantees. Almost all grantees met recommended thresholds for ADRs (18). However, we found considerable variation in quality indicators, and some grantees fell short of desired levels for certain indicators.

Stool test positivity rates were higher or lower than expected at a few grantees. Positivity rates depend on population characteristics, including screening history, and test characteristics, including threshold values for positivity. Although only extra-sensitive FOBTs were used in the CRCCP, various FITs were used. Positivity rates should be monitored, and unusually high or low rates and changes in rates over time should be investigated to rule out problems with test kits or processing and to identify any need to improve client instructions.

Stool tests are effective only when patients with positive findings are followed up with colonoscopy. In the CRCCP, 82.9% of positive results were followed up with colonoscopy, below the 90% quality indicator originally set for the CRCCP but exceeding the 80% target recently set as a quality metric by the US Multi-Society Task Force (USMSTF) (19) and exceeding rates reported in many settings (20–22). Some of the apparent lack of follow-up might be due to follow-up outside the CRCCP.

Follow-up of positive stool tests with colonoscopy is known to be challenging. A recent systematic review of interventions to improve follow-up found that patient navigators and provider reminders or performance data may help improve follow-up rates (22).

Follow-up of positive stool tests occurred within a reasonable amount of time for most grantees. Of those with follow-up in the CRCCP, 79.8% had colonoscopy within 90 days of the positive stool test (just below the 80% quality indicator established for the CRCCP) and 15.4% had colonoscopy 91 to 180 days after a positive stool test. The United States has no consensus guidelines for the time interval between a positive stool test and follow-up colonoscopy. A recent large study of a community-based setting found no significant increase in risk of CRC or advanced-stage disease associated with colonoscopy follow-up within 10 months of a positive FIT compared with 8 to 30 days (23). Although disease progression may be slow in most people, a short target interval may heighten patients' sense of urgency to follow up positive screening tests and reduce loss-to-follow-up due to patients moving or changing providers.

For colonoscopy, the specialty societies have proposed quality indicators for use in continuous quality improvement programs (4,5,18). To guide these efforts, the American Society for Gastrointestinal Endoscopy/American College of Gastroenterology Task Force on Quality in Endoscopy recommended a subset of 3 high-priority indicators: 1) ADR in asymptomatic average-risk persons (screening), 2) frequency of colonoscopies following recommended surveillance and rescreening intervals, and 3) cecal intubation rate with photodocumentation (5).

The cecal intubation rate was high for all grantees. The recommended performance target is 90% or more cecal intubation with photodocumentation for all examinations and 95% or more for screening examinations (5). In the CRCCP, the cecal intubation rate was more than 95% for all but 1 grantee, where the rate was 94.2%. We did not collect information on photodocumentation.

The ADR is generally considered the most important quality measure for colonoscopy. Its validity as a quality indicator was first demonstrated in a study of the Polish national colonoscopy screening program, in which ADRs were inversely related to the risk of interval CRC after screening colonoscopy (24). A larger study at Kaiser Permanente showed a dose-dependent inverse association between ADR and the risks of all-stage, advanced-stage, and fatal interval CRC (25). Recently, a prospective study of Poland's national program found that improvement in ADR, achieved by a comprehensive quality assurance program, translated into reduced risks of interval cancer and CRC death after screening colonoscopy (26).

In 2006, the USMSTF recommended that ADRs in first-time screening examinations for people aged 50 or older should be at least 25% for men and 15% for women (18). In the CRCCP, these thresholds were met at all but 1 grantee for men and all but 2 grantees for women. In 2014, the USMSTF raised these targets to 30% for men and 20% for women (5). Five grantees had ADRs below the new target of 30% for men, and 2 grantees had ADRs below the new target of 20% for women.

Efforts to increase ADRs have met with mixed success (27). Some factors that may improve ADR include split-dose preparation, and provider education on flat and depressed lesions and on withdrawal technique and public reporting of ADR (5,28). Several studies have demonstrated improvement in ADR through regular feedback and monitoring (29).

We found deviations from recommended rescreening and surveillance intervals in both directions, as has been documented in other settings (11,30). For example, for clients with a normal colonoscopy, 1 in 10 were recommended to receive the next colonoscopy in 5 years or less. For clients with advanced adenomas, 1 in

4 were told to return in 5 or more years. Surveillance that occurs too frequently provides little or no benefit while exposing patients to the risk of complications, increasing costs, and wasting resources that could instead be used for primary screening. Waiting too long increases risk of disease progression to a point where treatment may be less effective.

Some clients were told to have a test other than colonoscopy, usually a stool test, as their next test. At a few grantees, most of these clients were told to return in 1 year for the stool test. Clients who have a negative colonoscopy may have a stool test as their next screening test, but it should be after a 10-year interval. Because the risk of advanced adenomas within a few years after negative findings is low, interval testing is discouraged (15).

In the CRCCP, endoscopists used their usual report formats and terminology, and site staff had to assign bowel preparation quality (adequate vs inadequate) based on the descriptors in the endoscopy report. Some of the recommendations to return sooner than indicated in the guidelines might reflect endoscopists' concern that bowel preparation was suboptimal although classified as adequate in our database.

For hyperplastic polyps, the 10-year recommendation is for polyps 1 cm or less in the rectum or sigmoid colon. Hyperplastic polyps proximal to the sigmoid may warrant earlier return (17). Because we did not collect information about polyp location, we could not determine whether some of the recommendations for 5-year intervals were appropriate.

The quality measures discussed here were intended to measure the performance of individual endoscopists. However, we were able to look only at aggregated measures of performance at the grantee level. Poor performance by a clinician can be masked when data from large numbers of clinicians are combined. Variability among endoscopists is undoubtedly greater than variability among grantees. Screening programs and endoscopy practices should monitor performance at the level of the endoscopist so that improvement activities can be targeted to poor performers.

Under the Medicare Access and CHIP Reauthorization Act of 2015 (31), the Centers for Medicare & Medicaid Services (CMS) is required to implement a quality payment incentive program to reward value and outcomes (9). Clinicians, including those performing colonoscopy, may receive an increase or decrease in payments based on whether or not they participate in quality assessment. CMS is also moving toward public reporting of performance information to help consumers make informed choices about the health care they receive through Medicare.

Colonoscopy registries have been developed to facilitate monitoring. The GI Quality Improvement Consortium, a collaboration of the American Society for Gastrointestinal Endoscopy and American College of Gastroenterology, is a quality benchmarking registry for gastroenterology practices; it has more than 7.5 million colonoscopy cases as of January 2019 (8). Members submit data and receive reports that include the measures discussed here.

Even with the availability of funding, support services, and oversight provided by the federal screening program, CRCCP, we identified gaps in performance. Our findings reinforce the need for quality monitoring and improvement. Efforts to improve uptake that also monitor screening performance could achieve better patient outcomes. Enhanced education and feedback to providers on rescreening and surveillance guidelines may be needed in addition to expanded enrollment protocols to ensure that clients understand follow-up procedures.

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Author Information

Corresponding Author: Marion Nadel, PhD, MPH, Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, 4770 Buford Hwy, Mailstop S107-4, Chamblee, GA 30341. Telephone: 770-488-4772. Email: mrn1@cdc.gov.

Author Affiliations: [1]Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia. [2]Information Management Services Inc, Calverton, Maryland.

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Tables

Table 1. Number of Tests Provided in the Colorectal Cancer Control Program, by Grantee, 2009–2015[a]

Grantee Identifier[b]	Screening				Diagnostic Colonoscopy
	FOBT	FIT	Flexible Sigmoidoscopy	Colonoscopy	
1	0	0	0	1,700	0
2	0	2,478	2	571	116
3	11	188	1	2,206	1
4	6	5,350	0	285	290
5	0	0	4	1,800	0
6	0	0	0	857	0
7	0	74	492	0	5
8	0	148	8	2,311	6
9	4	7	2	1,715	10
10	0	3,032	0	4	265
11	3,980	0	2	593	188
12	0	1,166	0	217	50
13	4,360	2,657	3	915	604
14	34	400	2	1,928	37
15	3,098	3	0	967	103
16	840	415	1	309	35
17	0	1,011	0	26	36
18	0	468	0	721	19
19	0	0	0	1,754	0
20	12	0	0	978	0
21	0	2,003	1	228	139
22	0	0	0	275	0
23	0	12	2	1,352	0
24	0	116	0	0	6
25	12	318	1	538	31
26	779	504	10	2,199	138
27	0	1,666	3	242	368
28	137	3,241	0	167	202
All 28 grantees	13,273	25,257	534	24,858	2,649

Abbreviations: FIT, fecal immunochemical test; FOBT, guaiac fecal occult blood test.
[a] The Centers for Disease Control and Prevention provided Colorectal Cancer Control Program funding to grantees in 25 states and 4 tribal organizations for colorectal cancer screening, surveillance, and diagnostic services for underinsured or uninsured asymptomatic, low-income adults aged 50–64. One grantee was excluded from analysis because of missing data.
[b] Grantees identified by randomly assigned numbers.

Table 2. Completeness and Timeliness of Diagnostic Colonoscopy After a Positive Result From a Fecal Occult Blood Test or a Fecal Immunochemical Test in the Colorectal Cancer Control Program, by Grantee, 2009–2015[a]

Grantee Identifier[b]	No Colonoscopy Follow-Up, No. (%[c]) of Tests	Colonoscopy Follow-Up in . . ., No. (%[d]) of Tests			Total No. of Tests
		≤90 Days	91–180 Days	≥181 Days	
2	11 (8.7)	105 (90.5)	9 (7.8)	2 (1.7)	127
4	44 (13.2)	269 (92.8)	20 (6.9)	1 (0.3)	334
10	50 (15.9)	217 (81.9)	38 (14.3)	10 (3.8)	315
11	10 (5.1)	173 (92.0)	14 (7.4)	1 (0.5)	198
12	16 (24.2)	44 (88.0)	5 (10.0)	1 (2.0)	66
13	217 (26.4)	385 (63.7)	170 (28.1)	49 (8.1)	821
14	4 (9.8)	30 (81.1)	7 (18.9)	0	41
15	7 (6.4)	91 (88.3)	10 (9.7)	2 (1.9)	110
16	1 (2.8)	29 (82.9)	4 (11.4)	2 (5.7)	36
17	15 (29.4)	3 (8.3)	13 (36.1)	20 (55.6)	51
18	19 (50.0)	14 (73.7)	5 (26.3)	0	38
21	32 (18.7)	115 (82.7)	20 (14.4)	4 (2.9)	171
25	3 (8.8)	24 (77.4)	4 (12.9)	3 (9.7)	34
26	22 (13.8)	122 (88.4)	13 (9.4)	3 (2.2)	160
27	50 (12.0)	328 (89.1)	32 (8.7)	8 (2.2)	418
28	28 (12.2)	148 (73.3)	32 (15.8)	22 (10.9)	230
All 28 grantees[e]	548 (17.1)	2,113 (79.8)	407 (15.4)	129 (4.9)	3,197

[a] The Centers for Disease Control and Prevention provided Colorectal Cancer Control Program funding to grantees in 25 states and 4 tribal organizations for colorectal cancer screening, surveillance, and diagnostic services for underinsured or uninsured asymptomatic, low-income adults aged 50–64. One grantee was excluded from analysis because of missing data. Table shows data only for grantees (16 of 28) that had a total number of at least 30 positive tests (fecal occult blood tests or fecal immunochemical tests) during the program.
[b] Grantees identified by randomly assigned numbers.
[c] Percentages based on total N in row.
[d] Percentages based on the number of clients that had colonoscopy follow-up. Percentages may not sum to 100% because of rounding.
[e] Includes grantees that had fewer than 30 positive fecal occult blood tests or fecal immunochemical tests during the program.

Table 3. Rescreening and Surveillance Recommendations for Average-Risk Clients, by Outcome of the Initial Colonoscopy in the Colorectal Cancer Control Program, 2009–2015[a]

Initial Colonoscopy Outcome	Recommended Interval to Next Colonoscopy, No. (%) of Clients						Other Tests Recommended, No. (%) of Clients	Total No. of Clients (n = 20,075)
	<3 y	3 y	>3 y to <5 y	5 y	>5 y to <10 y	10 y		
Normal	64 (0.6)	99 (0.9)	5 (0)	1,035 (9.2)	205 (1.8)	9,542 (85.3)[b]	242 (2.2)	11,192
Hyperplastic or nonadenomatous polyps	65 (2.2)	149 (4.9)	7 (0.2)	677 (22.4)	75 (2.5)	1,961 (65.0)[b,c]	85 (2.8)	3,019
1 or 2 Tubular adenomas <1 cm without high-grade dysplasia or villous histology	87 (2.9)	524 (17.5)	13 (0.4)	2,216 (74.1)[b]	15 (0.5)[b]	128 (4.3)[b]	6 (0.2)	2,989
Serrated polyps[d]	11 (4.9)	80 (35.6)	0	128 (56.9)	2 (0.9)	4 (1.8)	0	225
Advanced adenoma[e]	467 (18.6)	1,388 (55.2)[b]	8 (0.3)	624 (24.8)	4 (0.2)	11 (0.4)	14 (0.6)	2,516
>10 Adenomas of any size or histology	21 (42.0)[b]	20 (40.0)	0	9 (18.0)	0	0	0	50
Cancer	65 (77.4)[b]	8 (9.5)	0	5 (6.0)	0	1 (1.2)	5 (6.0)	84

[a] The Centers for Disease Control and Prevention provided Colorectal Cancer Control Program funding to grantees in 25 states and 4 tribal organizations for colorectal cancer screening, diagnostic, and surveillance services for underinsured or uninsured asymptomatic, low-income adults aged 50–64. One grantee was excluded from analysis because of missing data. Includes clients at average risk who underwent an initial complete colonoscopy as a primary screening test or to follow up a positive stool test. A total of 853 clients were excluded because of incomplete data on screening outcome or recommended interval to the next test.
[b] Intervals that adhere to national guidelines (15,16).
[c] Recommended surveillance interval for small (<1 cm) hyperplastic polyps in the rectum or sigmoid. Hyperplastic polyps proximal to the sigmoid may require earlier follow up (17).
[d] Recommended follow-up interval for serrated polyps depends on the location, size, number and histology of polyps (15,17).
[e] Advanced adenoma category includes findings of 3–10 adenomas of any size, ≥1 adenoma ≥1 cm, or ≥1 adenoma with villous histology or high-grade dysplasia.

Table 4. Adenoma Detection Rate[a] Among Clients Aged ≥50 Years, by Grantee, Sex, and Reason for Test, Colorectal Cancer Control Program, 2009–2015[b]

	Primary Screening (Average Risk of CRC)				Primary Screening (Family History of CRC)				Follow-Up to Positive FOBT/FIT			
	Male		Female		Male		Female		Male		Female	
Grantee Identifier[c]	N	ADR	N	ADR	N	ADR	N	ADR	N	ADR	N	ADR
1	320	39.4	1,270	22.7	—	—	59	32.2	—	—	—	—
2	185	44.3	338	27.5	—	—	—	—	—	—	89	34.8
3	846	34.4	1,242	23.3	—	—	—	—	—	—	—	—
4	—	—	—	—	—	—	106	43.4	90	45.6	187	34.8
5	492	42.1	773	27.6	55	23.6	150	14.0	—	—	—	—
6	291	32.0	412	23.1	—	—	36	36.1	—	—	—	—
8	770	46.0	866	36.1	89	47.2	126	40.5	—	—	—	—
9	343	42.6	998	33.8	—	—	79	40.5	—	—	—	—
10	—	—	—	—	—	—	—	—	60	56.7	198	52.0
11	—	—	—	—	93	45.2	292	25.0	60	35.0	106	25.5
12	34	26.5	54	27.8			46	32.6	—	—	38	42.1
13			78	24.4	59	50.8	265	30.9	99	40.4	470	30.2
14	807	19.3	932	11.7	—	—	—	—	—	—	—	—
15	51	47.1	382	34.6	60	45.0	354	29.9	—	—	90	37.8
16	105	25.7	103	14.6	—	—	—	—	—	—	—	—
18	211	46.9	379	33.5	35	48.6	71	33.8	—	—	—	—
19	515	29.5	885	23.2	88	28.4	149	30.9	—	—	—	—
20	247	27.9	501	20.6	31	32.3	75	12.0	—	—	—	—
21	37	32.4	108	31.5	—	—	—	—	39	64.1	92	35.9
22	66	54.5	104	43.3	—	—	—	—	—	—	—	—
23	387	39.0	664	24.8	—	—	62	35.5	—	—	—	—
25	167	40.1	268	26.1	—	—	—	—	—	—	—	—
26	419	38.4	1,159	24.4	82	43.9	264	28.4	49	49.0	77	33.8
27	—	—	—	—	—	—	55	30.9	115	48.7	227	37.0
28	—	—	54	38.9	—	—	45	35.6	82	54.9	110	39.1
All 28 grantees	6,364	36.0	11,609	25.7	808	42.2	2,361	30.1	724	47.9	1,771	35.6

Abbreviations: —, grantee had fewer than 30 clients in category; ADR, adenoma detection rate; CRC, colorectal cancer; FOBT, fecal occult blood test; FIT, fecal immunochemical test.

