Integrated implementation of evidence-based interventions to increase colorectal cancer screening through public health-primary care partnerships

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Abstract

Background

In 2015, the Centers for Disease Control and Prevention funded the Colorectal Cancer Control Program (CRCCP), which partners with health systems and primary care clinics to increase CRC screening uptake. We interviewed CRCCP stakeholders to explore factors that support an integrated implementation of evidence-based interventions and supporting activities to promote CRC screening with other screening and chronic disease management activities in primary care clinics.

Methods

Using the Consolidated Framework for Implementation Research, we conducted a literature review and identified constructs to guide data collection and analysis. We purposively selected four CRCCP awardees that demonstrated ongoing engagement with clinic partner sites, willingness to collaborate with CDC and other stakeholders, and availability of high-quality data. We gathered background information on the selected program sites and conducted primary data collection interviews with program staff and partners. We used NVivo QSR 11.0 to systematically pilot-code interview data, achieving a Kappa coefficient of 0.8 or higher, and then implemented a stepwise process to identify site-specific and cross-cutting emergent themes.

Results

Programs reported that they support clinic partners' integrated implementation by providing coordinated application processes and braided funding streams, and by funding partner organizations to provide technical assistance to support efficient implementation of evidence-based interventions and supporting activities into existing clinic workflows. These actions, in turn, support clinics in implementing evidence-based interventions and supporting activities that promote both CRC screening and other chronic disease screening and management.

Discussion

The selected CRCCP programs and their partners implement activities to support the integration of evidence-based interventions and supporting activities with other clinic efforts. These integrated efforts support increased efficiency of clinic workflow, improved coordination of patient care, increased uptake of screening and improved patient outcomes.

Conclusions

The findings provide insights into how public health programs can support primary care clinics in integrating interventions and activities into existing workflows to support efficient, coordinated delivery of quality patient-centered care.

Contributions To The Literature

- Describes how Colorectal Cancer Control Program public health and primary care partnerships support integrated implementation of evidence-based interventions and supporting activities to promote colorectal cancer screening and management of other chronic diseases.
- Provides insights into how public health programs and primary care clinics can collectively support integrated implementation of interventions into clinic workflows to support efficient, coordinated delivery of interventions to ensure patient-centered care.
- Includes a defining set of theory-driven constructs relevant to integrated implementation of chronic disease management interventions and activities within clinical settings.

Introduction

Collaboration between public health and primary care is seen as an opportunity to promote health at the individual and community levels [1–3]. Integrated implementation of patient care interventions and activities can support primary care clinics in improving efficiency of clinic workflows and coordinating delivery of patient-centered preventive care [4, 5]. Integrated implementation also may support longer-term outcomes, including clinic institutionalization of health promotion practices and cost savings [6, 7]. Public health partners can play an important role in supporting the implementation of these practices in primary care settings.

In 2015, the Centers for Disease Control and Prevention (CDC) funded the Colorectal Cancer Control Program (CRCCP), which is based on a health systems change model that promotes integrating public health and primary care to improve population health; specifically, to increase colorectal cancer (CRC) screening among medically underserved populations (Fig. 1) [8].

CDC funded 30 CRCCP program sites (hereafter referred to as programs) that partner with primary care clinics (hereafter referred to as clinic partners) to implement evidence-based interventions (EBIs) recommended by the Community Preventive Services Task Force in *The Community Guide* [9] coupled with other supporting activities (SAs) to increase the uptake of CRC screening. The CRCCP DP15-1502 was funded for 5 years from 2015–2020. Participating clinic partners selected up to four EBIs prioritized by CDC—patient reminders, provider reminders, provider assessment and feedback, and reducing structural barriers to screening—and other SAs to implement based on clinic priorities and feasibility. SAs include implementing community health worker-led activities, patient navigation, health information technology, professional development, and small media. CRCCP programs and partners with relevant expertise, such as the American Cancer Society and the State Primary Care Association, provide technical support to implement these activities. Because the CRCCP is focused on health systems change—such as

improving workflows and electronic health record (EHR) systems to incorporate EBIs/SAs so that they are sustainable—the opportunity exists to integrate the implementation of EBIs and SAs to promote not just CRC screening but also other screening and/or chronic disease management activities. Intended outcomes of this integrated approach to implementing EBIs and SAs include improved efficiency of clinic workflow, improved coordination of patient care, increased uptake of CRC screening, and improved patient outcomes.

This study aimed to examine CRCCP clinics where EBIs and SAs to promote CRC screening were integrated with other screening and chronic disease management activities and to identify practices facilitating this integration. CDC intends to use the study findings for CRCCP implementation. Findings could also potentially be used by other organizations involved in promoting CRC screening and management of other chronic diseases. Lessons learned also may support cancer screening integration efforts among other chronic disease programs.

Methods

We used the Consolidated Framework for Implementation Research (CFIR) [10] to structure our approach to identify factors that support integrated implementation of EBIs and SAs, focusing on characteristics of the inner setting (clinics, in this context)—features of structural, political, and cultural context. Using the CFIR, we conducted a literature review to identify key constructs relevant to integrated implementation that aligned with CFIR inner setting constructs: readiness for implementation, structural characteristics, and networks and communication. Our literature review yielded four key integrated implementation constructs (Table 1) that guided data collection and analysis efforts.

Our primary evaluation question was, “What factors support integrated implementation of EBIs and SAs to promote CRC screening with other screening and chronic disease management activities within primary care clinics?” We developed additional evaluation questions (see Additional file 1) related to each of the key constructs in Table 1. An overview of our methodological approach is provided in Fig. 2 and further detail about site selection, data collection, and analysis are provided below.