[a] Defined as the percentage of clients with ≥1 adenoma detected.

[b] The Centers for Disease Control and Prevention provided Colorectal Cancer Control Program funding to grantees in 25 states and 4 tribal organizations for colorectal cancer screening, surveillance, and diagnostic services for underinsured or uninsured asymptomatic, low-income adults aged 50–64. One grantee was excluded from analysis because of missing data. Data are shown only for grantees that had at least 30 clients in the categories for sex and reason for test. Includes data on only the first colonoscopy obtained by each client in the program.

[c] Grantees identified by randomly assigned numbers.

Appendix. Supplemental Tables A–D

Table A. Rescreening and Surveillance Recommendations for Average-Risk Clients Receiving an Initial Colorectal Cancer Control Program Colonoscopy With an Outcome of Normal or No Findings, 2009–2015[a]

Grantee Identifier	Recommended Interval to Next Colonoscopy, No. (%) of Clients				Other Test Recommended, No. (%) of Clients	Total No. of Clients
	≤3 y	5 y	>5 y to <10 y	10 y		
1	5 (0.6)	48 (5.3)	22 (2.4)	827 (91.5)	2 (0.2)	904
2	13 (4)	14 (4.3)	4 (1.2)	291 (90.1)	1 (0.3)	323
3	46 (3.9)	171 (14.6)	43 (3.7)	913 (77.7)	2 (0.2)	1,175
4	0	15 (9.6)	0	139 (88.5)	3 (1.9)	157
5	7 (1.1)	34 (5.2)	2 (0.3)	611 (93.4)	0	654
6	3 (0.7)	27 (6.4)	1 (0.2)	388 (92.4)	1 (0.2)	420
8	11 (1.5)	108 (14.4)	11 (1.5)	622 (82.7)	0	752
9	7 (1)	91 (13.6)	12 (1.8)	560 (83.6)	0	670
10	0	7 (9.3)	1 (1.3)	63 (84)	4 (5.3)	75
11	1 (1.1)	2 (2.2)	0	62 (69.7)	24 (27)	89
12	9 (13)	26 (37.7)	1 (1.4)	26 (37.7)	7 (10.1)	69
13	5 (1.4)	20 (5.4)	11 (3)	217 (59)	115 (31.3)	368
14	4 (0.3)	30 (2.2)	5 (0.4)	1,298 (97.1)	0	1,337
15	10 (3.9)	130 (50.4)	15 (5.8)	102 (39.5)	0	258
16	15 (12)	43 (34.4)	4 (3.2)	57 (45.6)	4 (3.2)	125
18	6 (2.2	30 (11.2)	15 (5.6)	214 (80.1)	2 (0.7)	267
19	0	3 (0.3)	0	869 (99.7)	0	872
20	1 (0.2)	22 (4.5)	3 (0.6)	458 (94.2)	2 (0.4)	486
21	3 (2.4)	36 (28.6)	12 (9.5)	74 (58.7)	1 (0.8)	126
22	1 (1.7)	17 (28.8)	0	40 (67.8)	1 (1.7)	59
23	5 (0.9)	50 (9.1)	1 (0.2)	491 (89.8)	0	547
25	1 (0.4)	15 (5.8)	5 (1.9)	239 (91.9)	0	260
26	5 (0.5)	74 (8.1)	31 (3.4)	741 (81.3)	59 (6.5)	911
27	4 (2.6)	9 (5.8)	2 (1.3)	129 (82.7)	12 (7.7)	156
28	1 (0.9)	11 (9.9)	4 (3.6)	94 (84.7)	0	111
All 28 grantees	163 (1.5)	1,035 (9.2)	205 (1.8)	9,542 (85.3)	242 (2.2)	11,192

[a] Grantee-specific data are displayed only for those grantees with at least 30 clients with this screening outcome. For some grantees, percentages do not add to 100% because recommendations for >3 year to <5 year intervals are not displayed because there were so few.

Table B. Rescreening and Surveillance Recommendations for Average-Risk Clients Receiving an Initial Colorectal Cancer Control Program Colonoscopy With an Outcome of Hyperplastic or Other Nonadenomatous Polyps, 2009–2015[a]

Grantee Identifier	Recommended Interval to Next Colonoscopy, No. (%) of Clients				Other Test Recommended, No. (%) of Clients	Total No. of Clients
	≤3 y	5 y	>5 y to <10 y	10 y		
1	12 (4.3)	51 (18.2)	10 (3.6)	204 (72.9)	2 (0.7)	280
2	6 (5.9)	15 (14.9)	0	80 (79.2)	0	101
3	40 (14.4)	84 (30.2)	4 (1.4)	150 (54)	0	278
5	8 (4)	40 (20)	2 (1)	150 (75)	0	200
6	3 (2.7)	15 (13.3)	0	94 (83.2)	1 (0.9)	113
8	19 (7.8)	56 (23)	7 (2.9)	160 (65.6)	1 (0.4)	244
9	10 (4.8)	44 (21)	1 (0.5)	155 (73.8)	0	210
10	5 (10.4)	20 (41.7)	0	23 (47.9)	0	48
13	9 (9.8)	16 (17.4)	7 (7.6)	33 (35.9)	27 (29.3)	92
14	4 (2.5)	13 (8.1)	3 (1.9)	140 (87.5)	0	160
15	18 (23.4)	40 (51.9)	3 (3.9)	16 (20.8)	0	77
16	20 (29)	33 (47.8)	1 (1.4)	13 (18.8)	1 (1.4)	69
18	9 (8.7)	39 (37.9)	12 (11.7)	43 (41.7)	0	103
19	1 (0.7)	5 (3.4)	0	143 (96)	0	149
20	0	8 (8.2)	0	90 (91.8)	0	98
21	2 (4.3)	23 (48.9)	3 (6.4)	19 (40.4)	0	47
22	3 (8.3)	17 (47.2)	1 (2.8)	13 (36.1)	2 (5.6)	36
23	4 (2.1)	41 (21.2)	2 (1)	146 (75.6)	0	193
25	3 (4.3)	9 (12.9)	4 (5.7)	52 (74.3)	1 (1.4)	70
26	23 (8.3)	73 (26.4)	13 (4.7)	123 (44.6)	41 (14.9)	276
27	4 (6.2)	18 (27.7)	0	42 (64.6)	1 (1.5)	65
28	2 (5.3)	4 (10.5)	2 (5.3)	30 (78.9)	0	38
All 28 grantees	214 (7.1)	677 (22.4)	75 (2.5)	1,961 (65)	85 (2.8)	3,019

[a] Grantee-specific data are displayed only for those grantees with ≥30 clients with this screening outcome. For some grantees, percentages do not add to 100% because recommendations for >3 year to <5 year intervals are not displayed because there were so few.

Table C. Rescreening and Surveillance Recommendations for Average-Risk Clients Receiving an Initial Colorectal Cancer Control Program Colonoscopy With an Outcome of 1 or 2 Tubular Adenomas, 2009–2015[a]

Grantee Identifier	Recommended Interval to Next Colonoscopy, No. (%) of Clients				Total No. of Clients
	<3 y	3 y	5 y	10 y	
1	2 (1.2)	37 (22)	126 (75)	2 (1.2)	168
2	2 (2)	4 (4)	93 (93)	1 (1)	100
3	16 (5.3)	54 (17.9)	227 (75.4)	3 (1)	301
4	0	0	47 (100)	0	47
5	7 (2.7)	43 (16.5)	207 (79.3)	0	261
6	2 (1.9)	11 (10.5)	91 (86.7)	1 (1)	105
8	14 (4.6)	50 (16.4)	225 (73.8)	15 (4.9)	305
9	2 (0.8)	33 (12.4)	222 (83.5)	7 (2.6)	266
10	1 (2.6)	5 (12.8)	33 (84.6)	0	39
13	5 (4.8)	22 (21.2)	73 (70.2)	1 (1)	104
14	0	6 (4.2)	137 (95.8)	0	143
15	6 (5.2)	33 (28.7)	73 (63.5)	1 (0.9)	115
18	11 (9.2)	40 (33.6)	67 (56.3)	0	119
19	0	6 (3.3)	85 (47.2)	89 (49.4)	180
20	1 (0.9)	71 (65.1)	35 (32.1)	0	109
21	3 (7.5)	11 (27.5)	26 (65)	0	40
22	5 (11.9)	8 (19)	29 (69)	0	42
23	1 (0.9)	21 (18.4)	88 (77.2)	0	114
25	1 (1.4)	8 (11.1)	62 (86.1)	0	72
26	6 (3.1)	29 (15.1)	140 (72.9)	6 (3.1)	192
27	1 (2.2)	6 (13.3)	38 (84.4)	0	45
28	0	10 (17.9)	46 (82.1)	0	56
All 28 grantees	87 (2.9)	524 (17.5)	2,216 (74.1)	128 (4.3)	2,989

[a] Grantee-specific data are displayed only for those grantees with ≥30 clients with this screening outcome. For some grantees, percentages do not add to 100% because recommendations for >3 year to <5 year intervals, >5 year to <10 year intervals, and other test recommended are not displayed because there were so few.

Table D. Rescreening and Surveillance Recommendations for Average-Risk Clients Receiving an Initial Colorectal Cancer Control Program Colonoscopy With an Outcome of Advanced Adenoma, 2009–2015[a,b]

Grantee Identifier	Recommended Interval to Next Colonoscopy, No. (%) of Clients				Total No. of Clients
	≤1 y	>1 y to <3 y	3 y	5 y	
1	14 (6.7)	3 (1.4)	87 (41.8)	100 (48.1)	208
2	22 (23.7)	0	52 (55.9)	18 (19.4)	93
3	35 (18.2)	5 (2.6)	101 (52.6)	51 (26.6)	192
4	0	0	42 (84)	8 (16)	50
5	27 (20.5)	6 (4.5)	94 (71.2)	5 (3.8)	132
6	11 (14.9)	0	60 (81.1)	3 (4.1)	74
7	9 (23.1)	0	20 (51.3)	10 (25.6)	39
8	55 (16.7)	13 (4)	191 (58.1)	67 (20.4)	329
9	13 (9.6)	1 (0.7)	97 (71.3)	24 (17.6)	136
10	9 (12)	3 (4)	37 (49.3)	26 (34.7)	75
13	13 (16.7)	2 (2.6)	56 (71.8)	5 (6.4)	78
14	4 (5.4)	0	52 (70.3)	18 (24.3)	74
15	25 (34.7)	9 (12.5)	29 (40.3)	8 (11.1)	72
16	4 (13.3)	1 (3.3)	7 (23.3)	16 (53.3)	30
18	18 (20.9)	7 (8.1)	39 (45.3)	22 (25.6)	86
19	11 (9.4)	0	95 (81.2)	9 (7.7)	117
20	4 (10.3)	0	33 (84.6)	2 (5.1)	39
21	19 (33.3)	6 (10.5)	21 (36.8)	11 (19.3)	57
22	13 (28.9)	1 (2.2)	9 (20)	20 (44.4)	45
23	23 (18.5)	3 (2.4)	54 (43.5)	43 (34.7)	124
25	2 (4)	5 (10)	33 (66)	8 (16)	50
26	17 (7.8)	9 (4.1)	75 (34.2)	107 (48.9)	219
27	15 (19.5)	2 (2.6)	27 (35.1)	30 (39)	77
28	14 (24.1)	1 (1.7)	40 (69)	3 (5.2)	58
All 28 grantees	386 (15.3)	81 (3.2)	1,388 (55.2)	624 (24.8)	2,516

[a] Advanced adenoma includes findings of 3–10 adenomas of any size, ≥1 adenoma ≥1 cm, or ≥1 adenoma with villous features or high grade dysplasia.
[b] Grantee-specific data are displayed for those grantees with ≥30 clients with this screening outcome. For some grantees, percentages do not add to 100% because recommendations for >3 year to <5 year intervals, >5 year intervals, and other test recommended are not displayed because there were so few.

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IMPLEMENTATION EVALUATION

Adoption and Implementation of Evidence-Based Colorectal Cancer Screening Interventions Among Cancer Control Program Grantees, 2009–2015

Peggy A. Hannon, PhD, MPH[1]; Annette E. Maxwell, DrPH[2]; Cam Escoffery, PhD, MPH[3]; Thuy Vu, MPH[1]; Marlana J. Kohn, MPH[1]; Lindsay Gressard, MPH, MEd[4]; Laurel Dillon-Sumner, MA[1]; Caitlin Mason, PhD[1]; Amy DeGroff, PhD, MPH[4]

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PEER REVIEWED

Summary

What is already known on this topic?

Colorectal Cancer Control Program (CRCCP) grantees from 2009 through 2015 were encouraged to implement evidence-based interventions (EBIs) to promote colorectal cancer screening.

What is added by this report?

This report studies EBI implementation over a 5-year period in a stable group of grantees.

What are the implications for public health practice?

There was some turnover regarding which EBIs were implemented, and implementation did not get easier over time for EBIs that were sustained. Our findings can be applied to evaluating and supporting EBI implementation in the next CRCCP funding cycle and in the National Breast and Cervical Cancer Early Detection Program as they adopt a similar approach to promoting EBIs and collaborating with health systems.

Abstract

Purpose and Objectives

Colorectal cancer (CRC) is the second-leading cause of cancer death in the United States. Although effective CRC screening tests exist, CRC screening is underused. Use of evidence-based interventions (EBIs) to increase CRC screening could save many lives. The Colorectal Cancer Control Program (CRCCP) of the Centers for Disease Control and Prevention (CDC) provides a unique opportunity to study EBI adoption, implementation, and maintenance. We assessed 1) the number of grantees implementing 5 EBIs during 2011 through 2015, 2) grantees' perceived ease of implementing each EBI, and 3) grantees' reasons for stopping EBI implementation.

Intervention Approach

CDC funded 25 states and 4 tribal entities to participate in the CRCCP. Grantees used CRCCP funds to 1) provide CRC screening to individuals who were uninsured and low-income, and 2) promote CRC screening at the population level. One component of the CRC screening promotion effort was implementing 1 or more of 5 EBIs to increase CRC screening rates.

Evaluation Methods

We surveyed CRCCP grantees about EBI implementation with an online survey in 2011, 2012, 2013, and 2015. We conducted descriptive analyses of closed-ended items and coded open-text responses for themes related to barriers and facilitators to EBI implementation.

Results

Most grantees implemented small media (≥25) or client reminders (≥21) or both all program years. Although few grantees reported implementation of EBIs such as reducing structural barriers (n = 14) and provider reminders (n = 9) in 2011, implementation of these EBIs increased over time. Implementation of provider assessment and feedback increased over time, but was reported by the fewest grantees (n = 17) in 2015. Reasons for discontinuing EBIs included funding ending, competing priorities, or limited staff capacity.

Implications for Public Health

CRCCP grantees implemented EBIs across all years studied, yet implementation varied by EBI and did not get easier with time. Our findings can inform long-term planning for EBIs with state and tribal public health institutions and their partners.

Introduction

Colorectal cancer (CRC) is the second-leading cause of cancer death in the United States (1). The US Preventive Services Task Force (USPSTF) recommends CRC screening for average risk adults, aged 50 to 75 years, using either stool-based tests (ie, fecal occult blood test [FOBT], fecal immunochemical test [FIT], or multitargeted stool DNA test [FIT-DNA]) or tests that directly visualize the colon (ie, colonoscopy, sigmoidoscopy, or computed tomographic colonography) (2). However, CRC screening is underused; estimates of screening rates in the United States range from 63% (National Health Interview Survey, 2015) to 68% (Behavioral Risk Factor Surveillance System, 2016) (3,4). CRC screening rates are substantially lower for populations without health insurance, populations without a medical home, and Asian and Pacific Islander and Hispanic populations (3,5,6). Increasing CRC screening rates to 80% has the potential to prevent 277,000 CRC cases and 203,000 CRC deaths by 2030 (3), partly because CRC screening has the potential not only to detect cancer early but also to prevent it through the identification and removal of precancerous polyps. Many organizations support the "80% in Every Community" initiative (http://nccrt.org/80-in-every-community/), which established the goal of 80% of the total population of adults aged 50 to 75 years being up to date for CRC screening.

The Colorectal Cancer Control Program (CRCCP) is a CDC initiative to increase CRC screening among adults aged 50 to 75 (www.cdc.gov/cancer/crccp) (7). The program's grantees — most often state health departments and tribal health agencies — are funded (in part) to promote CRC screening by using 5 evidence-based interventions (EBIs). We focus on the first cycle of the CRCCP from 2009 through 2015, which funded 29 grantees. The evaluation activities we describe were conducted from 2011 through 2015.

Purpose and Objectives

The CRCCP provides a unique opportunity to study EBI adoption, implementation, and maintenance over several years in a stable group of grantee organizations and in the context of a national program. Few studies examine EBI implementation among the same organizations longitudinally over the course of 5 years or more (8,9). We studied grantees' early experiences with adopting and implementing EBIs and compared their experiences with National Breast and Cervical Cancer Early Detection Program (NBCCEDP) grantees that did not receive CRCCP funding and were not explicitly directed to use EBIs (10–13). Grantees and nongrantees were equally likely to implement practices that are not recommended by the Guide to Community Preventive Services (Community Guide), but grantees were more likely to implement EBIs (13). This finding showed that CDC's encouragement and financial support to the grantees to use these EBIs was effective, because all grantees were using at least 1 or 2 EBIs by the end of the second program year. The intended contribution of this study is to determine whether grantees maintained the EBIs they implemented over time and why (or why not). We assessed 1) how many grantees implemented each EBI from 2009 through 2015; 2) grantees' perceived ease of implementing each EBI; 3) the maintenance of specific EBIs from year to year; and 4) qualitative data describing why grantees stopped using EBIs as well as facilitators and barriers to implementing EBIs.

Intervention Approach

CDC's Division of Cancer Prevention and Control initially funded the CRCCP in 2009. The overall goal of CRCCP was to increase CRC screening rates to 80% in funded states and tribal areas by the end of the funding cycle, with a long-term objective of reducing CRC incidence and mortality. In 2009, a total of 22 states and 4 tribal entities were awarded CRCCP funds; an additional 3 states received CRCCP funds in 2010. All grantees' awards lasted through June 2015 (7).

Grantees used CRCCP funds for 2 program components. First, grantees provided CRC screening services to low-income and uninsured people in their region. Second, grantees promoted CRC screening at the population level. Grantees were strongly encouraged to use 1 or more of 5 EBIs from the Community Guide to promote CRC screening (grantees were free to choose any combination of the EBIs to implement and could change their choices over time). The Community Guide conducts systematic reviews of evidence to identify effective strategies to increase cancer screening and other health desirable behaviors (14). Three of the EBIs are classified as "client-oriented," meaning they focus on the person needing screening; these EBIs are small media (such as brochures, postcards, or posters), client reminders, and reducing structural barriers. Two of the EBIs are classified as "provider-oriented," meaning they increase the likelihood that providers will recommend screening; these EBIs are provider reminders and provider assessment and feedback (15,16). In addition, CDC encouraged grantees to use patient navigation; the NIH state-of-the-science conference statement on enhancing the use and quality of CRC screening recommends patient navigation as an evidence-based strategy for CRC screening (17).

The EBIs listed above vary in terms of complexity and partnerships required. The client-oriented EBIs could be implemented directly by grantees or by their clinical or community partners. The provider-oriented EBIs may be more complex from the perspective of a typical grantee organization because they require 1 or more clinic or health system partners. In addition, implementing provider reminders or provider assessment and feedback may require working with or adapting electronic health records. Given the grantees' organizational context (state and tribal departments of health), the provider-oriented EBIs may be more challenging to implement than the client-oriented EBIs.

A key assumption underlying the CRCCP is that if grantees implement EBIs, CRC screening rates will increase. The evaluation described below focused on whether grantees implemented and maintained EBIs over the funding cycle (measured with quantitative survey items) and barriers and facilitators to implementing and maintaining EBIs (measured with open-text survey responses).

Evaluation Methods

Staff members of CDC and the Cancer Prevention and Control Research Network (CPCRN) conducted this study. CPCRN is a national network of academic, public health, and community partners who work together to reduce the burden of cancer, especially among those disproportionately affected (18–20). CDC and the National Cancer Institute (NCI) fund the CPCRN to accelerate the adoption of evidence-based cancer prevention and control practices.

A CPCRN work group collaborated with CDC to develop and implement a grantee survey as part of the CRCCP evaluation. The first online survey of the 29 CRCCP grantees asked about the first 2 years of program implementation and was administered during November and December 2011. Subsequent grantee surveys were administered in 2012 (program year 3), 2013 (program year 4), and 2015 (program year 6). The survey was administered following the end of each fiscal year. No survey was administered for program year 5 because of delays with the Paperwork Reduction Act review process.

Grantee organizations were 25 state departments of health and 4 tribal organizations that received funding through the CRCCP. For every survey administration, the 29 CRCCP program directors received an emailed invitation letter jointly signed by CDC and the CPCRN asking them to identify the person most knowledgeable about day-to-day operations of the CRCCP to complete the survey. Typically, this was a program director or coordinator. Respondents completed the survey online; the process was programmed by using Qualtrics survey software (Qualtrics) in 2011 and by using DatStat Illume survey software (DatStat Corp) in 2012 through 2015. The survey questionnaire and procedures were declared exempt from review by the University of Washington and CDC institutional review boards. Data collection was approved by the Office of Management and Budget (control number 0920–1074).

Survey questionnaire

The questionnaire covered several topics; we present data on grantee efforts to promote population-level CRC screening for the first funding cycle of CRCCP (2009–2015). The survey included questions about grantee organization type (state department of health or tribal organization), survey respondent characteristics (role in CRCCP, length of involvement in CRCCP, and length of involvement in cancer control), whether there was turnover in the program director or program manager roles during 2009 through 2015, and questions about use of each of the 5 Community Guide–recommended EBIs. For each EBI, respondents were asked whether their CRCCP currently uses it or plans to use it in the next 12 months. In the 2012 through 2015 administrations of the survey, grantees were also asked if they implemented each EBI in the past but no longer do so.

Respondents rated the ease of implementing the EBIs on a 5-point Likert scale (1 = very difficult, 5 = very easy). They then answered open-ended questions specifically about facilitators and barriers to implementing EBIs. Grantees could also add any comments about EBI implementation that they did not provide earlier (eg, facilitators and barriers, success stories, and, if applicable, reasons for no longer using an EBI). For each survey administration, the questionnaire was pilot-tested with 4 grantees; 2 grantees reviewed a paper version of the questionnaire, and 2 reviewed the online version. The final questionnaire was revised to address feedback from the pilot test. Survey items are available from the authors on request.

Data analysis

All quantitative data were analyzed by using SPSS version 18 (IBM Inc). We performed descriptive analyses to determine the frequency of CRCCP grantees' use of EBIs, mean ratings of "ease of implementing" EBIs, and frequency of grantees' discontinuing EBIs. Two coders (L.D.S., P.A.H.) did a content analysis of grantees' open-text responses about facilitators and barriers to use of EBIs, and reasons for discontinuing EBIs. One coder (L.D.S.) did initial development of the codebook by using an emergent coding approach. The other coder (P.A.H.) reviewed the codebook and initial codes; the coders discussed and resolved discrepancies. Grantees had the opportunity to provide open-text responses about each EBI in each program year. Responses were

first coded separately by EBI and program year. The same themes came up across EBIs and program years, so the coders aggregated the results.

Results

Survey respondents

Almost all grantees participated in all 4 of the surveys; 28 grantees (96%) completed the survey in 2011 and 2013, and 29 grantees (100%) completed the survey in 2012 and 2015. Most survey respondents (82%) in 2015 were the program director and/or the program manager (Table 1).

EBI adoption, implementation, and maintenance

Overall, more grantees implemented client-oriented EBIs than provider-oriented EBIs (Table 2). By 2015 (program year 6), most grantees were implementing small media (n = 25) and client reminders (n = 26); few grantees stopped implementing these EBIs by 2015 (n = 4 for small media and n = 2 for client reminders) (Figure). Reducing structural barriers is classified as a client-oriented EBI, yet often requires health system support. In 2011, 14 grantees implemented reducing structural barriers, increasing to 23 by 2015. Fewer grantees implemented the provider-oriented EBIs, especially in the first years of the funding cycle. In 2011, 9 grantees implemented provider reminders and 14 implemented provider assessment and feedback. By 2015, 19 grantees implemented provider reminders and 17 implemented provider assessment and feedback. We saw the most turbulence for provider assessment and feedback; 9 grantees that reported implementing this EBI in program year 2 reported they no longer did so in program year 3.

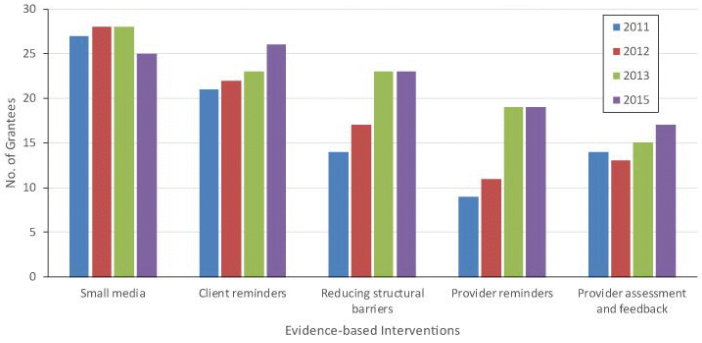

Figure. Number of grantees implementing evidence-based interventions among grantees for the Colorectal Cancer Control Program, 2011–2015. In 2011 and 2013, 28 grantees completed the survey; all 29 grantees completed the survey in 2012 and 2015. Data source includes the CRCCP grantee survey data, 2011–2015.

Perceived ease of EBI implementation

In general, the average ease of implementation ratings declined over time, indicating that grantees rated the same EBIs as more difficult to implement later in the program period (Table 2). This was not a perfect linear trend, yet every EBI had a lower average rating for program year 6 than for program year 2. The greatest decline was for provider assessment and feedback (1.18 points on a 5-point scale) and the smallest decline was for small media (0.23 points). Only grantees implementing a given EBI rated its ease in a given year. To see if the decline in average ease was due to those grantees newly implementing the EBIs each year, we restricted analysis to only those grantees who had implemented a given EBI the year before (ie, the "maintainers"; data not shown). In general, the average ratings of grantees implementing a given EBI for the first time and maintainers-only grantees were about the same (differences between the 2 groups were ≤.20 on a 5-point scale). The only exception was provider assessment and feedback; maintainers in program year 3 rated this EBI as more difficult (2.50) than new implementers (3.10).

Grantees' open-text responses

Grantees had the option to provide open-text responses describing EBI successes, challenges, and reasons why they no longer implement specific EBIs. The survey did not require responses to these items; therefore, a minority of grantees provided responses for each EBI in a given year (range, 2–12 grantees per EBI writing comments for EBI successes, challenges, or reasons for discontinuing each year). Across EBIs, there were 25 to 30 open-text responses each program year.

Across EBIs, many grantees mentioned successful partnerships as key facilitators to implementation. In many cases, grantees' partners led implementation activities; in others, they provided connections, materials, or staff time. Staff capacity, as well as having well-trained staff, were also listed as important facilitators. Several grantees also discussed electronic health records as a facilitator for EBIs that involved sending information to clients and for the provider-oriented EBIs.

Several of the facilitators were also described as barriers. Grantees discussed problems with specific partnerships, lack of staff time or capacity, and challenges working with their partners' electronic health records as significant barriers to implementing EBIs. Other frequently mentioned barriers included getting approvals or arranging contracts with partner agencies and concerns about funding and sustainability. Grantees implementing provider-oriented interventions discussed competing provider/clinic priorities as a barrier.

Few grantees provided reasons for discontinuing specific EBIs. Of those who did, a common reason given (especially in program year 6) was the end of funding to sustain the EBI. A few grantees also noted that the EBI was part of a specific demonstration project within their CRCCP and that implementation ended when the demonstration project ended. The other most commonly given reasons for stopping specific EBIs included limited staff time or staff turnover and the desire to implement other EBIs (and not being able to implement all EBIs at one time). A couple of grantees also noted a shift in their partners' focus or priorities that led to the partner no longer being interested in the EBI.

Implications for Public Health

The first 6 years of the CRCCP provided a unique opportunity to study a consistent group of 29 organizations and how they adopted, implemented, and maintained or discontinued EBIs to promote CRC screening. We found that most grantees adopted and implemented small media and client reminders early in the study period; most grantees also maintained these 2 EBIs through 2015. These client-oriented EBIs are often considered simpler to implement than the provider-oriented EBIs because they do not necessarily require partnerships with health systems or modifications to electronic health records.

Adoption and implementation of the provider-oriented EBIs (provider reminders, provider assessment and feedback) and reduction of structural barriers was more gradual, with a few new grantees adopting these EBIs each year. There was also more turbulence in terms of implementation for these EBIs, with several grantees discontinuing them before 2015. Notable reasons for discontinuing EBIs were lack of resources, partners' priorities, and ending of funding. These less-frequently implemented and sustained EBIs may have more potential to affect screening rates (15,16,21). However, provider-oriented EBIs are more complex, which can reduce implementation (22). In the second CRCCP cycle, CDC is requiring grantees to implement 2 or more of the following EBIs: client reminders, reducing structural barriers, provider reminders, and provider assessment and feedback in health system clinics (23). Our finding that 3 of these 4 EBIs were challenging to implement by the first cycle of CRCCP grantees highlights the importance of evaluating and better understanding their implementation efforts and challenges so as to inform development or dissemination of resources to make them easier to sustain. Grantees may still use small media, but only as an additional supporting strategy. This guidance is more specific and directs grantees to higher-impact EBIs from the beginning of the new funding cycle (24).

Our findings raise questions about the sustainability of provider-oriented EBIs as implemented by the grantees. Wiltsey Stirman and colleagues identified 4 influences on sustainability of new programs: context, characteristics of the new program (including complexity), processes, and capacity (9). We found that grantees' reasons for discontinuing an EBI most often related to capacity issues. Context also may be an important factor. For instance, electronic health records systems were identified as a barrier to EBI implementation. This suggests that sustainability in clinic settings may be challenged when electronic health records systems cannot support integration of client and provider reminder systems as well as provider assessment and feedback reports. In the future, CRCCP and other similar programs may want to include more measures of sustainability and factors that influence sustainability (such as context) in evaluation instruments. These measures could potentially help grantees with their planning to sustain EBIs when funding ends and could help researchers better understand their implementation and de-implementation choices.

One of the counterintuitive findings of this study is that grantees did not find implementation easier with time. The trend appears to be that EBIs were perceived to be more difficult to implement over time, particularly for reducing structural barriers and provider assessment and feedback. Implementing the provider-oriented EBIs generally required strategic partnerships, and building and sustaining these partnerships is complex and takes ongoing effort (25). Challenges related to partnerships, electronic health records, and other issues may take a year or more to emerge. Another potential issue is that health systems serving high-need patients may find it difficult to maintain a focus on CRC screening, given competing priorities and limited resources.

Future research can explore determinants of EBI maintenance or abandonment and test strategies to assist organizations to maintain EBIs, including ones that address program factors, organizational context, processes, and capacity. CDC already provides training and technical assistance along with an incentive through CRCCP funding to implement EBIs. Additional strategies may be needed to help sustain more complex EBIs that require collaborating with health care systems and integrating with their health information technology. Future research should also explore implementation ease or difficulty in the context of the NBCCEDP, as grantees in this program are also encouraged to work with health system partners and use EBIs. There is significant overlap in NBCCEDP and CRCCP grantees, which creates the opportunity to discover potential synergies in implementing EBIs for multiple cancers across these programs or applying lessons learned from one program to another.

This study has several limitations. The small sample size of 29 grantees limited our ability to conduct inferential tests. This survey assessed only the grantees' perspectives, whereas implementing the EBIs usually involved working with partner organizations

who were not included in the survey. Some grantees experienced turnover in leadership such that the survey respondent changed over the course of the years studied; in these cases, it is difficult to know whether observed changes in the data reflect actual changes or changes in the perspective of the respondent. However, the pattern of rating implementation as stable or more difficult over time was consistent across years and across EBIs. Finally, not all grantees provided open-text data about barriers and facilitators to EBI implementation or their reasons for discontinuing EBIs. Given this, we cannot assess the overall impact of the barriers and facilitators on implementing and maintaining EBIs.

This study also has several strengths. We were able to study a group of 29 grantees that had stable funding over a 6-year period to implement EBIs to promote CRC screening, and we achieved very high response rates for the surveys across all years. The findings reveal not only which EBIs were adopted, but which were maintained over several years and thus had the most potential for sustained impact on screening rates. The findings have implications for the second CRCCP cycle (DP15–1502, 2015–2020) and for the implementation of EBIs in comparable clinical settings.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of CDC.

Author Information

Corresponding Author: Peggy A. Hannon, PhD, MPH, 1107 NE 45th St, Ste 200, Seattle, WA 98105. Telephone: 206-616-7859. Email: peggyh@uw.edu.

Author Affiliations: [1]University of Washington, Seattle, Washington. [2]University of California, Los Angeles, California. [3]Emory University, Atlanta, Georgia. [4]Centers for Disease Control and Prevention, Atlanta, Georgia.

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Tables

Table 1. Grantee and Survey Respondent Characteristics (N = 29), Colorectal Cancer Control Program (CRCCP), 2015

Characteristic	No. (%)
Grantee organization type	
State department of health	25 (86)
Tribal organization	4 (14)
Respondent role in CRCCP	
Program director	12 (41)
Program manager	9 (31)
Program director and manager	3 (10)
Other	5 (17)
Length of respondent's involvement in CRCCP	
<1 year	4 (14)
12–23 months	3 (10)
24–35 months	4 (14)
≥3 years	18 (62)
Length of respondents' involvement in cancer control, y	
<1	2 (7)
1–3	4 (14)
4–5	2 (7)
≥6	21 (72)
Change in CRCCP's program director or program manager during 2009–2015	
Yes, the program manager changed	5 (17)
Yes, the program director changed	6 (21)
Yes, both changed	6 (21)
No, there has been no change in either the program director or program manager	12 (41)

Table 2. Evidence-based Intervention (EBI) Implementation, Ease of EBI Implementation,[a] and EBI Maintenance,[b] Colorectal Cancer Control Program, 2011–2015

Category	Program Year 2, 2011 (n = 28)	Program Year 3, 2012 (n = 29)	Program Year 4, 2013 (n = 28)	Program Year 6, 2015 (n = 29)
Small media				
No. of grantees implementing	**27**	**28**	**28**	**25**
No. grantees maintaining implementation	—	26	27	24
No. grantees discontinuing implementation	—	1	0	4
No. grantees newly implementing	—	1	1	0
Average ease of implementation (SD)	**4.15 (1.08)**	**3.65 (0.75)**	**3.92 (0.80)**	**3.92 (0.86)**
Client reminders				
No. of grantees implementing	**21**	**22**	**23**	**26**
No. grantees maintaining implementation	—	19	19	21
No. grantees discontinuing implementation	—	2	2	2
No. grantees newly implementing	—	3	4	4
Average ease of implementation (SD)	**3.95 (0.74)**	**3.50 (1.03)**	**3.29 (0.92)**	**3.31 (1.12)**
Reducing structural barriers				
No. of grantees implementing	**14**	**17**	**23**	**23**
No. grantees maintaining implementation	—	10	15	20
No. grantees discontinuing implementation	—	4	1	3
No. grantees newly implementing	—	6	8	2
Average ease of implementation (SD)	**3.43 (1.16)**	**3.20 (1.08)**	**3.18 (0.96)**	**3.09 (1.00)**
Provider reminders				
No. of grantees implementing	**9**	**11**	**19**	**19**
No. grantees maintaining implementation	—	6	8	16
No. grantees discontinuing implementation	—	3	3	3
No. grantees newly implementing	—	5	11	2
Average ease of implementation (SD)	**3.56 (0.73)**	**3.40 (1.26)**	**2.47 (0.83)**	**3.26 (1.10)**
Provider assessment and feedback				
No. grantees implementing	**14**	**13**	**15**	**17**
No. grantees maintaining implementation	—	5	9	13
No. grantees discontinuing implementation	—	9	3	2
No. grantees newly implementing	—	7	6	4
Average ease of implementation rating (SD)	**3.71 (1.14)**	**3.10 (1.20)**	**1.92 (0.52)**	**2.53 (1.33)**

Abbreviation: — , not applicable; SD, standard deviation.

[a] Respondents rated the ease of implementing the EBIs on a 5-point Likert scale (1 = very difficult, 5 = very easy).

[b] Maintenance is defined as responding, "Yes, we currently implement this EBI" in 2 consecutive administrations of this survey. In a few cases, grantees maintaining implementation could not be computed for a given grantee because they did not complete the grantee survey for the prior year. In these cases, the numbers for grantees maintaining implementation, grantees discontinuing implementation, and grantees newly implementing will sum to less than the total grantees implementing number for a given program year.

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ORIGINAL RESEARCH

Developing a Web-Based Cost Assessment Tool for Colorectal Cancer Screening Programs

Sonja Hoover, MPP[1]; Sujha Subramanian, PhD[1]; Florence Tangka, PhD, MS[2]

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PEER REVIEWED

Summary

What is already known on this topic?

Centers for Disease Control and Prevention and RTI International designed a web-based cost assessment tool (CAT) to collect cost and resource data. The design of the CAT was based on published methods of collecting cost data for program evaluation.

What is added by this report?

We describe the development of the web-based CAT, evaluate the quality of the data obtained, and discuss lessons learned. We found that grantees were successfully able to collect and report cost data across years by using the web-based CAT.

What are the implications for public health practice?

Data on activity-based expenditures and funding sources, collected using the web-based CAT, are essential in planning for the allocation of limited health care resources.

Abstract

Introduction

We developed a web-based cost assessment tool (CAT) to collect cost data as an improvement from a desktop instrument to perform economic evaluations of the Centers for Disease Control and Prevention's (CDC's) Colorectal Cancer Control Program (CRCCP) grantees. We describe the development of the web-based CAT, evaluate the quality of the data obtained, and discuss lessons learned.

Methods

We developed and refined a web-based CAT to collect 5 years (2009–2014) of cost data from 29 CRCCP grantees. We analyzed funding distribution; costs by budget categories; distribution of costs related to screening promotion, screening provision, and overarching activities; and reporting of screenings for grantees that received funding from non-CDC sources compared with those grantees that did not.

Results

CDC provided 85.6% of the resources for the CRCCP, with smaller amounts from in-kind contributions (7.8%), and funding from other sources (6.6%) (eg, state funding). Grantees allocated, on average, 95% of their expenditures to specific program activities and 5% to other activities. Some non-CDC funds were used to provide screening tests to additional people, and these additional screens were captured in the CAT.

Conclusion

A web-based tool can be successfully used to collect cost data on expenditures associated with CRCCP activities. Areas for future refinement include how to collect and allocate dollars from other sources in addition to CDC dollars.

Introduction

Colorectal cancer (CRC) screening can detect early-stage CRC and adenomatous polyps (1,2). However, CRC screening remains low; only 67.3% of adults aged 50 to 75 years in the United States received CRC screening that was consistent with US Preventive Services Task Force recommendations (3). To explore the feasibility of a CRC screening program for the underserved US population, the Centers for Disease Control and Prevention (CDC) established the Colorectal Cancer Screening Demonstration Program (Demo), conducted from 2005 through 2009. In 2009, CDC modified and expanded efforts to promote and provide CRC screening to 29 states and tribal organizations through the Colorectal Cancer Control Program (Program 1), which was conducted from 2009 through 2014) (4).

CDC and RTI International conducted economic evaluations as part of the Demo and Program 1. To help improve cost evaluation of CRC screening, we developed a cost assessment tool (CAT) to collect cost data and to perform economic evaluations. Cost as-

sessments allow program planners and policy makers to determine optimal allocation of limited health care resources, identify the most efficient approach to implementing screening programs, and assess annual budget implications (5). However, cost assessment is a challenge for CRC programs because funds may come from many sources, different tests may be used (eg, colonoscopy vs stool tests), grantees may choose different screening promotion activities, and grantees may have different relationships with state and local public health organizations or with contractors. We focus on the CAT for Program 1 and describe lessons learned from designing and implementing the CAT to improve future data collection efforts.

Methods

The design of the web-based CAT for Program 1 (OMB no. 0920–0745) was based on published methods of collecting cost data for program evaluation (5–14). We collected data from a programmatic perspective on all funding sources of the grantees, including federal, nonfederal (eg, state or national organizations), and in-kind. We then asked grantees to collect cost data on activities relevant to the program in 5 budget categories: labor; contracts, materials, and supplies; screening and diagnostic services for each screening test provided; consultants; and administration. In the Program 1 CAT, all budget categories were allocated to specific program activities. We asked grantees to provide costs on screening promotion and provision activities. We also had a category of overarching activities, which included activities to support both screening promotion and provision activities, such as program management and quality assurance (Appendix).

Data collection procedures

For the Demo, we initially collected all resource use data via a Microsoft Excel-based tool. However, in 2009 we piloted a web-based tool. The web-based tool allowed us to embed data checks within the Program 1 CAT; therefore, fewer mistakes would be made during data entry and the quality of the data received would be improved. Examples of the embedded checks included asking grantees to allocate at least 95% of the total amount of annual funding to specific program activities in their reporting. By using an algorithm indicating that total allocation to spending activities was equal to or greater than 95% of total funding, the grantee could submit the CAT; if total allocation was less than 95%, the grantee needed to revise inputs. Grantees also had to confirm that 100% of staff time spent was allocated to specific activities and that the amount of funding received and the amount of carryover funding from previous years were accurate. If any of these checks failed, the grantee would need to review and revise inputs before submitting. Because of the ease of use of the web-based tool and the success of embedded checks, we implemented the web-based tool for Program 1.

In the Demo version of the CAT, we had an overall "other" category for activities that were not easily placed in existing categories. The activities that were placed in this "other" category were activities where grantees received lump-sum amounts that could not be easily divided among existing activities, or activities that were not included in the existing list. In the Program 1 web-based CAT, we added 2 "other" categories: an "other" category specifically for screening promotion activities, and an "other" category specifically for screening provision activities. In analyzing the second year of Program 1 CAT data, we found commonalities in activities that were included in the "other" categories, leading us to add more activities to the CAT, including patient navigation for both screening promotion and screening provision components and mass media for screening promotion activities.

In addition to collecting Program 1 cost data, we collected data on the number of screenings conducted by the grantee. We asked grantees to report on total number of individuals screened, screening tests performed by test type, follow-up colonoscopies, adenomatous polyps/lesions detected, and cancers detected. We also asked grantees to report total number of people previously diagnosed with CRC who were undergoing follow-up surveillance for recurrence or development of CRC and total number of people enrolled in insurance programs. We used this data to supplement the Colorectal Cancer Clinical Data Elements (CCDEs) that Program 1 grantees provided CDC. While the CCDEs collected data only on screenings funded by CDC, the Program 1 CAT collected the same information for all screenings facilitated by the grantee regardless of the source of funding.

To maintain systematic and standardized data collection, we provided all grantees with a data user's guide and provided technical assistance via teleconferences and email. We hosted webinars about how to collect and input data using the Program 1 web-based CAT. The information in the Program 1 CAT was collected retrospectively; however, to improve the accuracy of the data, grantees were encouraged to track and log information required prospectively when feasible. Cost data were collected and analyzed on an annual basis for 5 years (2009–2014). In the first year of Program 1, we collected data from 26 grantees; in years 2 through 5, we collected data from 29 grantees annually.

Data quality assessment and analysis

On completion of the annual submission of the Program 1 CAT, we conducted data quality checks. We confirmed that data were entered into each of the broad categories of personnel, contracts,

screening provision, and administration/overhead. If no costs were reported in any of these categories, we followed up with grantees to understand why. When funding amounts were reported for screening provision, we verified that screening numbers were also provided in the tool (or to CDC in year 5). Each year, before releasing the Program 1 annual CAT summary data to grantees, CDC also compared the data reported in the CAT with information in the fiscal database on approved, expended, and carryover funds. We generally found high levels of concordance.

To analyze the Program 1 CAT, we calculated staff cost per activity by using salary information and hours spent by staff members on each activity. We also calculated cost of contracts by activity and prepared a summary of cost data for each submission for each grantee's review and approval. The summary provided grantees with information on the labor and nonlabor cost per activity and costs by budget category and in-kind contributions.

We performed 4 different analyses. First, we examined the distribution of funding from CDC, in-kind, and other sources. This evaluation of funding was essential to identify the extent to which assessments based on CDC funding alone would provide valid results and whether all funding sources needed to be considered. Second, we analyzed the cost by budget categories because certain types of data, such as contracts, tend to be more difficult to allocate to specific activities. Third, we examined the distribution of expenditures for screening promotion activities, screening provision activities, and overarching activities for each year of the program. On the basis of qualitative feedback from grantees, we anticipated that the overarching component would be high in year 1 because a large proportion of resources was initially allocated to planning activities; similarly, screening provision costs would be low because of the contracts that needed to be executed before initiating screenings of eligible individuals. Fourth, we evaluated the percentage of total expenditures that was not allocated to specific activities by year (ie, reported as miscellaneous "other" activity) and summarized the "other" activity category across all program years. As a quality measure, we required that at least 95% of the total funding be allocated to specific budget categories.

We compared the number of people screened based on data from both the Program 1 CAT and from the CCDEs. For grantees reporting other funding sources in addition to CDC dollars and where the other sources were earmarked for screening provision, we anticipated higher reported numbers of people screened. To reduce the reporting burden, in year 5 we did not require grantees to report the number of people screened if they received only CDC funding. We asked only grantees who received funds from non-CDC sources to report screens in the Program 1 CAT and used the screens reported in the CCDEs for grantees who reported only CDC funding (some of these grantees continued to voluntarily report the screens performed in the CAT). Because we could not verify additional funding for all grantees for each year in sufficient detail, we excluded selected grantees from this comparative analysis. We excluded grantees if they had not yet begun screening (generally during year 1) and if they reported extra funding inconsistently across years (eg, if a grantee reported extra funding in years 1, 3, and 4 but not in 2, they were excluded because screens sometimes overlap across years, and we could not ensure accuracy). Overall, we had a total of 45 program years with only CDC funds for screening, and 57 program-years with other funding for screening.

Results

On average, most funding (85.6%) was from CDC (Figure 1). A smaller proportion of grantees indicated that they received in-kind contributions (7.8%) or funding from other sources (6.6%). The total amount from all sources equaled $148,016,341.

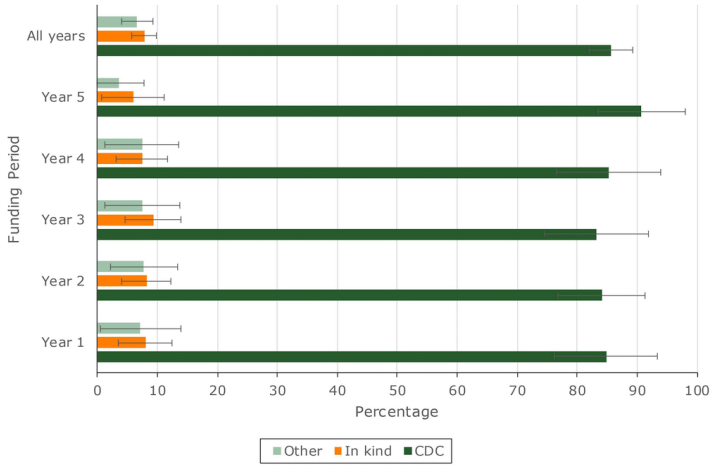

Figure 1. Percentage distribution of funding sources, by year, Colorectal Cancer Control Program, 2009–2014. Error bars indicate confidence intervals.

In year 1, most costs (43.8%) were for overarching activities, which decreased to 37.2% by year 5 (Table 1). Screening promotion activities costs accounted for one-third of cost in year 1 and decreased to 27.5% by year 5. Screening provision activities comprised the smallest percentage of total costs in year 1 and ranged from 34% to 39% for years 2 to 5. The total amount by year ranged from $22,612,125 in year 1 to $33,037,756 in year 2.

The largest total cost category in all years was contracts, materials, and supplies (Figure 2). This category was intended primarily for nonclinical services and averaged 39.4% across the years. Con-

tracts generally comprised the largest part of these costs, while materials and supplies accounted for a smaller portion. The lowest costs were in the consultants category: grantees reported using less than 4% of their funding for consultants in any year.

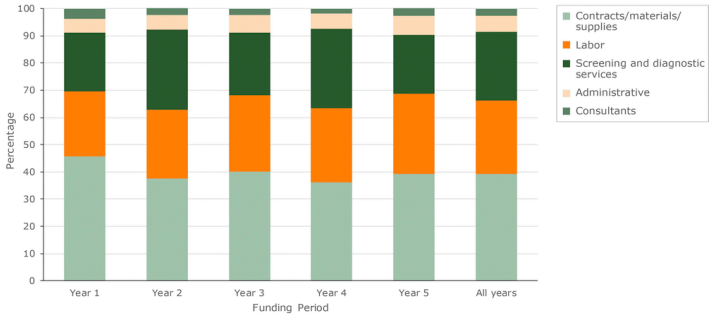

Figure 2. Percentage distribution of total cost by budget category, Colorectal Cancer Control Program, 2009–2014.

Overall, grantees were able to allocate more than 95% of their costs to specific program activities. Across years, grantees were unable to allocate approximately 2.4% of costs among promotion activities, 0.8% of costs among provision activities, and 1.8% of costs among other activities (Table 2).

Grantees who received funding from other sources reported higher average screening numbers in the Program 1 CAT compared with the CCDEs (Table 3). Across all years, grantees with additional funding reported an average absolute difference of 976 individuals screened compared with what was reported in the CCDEs. Grantees that did not report additional funding reported similar screening numbers as in the Program 1 CAT and the CCDEs with an average absolute difference across all years of 6.

Discussion

We described how we developed and used a standardized cost data collection instrument to support an economic evaluation of grantees participating in Program 1. We collected data from grantees annually for 5 years. We found that, in addition to CDC, in-kind cost contributions and funding from other sources were important sources of assistance to the programs, although not all grantees indicated that they were recipients of additional contributions. Among those who did, many did not receive or report additional contributions consistently. This may account for the slight variation in distribution of funding sources across years, particularly in the last year of the program. To collect this data more accurately in the future, grantees need to be provided guidance on how to collect this information.

Spending for overarching activities, those that supported both screening promotion and screening provision activities, were a significant portion of grantees' expenditures, particularly in the early years. This was not surprising because programs were in their start-up phases and had not yet begun in earnest to promote or provide CRC screening. Grantees needed time, for example, to hire their staff and form partnerships to make the programs viable. As the programs were implemented, the proportion of funding used for these overarching activities generally decreased, as expected.

All grantees reported cost data by budget category, and more than half of expenditures was allocated to labor and to screening and diagnostic services. On the basis of previous experience in using a cost tool (to collect resource use data for the National Breast and Cervical Cancer Early Detection Program), labor and clinical service costs are typically captured accurately (15). However, allocating contracts expenditures can be more difficult to accomplish systematically because contract funds are provided to partners who often do not report details on the activities performed to the grantees. Future studies can be designed to collect additional information in a consistent manner from partner organizations to increase the completeness and quality of the activity-based cost assignment.

We found that grantees were able to collect and assign most of their costs to activities conducted during the program years. All grantees were able to allocate 95% or more of their funding to specific activities in the Program 1 CAT. To achieve this detailed reporting, we found numerous processes critical. First, it was important to solicit grantee input in formulating the activity listing in the CAT. Although there was a focus on evidence-based interventions recommended in *The Guide to Community Preventive Services* by the Community Preventive Services Task Force (such as client reminders and small media), grantees also conducted screening promotion activities that were not evidence-based interventions (eg, patient navigation, professional training) that we ultimately included in the Program 1 CAT (16). Second, grantee input during the design of the web-based CAT was invaluable in terms of creating a user-friendly tool. The web-based CAT had embedded checks to ensure efficiency in collection of high-quality data, which included a 1-step review and finalization process before submission. Third, we had a dedicated staff person provide technical assistance to grantees via telephone or email. We also drafted a detailed user's guide that contained definitions of activities and step-by-step instructions on how to enter data.

We found it was essential on the Program 1 CAT to solicit from grantees the number of people screened for CRC and the number of screens conducted. Nearly 15% of funding was from sources other than CDC, and much of this funding was allocated to screen-

ing provision. Grantees with additional funding sources were able to conduct more screens than grantees who did not report added funding. Had we not asked for this information, we would have substantially underestimated the number of people screened. With the complete screening information available in the CAT, we were able to perform a comprehensive assessment of the cost per screen to inform future program planning (15,17).

We encountered numerous limitations in analyzing cost data collected by grantees. Although we collected 5 years of data from grantees, the ultimate sample size was small for each period (26 grantees in year 1, 29 grantees in years 2–5). We attempted through trainings and the user's guide to define the program activities for the grantees and designate how to allocate time. Although in most cases we were able to attribute most of the costs to program activities, some inconsistencies are likely in how grantees ultimately defined the activities. We also anticipated recall bias related to time inputs, although we tried to alleviate that through training and by encouraging tracking of data prospectively. Lastly, some grantees were unable to disaggregate contracts and other inputs into activities and could only report them as a lump sum. These were allocated into the "other" categories.

We provide details on the methods used to collect data on activity-based expenditures and funding sources. These data are necessary to plan for optimal use of resources, and the additional details in these data are advantageous compared with previously existing resources such as budget or funding information. Although the focus of the CAT is specifically on cost and resource collection for the Demo and for Program 1, the CAT can be customized. For example, the CAT has been used with success in estimating cost and resource use for both national and international cancer registries and for other cancer screening programs (18–26). On the basis of lessons learned from this 5-year data collection effort, the CAT was redesigned and tailored for each individual grantee for Program 2 (2015–2020), which is the next iteration of the Program.

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Author Information

Corresponding Author: Sonja Hoover, MPP, 307 Waverley Oaks Rd, Suite 101, Waltham, MA 02452. Telephone: 781-434-1722. E-mail: shoover@rti.org.

Author Affiliations: [1]RTI International, Waltham, Massachusetts. [2]Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia.

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Tables

Table 1. Distribution of Total Costs, by Year and Activity, Colorectal Cancer Control Program, 2009–2014

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	All Years
Screening promotion activities, % (95% CI)	33.1 (25.5–40.8)	26.8 (20.5–33.2)	26.7 (21.1–32.3)	24.2 (18.5–29.9)	27.5 (21.8–33.3)	27.6 (24.8–30.3)
Screening provision activities, % (95% CI)	23.0 (16.9–29.2)	33.7 (27.4–40.0)	33.8 (28.8–38.8)	38.6 (33.0–44.1)	35.2 (29.6–40.9)	33.1 (30.4–35.7)
Overarching activities, % (95% CI)	43.8 (36.1–51.6)	39.5 (31.7–47.3)	39.4 (33.6–45.3)	37.3 (31.5–43.0)	37.2 (31.7–42.7)	39.4 (36.4–42.3)
Total costs, $	22,612,125	33,037,756	32,247,955	31,439,050	28,679,456	148,016,341

Abbreviation: CI, confidence interval.

Table 2. Percentage of Total Costs Allocated to "Other" Cost Category[a], Colorectal Cancer Control Program, 2009–2014

Activity	Year 1 (95% CI)	Year 2 (95% CI)	Year 3 (95% CI)	Year 4 (95% CI)	Year 5 (95% CI)	All years (95% CI)
Promotion: other screening promotion activities	2.7 (1.2–4.2)	3.5 (1.1 to 6.0)	2.7 (0.9 to 4.5)	1.0 (0.0 to 2.0)	2.2 (0.4 to 4.0)	2.4 (1.6 to 3.2)
Provision: other screening provision activities	0.9 (−0.6 to 2.4)	0.6 (−0.1 to 1.3)	1.2 (0.0 to 2.4)	0.2 (−0.1 to 0.4)	0.9 (0.3 to 1.5)	0.8 (0.3 to 1.2)
Other activities	1.9 (0.9 to 2.8)	1.3 (0.1 to 2.6)	1.1 (−0.1 to 2.3)	2.2 (0.6 to 3.8)	2.7 (1.6 to 3.8)	1.8 (1.3 to 2.4)

Abbreviation: CI, confidence interval.
[a] Activities in the "other" category were combined activities that received lump-sum amounts that could not be easily divided among existing activities or were activities that were not included in the list of activities provided to grantees.

Table 3. Comparison of Number of People Screened[a] Reported in Program Cost Assessment Tool (CAT) and CDC Colorectal Cancer Clinical Data Elements (CCDEs)[b]

Category (No. of Grantees)	Average Absolute Difference Between Reporting Methods					
	Year 1	Year 2	Year 3	Year 4	Year 5[c]	All Years
Grantees reporting extra funding (57)[d]	1,284	1,032	689	978	978	976
Grantees not reporting extra funding (45)[e]	3	15	5	3	1	6

[a] Number of people who reported having a colorectal cancer screen using either fecal occult blood test, fecal immunochemical test, sigmoidoscopy, or colonoscopy.
[b] Average absolute difference was calculated by averaging the absolute differences between the number of individuals screened and reported in the CAT and the number screened and reported in the CCDEs. The total number of screens reported on the CAT was 76,297 (ranging from 16 to 9,762) and on the CCDEs was 20,997 (ranging from 16 to 1,460).
[c] Exclusions are different than in previous years because in year 5 we allowed grantees to defer to CCDEs numbers instead of reporting screening numbers on the CAT.
[d] The number of grantees included who reported extra funding was 8, 13, 14, 12, and 10 in years 1, 2, 3, 4, and 5, respectively.
[e] The number of grantees included who did not report extra funding was 10, 9, 9, 11, and 6 in years 1, 2, 3, 4, and 5, respectively.

Appendix. Description of Colorectal Cancer Control Program Activities

Program Activity	Description
1. Screening promotion activities	
1a) Client reminders	Reminders include letters, postcards, emails, or phone calls to alert patients that it is time for their cancer screening. Some reminders note only that the test is due, while others include facts about the screening or offer to help set up an appointment in addition to including a reminder that the test is due.
1b) Small media	Small media include videos and printed materials such as letters, brochures, and newsletters. These materials can be used to inform and motivate people to be screened for cancer. They can provide information tailored to specific individuals or targeted to general audiences.
1c) Mass media	Mass media include radio, television, billboards, magazines, newspapers, public service announcements, and advertisements.
1d) Outreach/incentives/patient education	Outreach/incentives/education include outreach activities, such as attendance and activities at health fairs, costs of incentives to patients to participate in programs, and activities related to patient education.
1e) Provider assessment and feedback	These interventions assess how often providers offer or deliver screening to clients (assessment) and then give providers information about their performance (feedback). The feedback may describe the performance of an individual provider or of a group of providers (eg, mean performance for a practice). The performance may be compared with a goal or standard.
1f) Provider reminders	Reminders inform health care providers that it is time for a client's cancer screening test (called a "reminder") or that the client is overdue for screening (called a "recall"). The reminders can be provided in different ways, such as flagging client charts, building provider reminders into electronic medical record systems or provider office appointment systems, or by email to the provider.
1g) Reduction in structural barriers	Many structural barriers (eg, distance from screening location, limited hours of operation, lack of day care for children, language and cultural factors) can make it difficult for people to seek screening for cancer. Interventions designed to reduce these barriers may facilitate access by • Reducing time or distance between service delivery settings and target populations • Modifying hours of service to meet client needs • Offering services in alternative or nonclinical settings • Eliminating or simplifying administrative procedures and other obstacles (eg, revising clinic flow procedures, adopting electronic medical records systems) We are not asking about patient navigation services here; patient navigation for screening promotion and screening provision is covered elsewhere in the Cost Assessment Tool.
1h) Patient navigation and support	Establishing a patient support system or using patient navigators can ensure that appropriate screening, diagnostic, and treatment services are received in a timely manner. Some programs may refer to this as case management. Some roles of the patient navigator include • Assisting with scheduling appointments, transportation, or dependent care • Providing patient education about colorectal cancer screening and testing modalities regarding screening (eg, rationale, importance, bowel prep) • Reminding patients about their colonoscopy appointment or returning their fecal occult blood test/fecal immunochemical test kits • Providing peer support to help with cultural or emotional concerns (eg, allay fears)
1i) Reduction in out-of-pocket costs	Interventions could include reducing the costs of the screening tests, providing vouchers, reimbursing clients or clinics, and/or reducing health insurance costs.
1j) Enrolling in insurance programs	Assistance is provided to individuals eligible for Medicaid or other insurance programs to enroll.
1k) Other screening promotion activities (please specify)	Programs report any additional screening promotion activity that is not reportable under the above options and provide a description of the activity.
2. Screening provision activities	
2a) Manage provider contracts, billing systems, and other procedures	• Manage contract with local physicians and clinics to deliver screening services • Monitor administrative billing and reimbursement system
2b) Patient navigation and support (client directed)	Use patient navigators to ensure that timely screening and diagnostic services are provided to clients screened by the program.
2c) Provide screening and diagnostic services	Provide colorectal cancer prescreening, screening, diagnostic follow-up, and surveillance colonoscopy services.
2d) Ensure appropriate treatment of complications and cancers	Develop and execute a plan to obtain treatment services for people diagnosed with cancer or experiencing medical complications.

(continued on next page)

(continued)

Program Activity	Description
2e) Other screening provision activities (please specify)	Report any additional screening provision activity that is not reportable under the above options and provide a description of these activities.
3. Overarching activities	
3a) Program management	• Monitor program performance • Manage fiscal system • Manage contract with local physicians and clinics to deliver screening services • Coordinate administrative-related policies and procedures • Manage programmatic/administrative/reporting issues; travel for program meetings • Monitor administrative billing and reimbursement system • Recruit, hire, and train staff members as required on an ongoing basis • Continue to collaborate with Centers for Disease Control and Prevention (CDC)
3b) Quality assurance and professional development	• Monitor quality control standards and mechanisms • Continually review clinical policies and procedures • Educate and train health care professionals
3c) Partnership development and maintenance	• Maintain a relationship with the CDC-funded comprehensive cancer control implementation program • Maintain partnerships with diverse group of entities
3d) Clinical and cost data collection and tracking	• Monitor and provide feedback by using patient data tracking system • Collect and report person-level clinical data • Collect and report cost data
3e) Program monitoring and evaluation	• Collaborate with CDC in the monitoring and evaluating of the overall program • Implement program-specific monitoring and evaluation
3f) Other activities	Report any additional activities that are not reportable under the above options and provide a description of these activities.

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ORIGINAL RESEARCH

Comparison of Program Resources Required for Colonoscopy and Fecal Screening: Findings From 5 Years of the Colorectal Cancer Control Program

Sujha Subramanian, PhD[1]; Florence K.L. Tangka, PhD[2]; Sonja Hoover, MPP[1]; Maggie Cole-Beebe, PhD[1]; Djenaba Joseph, MD, MPH[2]; Amy DeGroff, PhD, MPH[2]

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PEER REVIEWED

Summary

What is already known on this topic?

Three years of program data from the Centers for Disease Control and Prevention's (CDC's) Colorectal Cancer Control Program (CRCCP) showed that although the clinical cost of colonoscopy programs was higher than the clinical cost for guaiac fecal occult blood tests and fecal immunochemical tests programs, the cost of nonclinical services required to manage the programs and deliver the screenings was similar.

What is added by this report?

CDC and RTI International collected 5 years of cost data from 29 CRCCP grantees by using a standardized data collection instrument and assessed differences in costs by screening test used.

What are the implications for public health practice?

CRCCP grantees incurred costs in addition to the clinical cost of the screening procedures to support planning and management, contracting with providers, and tracking patients.

Abstract

Introduction

Colonoscopy and guaiac fecal occult blood tests and fecal immunochemical tests (FOBT/FIT) are the most common colorectal cancer screening methods in the United States. However, information is limited on the program resources required over time to use these tests.

Methods

We collected cost data from 29 Centers for Disease Control and Prevention Colorectal Cancer Control Program (CRCCP) grantees by using a standardized data collection instrument for 5 program years (2009–2014). We created a panel data set with 124 records and assessed differences by screening test used.

Results

Forty-four percent of all programs (N = 124) offered colonoscopy (55 of 124), 32% (39 of 124) offered FOBT/FIT, and 24% (30 of 124) offered both. Overall, total cost per person was higher in program year 1 ($3,962), the beginning of CRCCP than in subsequent program years ($1,714). The cost per person was $3,153 for programs using colonoscopy and $1,291 for those using FOBT/FIT with diagnostic colonoscopy. The average clinical cost per person was $1,369 for colonoscopy and $280 for FOBT/FIT during the program (these do not reflect cost of repeated FOBT/FIT screens). Programs serving a large number of people had lower per-person costs than those serving a small volume, probably because of fixed costs related to nonclinical expenses.

Conclusion

Colorectal cancer screening programs incur costs in addition to the clinical cost of the screening procedures to support planning and management, contracting with providers, and tracking patients. Because programs can achieve potential economies of scale, partnerships among smaller programs for screening delivery could decrease overall costs.

Introduction

The Centers for Disease Control and Prevention (CDC) initiated the Colorectal Cancer Control Program (CRCCP) in 2009 to promote and provide screening to increase colorectal cancer (CRC) screening uptake in target populations. Under the program, CDC funded 29 grantees (25 states and 4 tribal organizations); grantees

generally offered free screening colonoscopy or fecal tests to low-income people who were uninsured or underinsured. In an interim analysis of CRCCP, we assessed differences in costs of clinical and nonclinical screening incurred by CRCCP grantees during the first 3 years of the program and found that the cost of screening and diagnostic services per person served was $1,150 for colonoscopy programs and $304 for FIT/FOBT-based programs (1). Overall, FOBT/FIT-based programs and colonoscopy programs incurred substantial nonclinical costs per person served ($1,018 for colonoscopy and $980 for FIT/FOBT). Examples of nonclinical costs were managing contracts with providers and program management. These findings indicated that although the clinical cost of colonoscopy programs was higher than the clinical cost of FOBT/FIT programs, the cost of nonclinical services required to manage the programs and deliver the screenings was similar.

Our study expands on this prior analysis by evaluating cost over the 5-year period of the program and potential economies of scale in program implementation by assessing factors affecting the cost of screening provision. The large sample size available for analysis allowed us to perform multivariate analysis to evaluate the effect of large versus small programs on clinical and nonclinical costs, controlling for factors such as geographic location and type of screening test used. Prior research involving other screening programs indicated that these programs have high fixed costs (2–4). We theorized that programs that screen a large number of people may have a lower cost per-person than programs that screen a smaller number, which could have important implications for program planning and implementation.

Methods

Data collection

We developed a web-based cost assessment tool, the CRCCP Cost Assessment Tool (CRCCP-CAT), to collect information from CRCCP grantees on their program activities and expenditures. CRCCP-CAT is based on established methods for collecting cost data (5–8); a previously published article and a companion article in this collection describe the development and testing of CRCCP-CAT (9,10). For the CRCCP analyses, we collected data from each of the 29 CRCCP grantees. The grantees completed the web-based CAT annually, on the basis of program year, for a 5-year period beginning in July 2009 and ending in June 2014.

We collected cost information on the following: program funding source (CDC; other federal, nonfederal, state, or in-kind) and budget categories (staff salaries, contract expenditures, purchases of materials and equipment, and administration or overhead costs). Program staff members allocated these costs to screening activities, promotion activities, and overall program activities such as program management, partnership development, and administration. Promotion costs are discussed in a companion article in this collection (11). On the basis of the data provided in CRCCP-CAT, we allocated proportions of staff salary (based on number of hours and percentage of time worked) to specific activities. We then aggregated data on labor costs, nonlabor costs, and in-kind contributions for each activity for each grantee by year. Summaries of these data were sent to grantees annually for their review and approval.

The total sample size available for analysis was 124 program years over the 5-year period. We created a panel data set, which included each year of the program as 1 entry, and we reported our sample size in program years. Massachusetts (all years) and the Alaska Native Tribal Health Commission (all years) were excluded from the analyses because we were unable to disaggregate the clinical and nonclinical costs from contract payments in sufficient detail. Alabama, California, Iowa, New Mexico, and Oregon were all excluded in year 1 because they had not yet begun activities; Georgia, Michigan, and Nevada were not included in year 1 because they had not yet begun CRCCP. Georgia was also excluded from year 2 and Oregon from years 2 and 3 because their screening activities had not yet commenced during those years.

Descriptive analyses

We stratified the programs by type of screening test used: colonoscopy, FOBT/FIT, and programs that used both tests. Fecal tests that include FOBT and FIT were offered as screening tests, and colonoscopy was offered as screening and for follow-up diagnostic procedures. Programs with both tests offered both fecal tests and colonoscopy for colorectal cancer screening. Some programs also offered surveillance colonoscopies, and these were reported separately from screening colonoscopies.

We identified key characteristics of the program, including the region and number of people served by the program, which was categorized as large (>500), medium (235–500), and small (<235) on the basis of the distribution of the underlying data. We also reported screening and diagnostic procedures for each type of program, including number of people who were screened or received surveillance colonoscopies, number of diagnostic procedures, and number of people identified with polyps. Use rates for the procedures were derived from information provided in CRCCP-CAT and from CRC clinical data elements that were collected from all programs by CDC (Office of Management and Budget [OMB] control no. 0920–0745).

We stratified cost information by the following activities: 1) direct clinical activities, such as provision of screening tests, diagnostic services, and surveillance procedures; 2) direct nonclinic-

al activities, such as managing provider contracts and billing systems and providing patient navigation and patient support services; and 3) indirect nonclinical overarching activities, such as program management and administration (Box).

Box. Component Activities of the Colorectal Cancer Control Program, 2009–2014

Direct clinical activities
Screening and diagnostic services
Surveillance procedures
Direct nonclinical activities
Provider contracts, billing systems, other billing procedures
Patient navigation and support
Labor costs for screening and diagnostic services (if reported)
Ensure cancer treatment
Other screening provision activities
Indirect nonclinical overarching activities (related to both screening promotion and screening procedures)
Program management
Quality assurance/professional development
Partnership development and maintenance
Clinical and cost data collection and tracking
Program monitoring and evaluation
Administration
Other activities

We calculated the cost per person aggregated across all program years and the cost for each program year to examine patterns across the 5-year period. We estimated adjusted costs (multivariate regression controlling for region, size of population served, and type of screening test) for total cost per person for direct clinical costs, direct nonclinical costs, and indirect costs. We estimated the average incremental effect on cost of each explanatory variable as the difference from one of the exponentiated coefficients and multiplying by the mean of the variable. Cost data were adjusted for regional differences by using the Bureau of Labor Statistics' Employment Cost Index.

Multivariable regression specification

We used multivariate analysis to assess the effect of volume of people screened on cost per person. We examined the total cost per person served by 3 cost components: total direct clinical cost, total direct nonclinical cost, and total indirect cost (12–14). Results of a Hausman test indicated that a fixed effects model was not appropriate for this panel data and that a mixed effects model should be used (15). We used a generalized linear model (GLM) with log link and specified a gamma distribution. We included data for years 2 to 5 in the regression estimation. We excluded year 1 because this was the start-up period, anticipating that costs for this year would differ from other program years.

GLM with log link allowed us to exponentiate the coefficient estimates without the need for a retransformation as is required when estimating a log–linear model. Regression results were tabulated in terms of the incremental effect on average cost. We used the Stata statistical package, version 14.0 (StataCorp LLC) to conduct all regression analyses and statistical tests of the model.

Results

Overall, 44.4% (55 of 124) of the programs assessed used colonoscopy as the primary screening test; 31.5% (n = 39) used FOBT/FIT, and 24.2% (n = 30) used both tests (Table 1). Of the programs that offered colonoscopy as the primary screening test, the greatest percentage (36.4%; n = 20) was in the Northeast, whereas of the 39 programs that offered FOBT/FIT as the primary screening test, most (61.5%; n = 24) were in the West. Forty-three percent (13 of 30) of the programs offering both tests were also located in the West. Programs offering FOBT/FIT and both types of tests were more likely to serve a large population (FOBT/FIT, 46.2% [18 of 39]; both tests, 63.3% [19 of 30]) than colonoscopy programs (10.9% [6 of 55]). On average, grantees using both tests screened 2,152 people over the 5-year period, followed by grantees using FOBT/FIT (683 people)) and grantees using colonoscopy (254 people). We also assessed program testing method by program characteristics (Table 2).

Overall, total cost per person decreased from year 1 ($3,962) to year 5 ($1,841); average cost across years 2,3,4, and 5 was $1,714. On average, the cost per person was highest in year 1 for each component. For example, in year 1, direct clinical cost per person was $1,068, decreasing in year 2 to $793, and remaining similar over the remaining years (Figure). Overall, the cost per person was high in year 1 compared with years 2 through year 5 for each component.

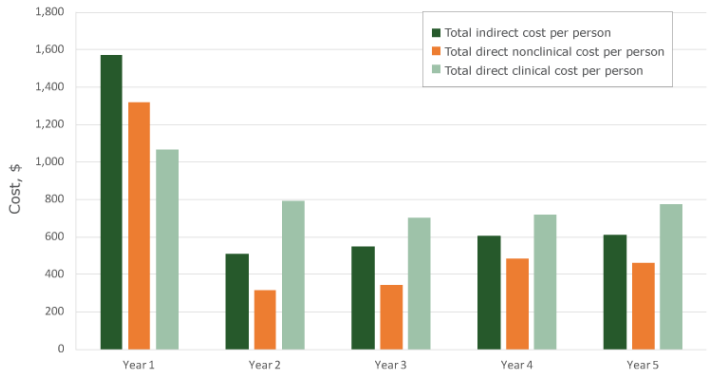

Figure. Five-year trends, cost per person screened, Colorectal Cancer Control Program, calculated on the basis of 124 program years, 2009–2014.

Cost per person by type of screening test varied significantly across the 3 test types (Table 3). On average, screening tests cost $2,060 per person, ranging from $1,057 for both tests to $3,153 for colonoscopy. All components were, on average, most expensive for colonoscopy programs; total costs per person were $1,369 for direct clinical costs, $863 for nonclinical costs, and $921 for indirect costs. By comparison, total cost per person for FOBT/FIT were $280 for direct clinical costs, $375 for direct nonclinical costs, and $636 for indirect costs. Total per person costs for both tests were $411 for direct clinical costs, $173 for direct nonclinical cost was, and $473 for indirect cost.

Examining the estimates for adjusted total cost per person, we found that programs using colonoscopy screening had an average $1,104 higher total cost per person served compared with programs using FOBT/FIT tests in years 2 through 5 (Table 4). Increased size of the population served lowered total cost significantly; in years 2 through 5, average costs for programs with medium populations were $899 lower than programs with small populations served, and programs with large populations were $1,313 lower.

The total number of people screened had some effect on the direct clinical cost per person; programs with large populations screened had $292 lower costs than programs with small populations screened. Colonoscopy programs had a higher direct clinical cost than FOBT/FIT programs ($2,365 higher).

Our estimates for total direct nonclinical cost per person served show that type of screening test did not affect direct nonclinical costs (Table 4). Similar to total costs, costs for programs with large populations served were $352 lower than programs with small populations served, whereas costs for programs with medium populations served were $270 lower.

We also found that total indirect cost per person served was significantly lower among programs with larger populations served (Table 4). The average indirect cost per person served was $467 lower among programs with a large population served and $320 lower among programs with a medium population served, compared with programs with a small population served. Region also significantly affected these costs. Programs in the Northeast had an average $179 lower indirect cost per person served than programs in the South.

Discussion

We compared the clinical and nonclinical costs across program years among CRCCP grantees offering colonoscopy, FOBT/FIT, or both tests for CRC screening. Our findings expand on our prior analysis and use 5 years of data to quantify the presence of economies of scale — programs that screen a larger number of people had lower cost per person than programs that screen a smaller number of people. After controlling for type of screening test, programs serving large and medium-size populations had per-person costs that were about $1,300 and $900 lower, respectively, than programs serving small populations.

Another key finding from our study was that public health–led CRCCP programs incurred substantial nonclinical costs. These costs are important to consider when planning future programs. On average, these costs were lower for programs with large patient volumes than for programs with small patient volumes. These findings indicate that substantial fixed costs are associated with nonclinical activities. These results are further evidence that economies of scale exist in CRC screening programs, as reported in other studies (2–4).

Analysis of patterns in cost per person indicated differences in cost between the first year and subsequent years of the program. The average cost per person served in the first year was twice that of the other years. This higher cost in the first year likely reflects start-up costs incurred by the programs while planning and beginning implementation. Furthermore, the number of people screened was generally lower in the first year. Any nonclinical costs incurred in the first year would have to be distributed across a much smaller cohort. High start-up costs in the initial years of the program were also reported in other studies (3,16,17), suggesting that first-year costs should perhaps be analyzed separately and not pooled with costs incurred in subsequent program years.

Additionally, we identified some differences across programs related to type of screening test used. The clinical cost of colonoscopy was almost 5 times the cost of FOBT/FIT per person when screening and diagnostic follow-up tests were included. Therefore, programs that use colonoscopy will only be able to screen about

one-fifth the number of people that FOBT/FIT programs can for the same level of funding in the initial years of the program. This cost would only affect the number of people screened in the short term because colonoscopy is recommended every 10 years for those at average risk and with normal results, whereas FOBT/FIT is recommended to be performed annually. The clinical costs over a 10-year period for colonoscopy and FOBT/FIT may not be substantially different. We did not find any consistent evidence of variation in indirect costs and direct nonclinical costs by type of screening test used. FOBT/FIT tests were the preferred approach when the primary goal was to offer first-time screening to a large cohort over a short period; we did not study FOBT/FIT with repeated testing. Future studies could assess additional program costs that may be incurred, to ensure adherence with colorectal cancer screening recommendations over the long term. Furthermore, we found some regional and screening test–related differences in indirect costs; future studies could explore whether these findings are replicated in other settings and the possible reasons for these differences.

The strength of the present cost analysis is that we were able to perform high-quality analysis by collecting and quantifying resources and using consistent definitions for program activities. Furthermore, we collected data across 5 years from multiple programs to yield a substantial panel data set of 124 program years. These cost data were consistently collected over a longer period than any other federally supported screening program and allowed for multivariate analysis, controlling for some determinants of potential variation across the programs.

Our analysis has several potential limitations. First, we used program year to assess potential year-to-year variation, but programs generally operate on a continuous basis. Therefore, screening tests could be performed in one year, while diagnostic follow-up and treatment, if required, could be provided in the following year. As a result, classification of costs and number screened in specific periods are not always an accurate reflection of program activities. Second, the study does not account for cost per patient over an extended period to compare the long-term cost of colonoscopy versus FOBT/FIT-based programs. We only report cost for the first testing period (screening and diagnostic tests required), and our estimates do not provide the overall cost of FIT/FOBT and colonoscopy programs. Third, there could be variation across programs by type of screening test used (eg, colonoscopy vs FOBT/FIT). This variation could influence the costs reported and may not have been adequately controlled in our analysis. Future research could systematically assess the factors that can lead to cost differences of activities by type of screening test selected.

Our analysis of the activity-based cost data across 5 years of the CRCCP reveals potential economies of scale: programs with larger screening volume incurred a lower cost per person served than smaller-volume programs. Therefore, encouraging partnerships to foster large-scale programs could be more efficient than funding multiple small screening programs. Additionally, CRC screening programs incur substantial nonclinical costs, regardless of type of test the program offers. Future CRC control programs might consider both these clinical and nonclinical costs when planning program implementation and evaluating program cost-effectiveness.

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Author Information

Corresponding Author: Sujha Subramanian, PhD, RTI International, 307 Waverley Oaks Rd, Ste 101, Waltham, MA 02452. Telephone: 781-788-8100. Email: ssubramanian@rti.org.

Author Affiliations: [1]RTI International, Waltham, Massachusetts. [2]Centers for Disease Control and Prevention, Atlanta, Georgia.

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Tables

Table 1. Program Characteristics and Clinical Services by Type of Primary Screening Test for All Program Years[a], Centers for Disease Control and Prevention Colorectal Cancer Control Program, 2009–2014

Characteristic	All (N = 124)	By Type of Test		
		Colonoscopy (n = 55)	FOBT/FIT (n = 39)	Colonoscopy and FOBT/FIT (n = 30)
By screening test	NA	44.4	31.5	24.2
Region, mean (95% confidence interval)				
Northeast[b]	20.2 (13.0–27.3)	36.4 (23.2–49.5)	0	16.7 (2.5–30.8)
Midwest[c]	18.6 (11.6–25.5)	9.1 (1.3–16.9)	28.2 (13.4–43.0)	23.3 (7.3–39.4)
South	17.7 (10.9–24.6)	23.6 (12.1–35.2)	10.3 (0.3–20.2)	16.7 (2.5–30.8)
West[c]	43.6 (34.7–52.4)	30.9 (18.3–43.5)	61.5 (45.6–77.5)	43.3 (24.5–62.2)
Size of population screened by program size[d], mean (95% confidence interval)				
Large population[b]	34.7 (26.2–43.2)	10.9 (2.4–19.4)	46.2 (29.8–62.5)	63.3 (45.0–81.6)
Medium population[c]	36.3 (27.7–44.9)	45.5 (31.9–59.0)	38.5 (22.5–54.4)	16.7 (2.5–30.8)
Small population[b]	29.03 (20.93–37.13)	43.6 (30.1–57.2)	15.4 (3.5–27.2)	20.0 (4.8–35.2)
Program reach, mean (95% confidence interval)				
No. of people screened[b]	848.0 (540.8–1,155.3)	253.9 (208.6–299.2)	683.3 (518.5–848.1)	2151.5 (981.6–3321.4)
No. of people under surveillance[b]	23.5 (15.8–31.2)	15.7 (9.3–22.0)	21.3 (11.9–30.8)	40.8 (13.4–68.1)
No. of diagnostic tests performed[b]	41.3 (25.1–57.5)	7.3 (5.2–9.4)	44.2 (29.9–58.5)	99.9 (38.7–161.0)
No. of polyps detected[b]	47.5 (41.0–54.1)	61.4 (50.7–72.0)	27.2 (20.0–34.4)	48.6 (35.1–62.1)

Abbreviation: FOBT/FIT, fecal occult blood test/fecal immunochemical test; NA, not applicable.
[a] Unit of analysis is program year. Total sample size available for analysis was 124 program years over the 5-year period. We used the χ^2 test to test for differences across the types of colorectal cancer screening tests.
[b] $P < .001$.
[c] $P < .05$.
[d] Small population = 228,339–736,635; medium population = 854,624–1,618,255; large population = 1,749,719–9,472,316.

Table 2. Program Testing Method by Program Characteristics, Centers for Disease Control and Prevention Colorectal Cancer Control Program, 2009–2014[a]

Characteristic	Colonoscopy	FOBT/FIT	Colonoscopy and FOBT/FIT
Region			
Northeast (n = 20)	80.0 (60.8 to 99.2)	0	20.0 (7.9 to 39.2)
Midwest (n = 20)	20.0 (0.8 to 39.2)	50.0 (6.0 to 74.0)	30.0 (8.0 to 52.0)
South (n = 19)	57.9 (33.5 to 82.3)	21.15 (0.9 to 41.2)	21.1 (0.9 to 41.2)
West (n = 46)	30.4 (16.6 to 44.3)	47.8 (32.8 to 62.8)	21.7 (9.4 to 34.1)
Population density			
Large population (n = 38)	13.2 (1.9 to 24.4)	42.1 (25.7 to 58.6)	44.7 (28.2 to 61.3)
Medium population (n = 43)	NA	34.9 (20.0 to 49.7)	9.3 (0.3 to 18.4)
Small population (n = 24)	66.7 (46.3 to 87.0)	20.8 (3.3 to 38.4)	12.5 (−1.8 to 26.8)

Abbreviation: FOBT/FIT, fecal occult blood test/fecal immunochemical test; NA, not applicable.
[a] Values are percentage (95% confidence interval).

Table 3. Cost per Person Screened by Type of Primary Test, Centers for Disease Control and Prevention Colorectal Cancer Control Program, 2009–2014

Type of Cost[a]	All	By Type of Test		
		Colonoscopy	FOBT/FIT	Colonoscopy and FOBT/FIT
Total cost per person[b]	2,060 (1,565–2,556)	3,153 (2,175–4,132)	1,291 (787–1,794)	1,057 (631–1,482)
Total direct clinical cost per person[b]	795 (631–958)	1,369 (1,069–1,669)	280 (216–343)	411 (283–539)
Total direct nonclinical cost per person[b]	543 (260–826)	863 (261–1,465)	375 (87–663)	173 (50–295)
Total indirect cost per person[b]	723 (535–912)	921 (552–1,290)	636 (390–882)	473 (238–708)

Abbreviation: FOBT/FIT, fecal occult blood test/fecal immunochemical test.
[a] All costs include in-kind contributions and were adjusted by using the Employment Cost Index for regional differences. Values are US dollars (95% confidence interval).
[b] $P < .001$. We used the χ^2 test to test for differences across the types of CRC screening tests.

Table 4. Adjusted Cost per Person Screened, Years 2 to 5, Centers for Disease Control and Prevention Colorectal Cancer Control Program, 2009–2014[a]

Variable	Total Per Person	Direct Clinical	Direct Nonclinical	Indirect
Region				
South				1 [Reference]
Northeast	(95) (−550 to 537)	(122) (−355 to 251)	70 (−177 to 587)	(179)[b] (−301 to −2)
Midwest	(31) (−513 to 642)	28 (−274 to 524)	(6) (−218 to 447)	(76) (−231 to 150)
West	318 (−179 to 976)	(16) (−254 to 337)	222 (−77 to 797)	90 (−89 to 336)
Size of population served by the program[c]				
Small population served				1 [Reference]
Large population served	−1,313[c] (−1,412 to −1181)	−292[b] (−445 to −62)	−352[d] (−377 to −302)	−467[d] (−495 to −429)
Medium population served	−899[d] (−1,098 to −636)	−118 (−325 to 192)	−270[d] (−333 to −150)	−320[d] (−388 to −226)
Screening test				
FOBT/FIT				1 [Reference]
Colonoscopy	1,104[d] (439 to 1,974)	2,365[c] (1 to 319 to 3 to 940)	76 (−139 to 469)	−64 (−196 to 115)
FOBT/FIT and colonoscopy	−215 (−563 to 237)	249 (−49 to 675)	−108 (−245 to 151)	−139 (−252 to 15)

Abbreviation: FOBT/FIT, fecal occult blood test/fecal immunochemical test.
[a] All costs include in-kind contributions and were adjusted by using the Employment Cost Index for regional differences. All estimates are based on multivariate analysis; each column is a separate regression. Values are dollars (95% confidence interval). Results are for years 2–5 (N = 105).
[b] $P < .05$.
[c] Small population = <235; medium population = 235–500; large population = >500.
[d] $P < .001$.

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ORIGINAL RESEARCH

Expenditures on Screening Promotion Activities in CDC's Colorectal Cancer Control Program, 2009–2014

Florence K. L. Tangka, PhD[1]; Sujha Subramanian, PhD[2]; Sonja Hoover, MPP[2]; Maggie Cole-Beebe, PhD[2]; Amy DeGroff, PhD[1]; Djenaba Joseph, MD, MPH[1]; Sajal Chattopadhyay, PhD[1]

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PEER REVIEWED

Summary

What is already known on this topic?

Colorectal Cancer Control Program grantees spent most of their funding on interventions recommended by the Community Guide. However, a third of grantees' funding was spent on interventions not recommended by the Community Guide.

What is added by this report?

Our results update previous estimates and provide data on the resources expended and the factors associated with using evidence-based interventions recommended by the Community Guide.

What are the implications for public health practice?

These findings will support future colorectal cancer program planning to ensure that resources are used to implement evidence-based interventions. Economic evaluations inform future scale-up and improve the efficiency of colorectal cancer screening programs to achieve the Healthy People 2020 objective.

Abstract

Introduction

The Centers for Disease Control and Prevention (CDC) established the Colorectal Cancer Control Program (CRCCP) in 2009 to reduce disparities in colorectal cancer screening and increase screening and follow-up as recommended. We estimate the cost for evidence-based intervention and non–evidence-based intervention screening promotion activities and examine expenditures on screening promotion activities. We also identify factors associated with the costs of these activities.

Methods

By using cost and resource use data collected from 25 state grantees over multiple years (July 2009 to June 2014), we analyzed the total cost for each screening promotion activity. Multivariate analysis was used to assess the factors associated with screening promotion costs reported by grantees.

Results

The promotion activities with the largest allocation of funding across the years and grantees were mass media, patient navigation, outreach and education, and small media. Across all years of the program and across grantees, the amount spent on specific promotion activities varied widely. The factor significantly associated with promotion costs was region in which the grantee was located.

Conclusion

CDC's CRCCP grantees spent the largest amount of the screening promotion funds on mass media, which is not recommended by the Community Preventive Services Task Force. Given the large variation across grantees in the use of and expenditures on screening promotion interventions, a systematic assessment of the yield from investment in specific promotion activities could better guide optimal resource allocation.

Introduction

Colorectal cancer (CRC) screening can reduce the burden of this disease and is recommended in guidelines (1–3). Analysis of data from the Behavioral Risk Factor Surveillance System showed that the prevalence of having had CRC screening was 67.3% (4), lower than the Healthy People 2020 goal of 70.5% and the National Colorectal Cancer Roundtable goal of 80% by 2018 (5). Even though the use of CRC screening tests has increased, screening use is lower among certain populations, such as the uninsured and those with less than a high school education (6). To reduce these disparities and increase quality screening and appropriate follow-up for CRC, the Centers for Disease Control and Prevention (CDC) established the Colorectal Cancer Control Program

(CRCCP) in 2009. CDC provided funding and technical assistance to 29 grantees (25 states and 4 tribal organizations) to increase CRC screening through population-level, evidence-based interventions (EBIs) and provide direct CRC clinical screening services to low-income uninsured and underinsured adults aged 50 to 64 years (7). EBIs are activities recommended by the Community Preventive Services Task Force (Community Guide) to increase CRC screening test use and include client reminders, provider reminders, provider assessment and feedback, and reducing structural barriers (8). Non-EBIs are screening promotion activities that were selected and used by grantees but have not been recommended by the Community Guide.

The objective of this study was to update the previous report (9) by using 5 years (2009–2014) of data to estimate the cost for EBI and non-EBI screening promotion activities and to examine expenditures on screening promotion activities. Results from this study will provide the economic basis to understand the resources expended on EBIs recommended by the Community Guide and evaluate the factors associated with the use of EBIs. These findings will support future CRC program planning to ensure that resources are used for implementing EBIs. Economic evaluations are essential to inform future scale-up and improve the efficiency of CRC screening programs to achieve the Healthy People 2020 objective.

Methods

Data were collected about grantees' expenditures for activities by using a web-based cost assessment tool (CRCCP-CAT). The design of the CRCCP-CAT was based on previously published methods to collect activity-based cost data for program evaluation (10–13). Grantee staff were trained to use the web-based CRCCP-CAT via webinars, a user's guide, and technical assistance. The web-based version of the tool allowed for real-time data collection. Because of embedded data checks, the quality of data reporting was also higher than prior testing with a Microsoft Excel–based instrument (14). Staff from CRCCP-funded grantees completed the CRCCP-CAT annually from July 2009 through June 2014.

By using the CRCCP-CAT, grantees provided information on funding from all sources: CDC, other federal, nonfederal, and in-kind contributions. Grantees reported on the following budget categories: staff salaries, contract expenditures, purchases of materials and equipment, and administration or overhead costs. Costs and resources used were then allocated to specific grantee activities related to screening promotion, screening provision, and overarching activities that supported both screening promotion and provision activities; all labor and nonlabor costs were assigned to the specific activities performed by the grantees (Box).

Box. Screening Promotion, Screening Provision, and Overarching Components of the Colorectal Cancer Control Program, 2009–2014

Screening Promotion Activities

- Client reminders
- Small media
- Provider assessment and feedback
- Provider reminders
- Reducing structural barriers (including patient navigation)
- Mass media
- Reducing out-of-pocket cost
- Enrolling in insurance programs
- Outreach, education, and incentives
- Patient navigation and support
- Other promotion activities

Five screening promotion activities (client reminders, small media, provider assessment and feedback, provider reminders, and reducing structural barriers) are evidence-based interventions and supporting activities recommended by the Community Preventive Services Task Force and published in the *Guide to Community Preventive Service*s for increasing colorectal cancer screening compliance using fecal occult blood tests.

Screening Provision Activities

- Provider contracts, billing systems, other billing procedures
- Patient navigation and support
- Screening and diagnostic services (only labor, if any are reported)
- Ensure cancer treatment
- Other screening provision activities
- Screening and diagnostic services (only clinical)
- Screening and diagnosis
- Surveillance

Overarching Components Activities

Overarching components relate to both screening promotion and screening provision activities.

- Program management
- Quality assurance and professional development
- Partnership development and maintenance
- Clinical and cost data collection and tracking
- Program monitoring and evaluation
- Administration
- Other activities

Costs were aggregated and analyzed for screening promotion activities, both EBIs and non-EBIs, across 25 state grantees for multiple years. Screening promotion activities included client reminders, small media (15,16), mass media, outreach and educa-

tion, provider assessment and feedback, patient navigation, and other promotion activities. The "other" promotion activities category accounted for only a small proportion of the expenditures and were pooled together for analysis. The activities were EBIs recommended by the Community Guide, such as provider reminders and reducing structural barriers (eg, modifying health center times, offering services in nonclinical settings). Additional activities included reducing out-of-pocket costs, enrolling patients in Medicaid or other private or public insurance, and other miscellaneous activities.

We created a panel data set that included 1 record for each grantee for each year of data submission. We analyzed the total cost for each screening promotion activity by grantees' state-level screening prevalence: high (screening rates ranging from 69.6 to 76.6 [>66th percentile]), medium (screening rates ranging from 65.9 to 69.5 [34th to 66th percentile]), and low (screening rates ranging from 56.5 to 65.8 [<34th percentile]). We also analyzed the total cost by grantees' populations eligible for screening based on percentiles (<34th percentile, 34th to 66th percentile, or >66th percentile), using an appropriate age range (age 50–75) for those eligible but not screened. We hypothesized that the baseline level of screening compliance and the total number of individuals eligible for screening might affect the resources expended on specific interventions. For example, while often a high-cost intervention, grantees may consider mass media when there is a large volume of unscreened individuals and low levels of screening compliance, given mass media's potential large reach. The Community Guide statement on mass media acknowledges that it will likely not have a meaningful impact when screening prevalence is high because of ceiling effects and the expectation that mass media would have a limited ability to address unresolved barriers among people who remain unscreened (17). We used the 2012 Behavioral Risk Factor Surveillance System (BRFSS) CRC screening measures (based on multiple tests recommended) to assess screening prevalence during the midpoint of the implementation of the CRCCP (July 2009 to June 2014) and population counts for grantee states from the 2012 American Community Survey to calculate the number of people eligible for CRC screening (people aged 50 to 75 years). Lastly, we looked at various characteristics (eg, geographic location, size of population eligible for screening, screening prevalence), comparing grantees that used mass media and those that did not. On the basis of a previous analysis (9), mass media was one of the most expensive interventions undertaken by the CRCCP. This analysis was undertaken to understand, among other things, whether there were specific characteristics associated with mass media use. All costs include in-kind contributions and were adjusted by using the employment cost index (18).

The total number of records available for analysis comprised 121 grantee years. We excluded the 4 tribal organization grantees from all years of our analysis because screening data for tribes or tribal organizations are not available through BRFSS, and we did not have accurate estimates of their eligible population (age 50–75 years). In addition, 3 grantees were not included in Year 1 because they did not implement the program until Year 2, and 1 grantee was excluded from Year 2 because it did not report screening promotion costs.

We provide descriptive analyses on grantee characteristics, mass media use, and award amounts. We used multivariate analysis to assess the factors associated with screening promotion costs reported by grantees; we ran a random effects model to account for the panel database that consisted of multiple years of data for each grantee. We examined both the cost of screening promotion and the percentage of total cost allocated to client-related and provider-related EBIs recommended by the Community Guide (Box). We used the log transformation of the dependent cost variable to account for the skewness in the distribution of promotion cost across the grantees. We estimated a random effects equation with grantee characteristics as explanatory variables. Grantee characteristics include region, population size, and screening prevalence. To avoid bias when interpreting the estimated coefficients, we used Duan smearing retransformation on the log-transformed dependent variable, promotion cost, and estimated 95% confidence intervals by using a bootstrapping technique (19). The same overall model specification was used to examine total promotion cost and the proportion of total funding allocated by each grantee to EBIs.

Results

Mass media was the largest cost category for all years of the CRCCP, with costs ranging from $65,453 to $104,351(Figure 1), and it comprised approximately 28% of funds spent on screening promotion. The client reminders category was most often the lowest cost category across years, with costs ranging from $6,241 to $23,350. Overall, across grantees and across all years of the program, the amount spent on specific promotion activities varied greatly, as evidenced by the large 95% confidence intervals. For example, in Year 1, the grantees spent a substantially larger proportion on small media than in any other subsequent program year. The highest costs for screening promotion intervention were mass media, patient navigation, outreach and education, and small media.

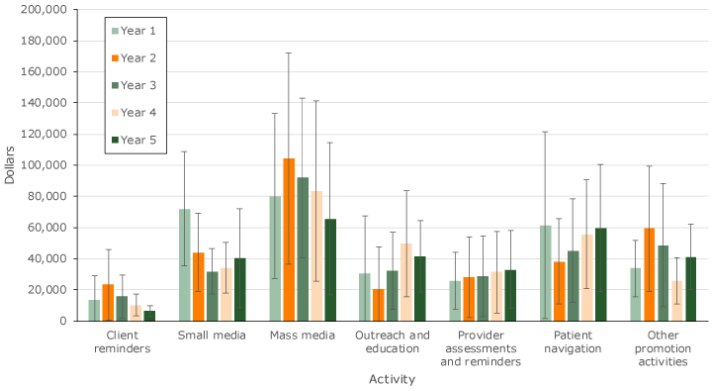

Figure 1. Average cost per grantee for each screening promotion activity, by year, Colorectal Cancer Control Program, 2009–2014. Error bars represent 95% confidence intervals.

Overall, 19% of grantees were in the South, 25% in the Northeast, 20% in the Midwest, and 36% in the West (Table 1). A higher proportion of grantees in the South used mass media than grantees in other regions, while the Northeast had the lowest proportion of grantees to use mass media. The average award ranged from $870,747 in the West to $1,614,766 in the Northeast.

The size of the population eligible for screening was similar for grantees overall and between those using mass media and those not (Table 1). Approximately 33% of grantees served areas with a small population eligible for screening, 32% with a medium eligible population, and 35% with a large eligible population. Of grantees using mass media, 36% were in areas with a medium eligible population; of grantees not using mass media, 40% were in areas with small eligible populations. The average award ranged from $938,551 for grantees serving areas with a medium population to $1,447,336 for grantees serving areas with a large population.

Estimates of screening prevalence did not vary much between those using and those not using mass media (Table 1). Overall, 36% of grantees serve areas with low screening prevalence, 31% serve areas with medium screening prevalence, and 32% serve areas with high screening prevalence. Of grantees using mass media, 35% are in areas of medium screening prevalence; of grantees not using mass media, 43% are in areas of low screening prevalence. The average award ranged from $855,663 in areas with a low screening prevalence to $1,421,591 in areas with a medium screening prevalence.

Grantees with high screening prevalence spent the most on patient navigation ($111,764) compared with grantees with medium ($32,746) and low ($15,248) screening prevalence (Figure 2, panel A). Alternatively, grantees with medium screening prevalence spent the most on mass media ($128,527), while grantees with low screening prevalence spent the most on small media ($59,066). Grantees with high screening prevalence spent the least on outreach and education, while grantees with low screening prevalence spent the least on client reminders. Grantees with large, medium, and small populations eligible for screening spent most on mass media ($76,240, $93,311, and $86,635, respectively) (Figure 2, panel B). All grantees, regardless of the size of their population eligible for screening, spent the least on client reminders.

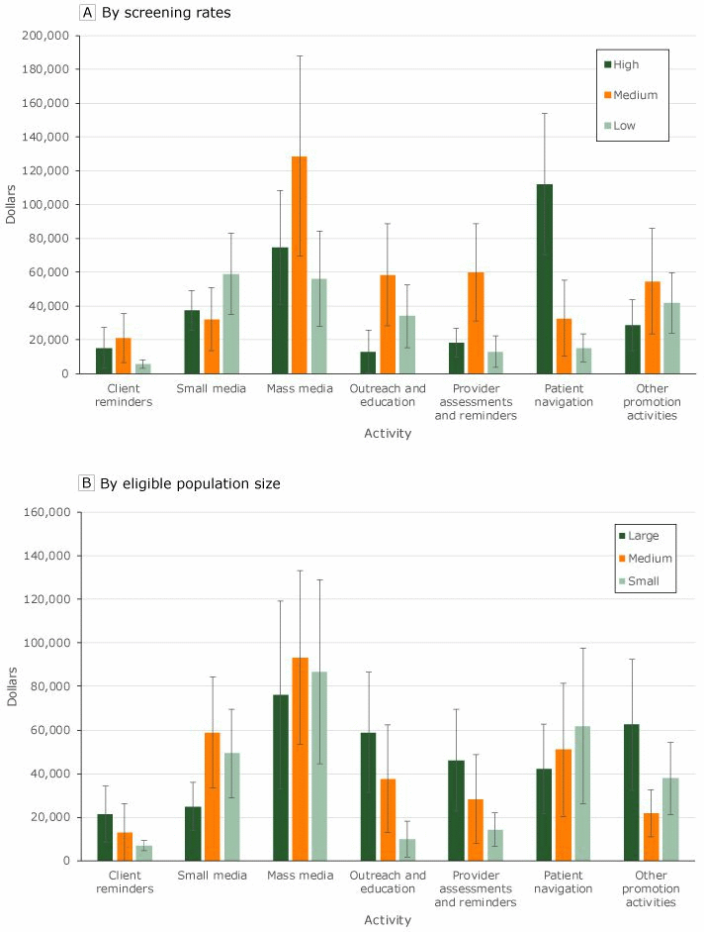

Figure 2. Average cost, in dollars, for each screening promotion activity (5-year period), by screening rates and by eligible population size, Colorectal Cancer Control Program, 2009–2014. Error bars represent 95% confidence intervals. State-level screening rates (panel A) were classified as high (screening rates ranging from 69.6 to 76.6 [>66th percentile]), medium (screening rates ranging from 65.9 to 69.5 [34th to 66th percentile]), or low (screening rates ranging from 56.5 to 65.8 [<34th percentile]). Grantee populations eligible for screening (panel B) were analyzed based on percentiles (small, <34th; medium, 34th–66th; large, >66th percentile) for those eligible but not screened.

In the regression estimating the regionally adjusted promotion cost, region was still a significant determinant of promotion costs even after we adjusted for regional differences in employment costs (Table 2). We found that grantees in the West have, on average across all years, a $236,051 lower promotion cost than those in the South.

The second regression estimated the percentage of regionally adjusted costs allocated toward client-related and provider-related EBIs recommended by the Community Guide. These activities included client reminders, small media, one-on-one education, reducing structural barriers, and provider assessment and feedback. Grantees in the West allocated a significantly greater percentage of total costs to Community Guide–recommended activities relative to grantees in the South (25%) (Table 2).

Discussion

Findings from the analysis of 5 years of cost data show that CRCCP grantees spent much of the screening promotion funds on interventions recommended by the Community Guide. We saw large variations across grantees in the amount spent on each promotion activity. The top screening promotion activities, excluding the "other" category, to which resources were allocated were mass media, patient navigation, outreach and education, and small media. Across the 5 years, grantees allocated more resources to small media in the first year of the program. Small media might be easier to implement while other interventions might require more planning; CDC and other organizations provide small media materials that grantees can easily tailor to implement targeted campaigns.

The highest cost category across the 5 years was mass media, an intervention for which the Community Guide did not have sufficient evidence to make a recommendation. Beyond general use of mass media campaigns (18 of 29 grantees in year 5), the share of screening promotion funds expended for this activity is high. Advertisements on television, radio, and billboards are more expensive than print materials such as letters and brochures for small media. This finding is consistent with findings reported in prior studies (9). Given the resources required for this screening promotion activity and its widespread use, it is critical to evaluate the effectiveness and cost-effectiveness of mass media to provide the evidence base to guide future decisions about resource allocation.

We also found differences in the allocation of funds to promotion interventions by levels of screening prevalence and the size of the population eligible for screening. Grantees in areas with a screening prevalence of 69.6% or higher allocated the smallest proportion of their screening promotion funds to outreach and education compared with grantees in areas with a screening prevalence of 69.5% or lower. The priority for grantees in areas with higher screening prevalence is navigating the patients along the screening continuum to ensure adherence with recommended screening, diagnostic follow-up, and referral for treatment recommendations; thus, these grantees spent more resources on patient navigation. All grantees expended fewer resources on client reminders than any other promotion activity. It is possible that clinics integrated client reminders into their electronic health record systems and bear the burden of any related costs. Regional variation existed in total allocation of resources to screening promotion activities and in the proportion of resources allocated to EBIs. Grantees in the South showed significant differences from those in the West. We hypothesize that there could be numerous potential reasons for this variation, including proportion of minorities served, which could result in cultural differences that may have affected selection of screening promotion interventions to target specific groups. Further assessments should explore the reasons for the regional variation.

Our study has several limitations. The grantees reported cost data retrospectively, which might result in misallocation of resources and errors in cost estimates. To reduce such errors, all grantees were provided a standardized data collection tool and user guides with activity definitions, training, and ongoing technical assistance. The cost assessment tool used in this study was previously tested and validated; several of the programs were already familiar with the tool. Our regression model was constrained by the small sample size (121 observations), which limits the number of explanatory variables we could include in the model. As a result, other unmeasured factors, in addition to the grantees' geographic region and the screening prevalence, could significantly influence screening promotion cost. We also found large variation in the cost across grantees, and a larger sample size would have allowed us to more fully explore these differences.

Nevertheless, our study provides a few lessons and reveals some additional gaps in the implementation economics literature. Small media was often used at the initiation of the program, and this could be due to the availability of small media materials (20) and tools that grantees could easily tailor. Standardized guidelines and tool kits for other types of EBIs should be made available so that they can be quickly and easily implemented, potentially saving time and money. Although the Community Guide did not yet have the evidence needed to recommend the use of mass media for CRC screening promotion, many grantees used this intervention, which suggests mass media has perceived value. Mass media, primarily television, has been effective in preventing tobacco use, a risk factor for tobacco-related chronic diseases (21). Results from analysis of benefits and costs of CDC's Screen for Life: National Colorectal Cancer Action Campaign (SFL) suggest that the

SFL campaign might have contributed to improving CRC screening rates at a minimal cost (16). Additional studies are needed to evaluate mass media's impact and cost-effectiveness and the decision-making process of grantees in selecting to use mass media.

Given the large variation across grantees on screening promotion interventions, a systematic assessment of needs matched with promotion activities, and their impact on screening rates, could provide better guidance on optimal resource allocation. In addition to the EBIs recommended by the Community Guide, grantees are using other interventions (eg, patient and provider incentives). CDC is applying these lessons learned to its study of the currently funded CRCCP grantees (15). Our ongoing study examines the cost-effectiveness of these interventions, those that are recommended by the Community Guide as well as those for which there is insufficient evidence to make a recommendation. Findings from the ongoing implementation economics studies will contribute to the evidence base for the optimal mix of cost-effective screening promotion activities and strategies that grantees can use to increase CRC screening rates. These strategies might also inform efforts to address other cancer screening programs.

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Author Information

Corresponding Author: Florence K. L. Tangka, PhD, Centers for Disease Control and Prevention, Division of Cancer Prevention and Control, 4770 Buford Hwy, NE, MS F-76, Atlanta, GA 30341-3717. Telephone: 770-488-4227. Email: fbt9@cdc.gov.

Author Affiliations: [1]Centers for Disease Control and Prevention, Atlanta, Georgia. [2]RTI International, Waltham, Massachusetts.

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Tables

Table 1. Grantee Characteristics, Mass Media Use, and Average Award, Colorectal Cancer Control Program, 2009–2014

Category	Overall, %	Grantees That Used Mass Media, %	Grantees That Did Not Use Mass Media, %	Average Award (including In-kind), Mean $ (95% CI)
Region				
South	19	27	6[a]	1,062,337 (903,115–1,221,559)
Northeast	25	18	36[b]	1,614,766 (1,095,380–2,134,152)
Midwest	20	24	13	970,045 (864,198–1,075,891)
West	36	31	45	870,747 (796,273–945,221)
Size of population eligible for screening				
Small (228,339–736,635)	33	28	40	967,876 (863,195–1,072,558)
Medium (854,624–1,618,255)	32	36	26	938,551 (849,482–1,027,621)
Large (1,749,719–9,472,316)	35	35	34	1,447,336 (1,111,326–1,783,346)
Screening Prevalence				
Low (56.5–65.8)	36	32	43	855,663 (788,107–923,219)
Medium (65.9–69.5)	31	35	26	1,421,591 (999,269–1,843,913)
High (69.6–76.6)	32	32	32	1,097,463 (991,600–1,203,326)

Abbreviation: CI, confidence interval.
[a] $P < .001$.
[b] $P < .05$.

Table 2. Regression Estimates for Cost of Screening Promotion and Proportion of Total Cost Allocated to Evidence-based Interventions, Colorectal Cancer Control Program, 2009–2014

Category	Total Cost of Screening Promotion, Estimate $ (95% CI)	Proportion of Total Cost Allocated to Client-related and Provider-related Evidence-based Strategies Recommended by the Community Guide, Estimate (95% CI)[a]
Region		
South		1 [Reference]
Northeast	−25,965 (−229,222 to 324,123)	0.145 (−0.082 to 0.372)
Midwest	−110,866 (−276,887 to −179,093)	−0.051 (−0.275 to 0.174)
West	−236,051[b] (−345,123 to −55,084)	0.245[b] (0.033 to 0.457)
Size of population eligible for screening		
Small (228,339–736,635)		1 [Reference]
Medium (854,624–1,618,255)	−26,755 (−195,041 to 231,280)	0.036 (−0.141 to 0.214)
Large (1,749,719–9,472,316)	20,025 (−171,755 to 320,351)	0.124 (−0.063 to 0.310)
Screening Prevalence		
Low (56.5–65.8)		1 [Reference]
Medium (65.9–69.5)	154,797 (−85,528 to 530,999)	−0.129 (−0.315 to 0.058)
High (69.6–76.6)	−107,439 (−265,727 to 153,173)	0.075 (−0.133 to 0.282)

Abbreviation: CI, confidence interval.
[a] Coefficients were estimated using Duan smearing retransformation.
[b] $P < .05$.