Site Selection

We purposively selected three CRCCP programs: Kentucky Department of Public Health; Rhode Island Department of Health; and Washington State Department of Health. We also included the Nebraska Department of Health and Human Service’s CRC program, which had been a CRCCP awardee funded from 2009–2015. Although Nebraska was not part of the 2015–2020 CRCCP, they maintained program efforts with state funds. These four programs participated in the CRCCP Learning Collaborative, an innovative initiative to develop and apply a standardized approach to evaluate the implementation, effectiveness, cost, and cost-effectiveness of multicomponent interventions to inform future scale-up of these interventions [7]. Based on cost-effectiveness analyses, all four programs exhibited partnerships with clinics to integrate CRC EBIs and SAs implementation.

Data Collection

For each selected program, we interviewed staff, clinic partners, and implementation partner organizations (e.g., non-clinic partners funded to provide technical assistance to clinics). The four theory-based constructs—governance structure, information sharing, funding environment, and leadership support—and evaluation questions informed the development of unique interview guides for each of the three participant roles. We selected these participant types to gather input from multiple perspectives. Sample interview questions are provided in Additional file 2.

Prior to primary data collection, we reviewed secondary data for each program, such as budgets and survey findings. Secondary data were not available for Nebraska because they were not receiving CRCCP funds at the time of our interviews. To gather contextual information about each program before initiating interviews, we spoke with CDC staff who provided tailored technical assistance directly to the three selected CRCCP programs.

We obtained verbal consent for interviews from each participant. Institutional Review Board approval was not required for this data collection because it did not constitute human subjects research. In total, 23 individuals, including representatives from one clinic partner location per program, participated in semi-structured telephone interviews (Table 2) using unique interview guides conducted between February and May 2019. Interviews were audio-recorded, with consent, and transcribed for analysis. The Standards for Reporting Qualitative Research checklist guided our qualitative methods and reporting of results (see Additional file 3) [25].

Analysis

Prior to analysis, we developed a coding dictionary based on our evaluation questions (see Additional file 4). A team of four analysts pilot-coded two interview transcripts using the qualitative software NVivo QSR 11.0. The team then met to develop consensus regarding refinement and application of the coding framework. Four interviews (20%) were double coded—independently coded by two analysts—and analysts achieved a Kappa coefficient of 0.8 or higher for each. The remaining interviews were divided evenly among the four analysts and independently coded. Following coding, analysts reviewed code reports to identify program-specific emerging themes and recorded these themes in summary tables that included a description of each theme, illustrative quotes supporting the theme, and the interviewee role for each quote. Analysts convened and reviewed all theme tables and identified cross-cutting emergent themes, which were themes that emerged across at least two programs.

Results

Brief descriptions of clinic partner approaches to integrated implementation of CRCCP activities are provided in Additional file 5. In the following sections, we present our results based on the four guiding integrated implementation constructs. These results are summarized in Figure 3.

Funding Environment

The clinic partners received funding from the CRCCP programs, typically to support start-up and ongoing costs associated with implementing the CRCCP within their sites. Two aspects of the funding environment were identified as facilitating integrated implementation: (1) coordination of funding by awardees across multiple chronic disease programs to support consolidated application processes for clinic partners, and (2) contracting with expert implementation partners to provide training and technical assistance to clinic partners that emphasized integrated implementation.

Participants discussed programs providing braided funding—a process that involves coordinating separate funding streams from multiple programs, such as CRCCP and the National Breast and Cervical Cancer Early Detection Program (NBCCEDP)—to pay for common activities such as patient navigation across programs, provider reminders and patient reminders (e.g., reminders for breast, cervical, and colorectal cancer screening). However, each funding stream is kept separate so programs can track requirements and outcomes. For example, program staff discussed developing funding opportunity announcements for clinic partners that braided funding streams from multiple programs. This approach enabled clinic partners to consolidate their funding applications and reporting processes while tracking distinct activities and outcomes for each funding stream. Participants also reported that by braiding funding from multiple chronic disease programs, clinic partners could submit a single funding application and receive a larger amount of funding that could be used to integrate implementation efforts across multiple chronic diseases. For instance, participants reported the use of braided funding to support patient navigation staff who coordinate screening and follow-up for CRC, breast cancer, and cervical cancer.

“The [health department’s] women’s cancer screening and colorectal had patient navigation contracts with all the [Federally Qualified Health Centers] throughout the state and in order to get the FQHCs to agree to do the colorectal, right from the beginning she integrated the contracts so we essentially were doubling the money that we were offering to them and it was an all or nothing kind of thing.”

– Program staff

“[We aim to] present different contract options which combine all the different funding sources...in an integrated way, approaching them with this single menu of different options collectively...versus one of us [from the health department] approaching them one month and then another one approaching them 3 months later.”

– Program staff

“[Braided funding supports] staff time and the training that we need for our staff to do the outreach for all of the cancer screenings.”

– Clinic staff

Participants also described how technical assistance and training, provided by expert implementation partners, facilitated integrated implementation. For example, implementation partners assisted clinics in adapting EHR or other referral systems to integrate CRC screening with existing referral systems for breast cancer screening such as mammography.

"[Implementation partner agency] is our partner in understanding how to look at [clinic] practice flows and how to coordinate, integrate, align the work we do.... They say, 'Okay, you really need to work on your electronic referrals [for screening]. Let's look at how you're doing that with mammograms. Let's look at how you're doing that with colonoscopy.'"

– Program staff

"We strongly encourage [clinic partners] to consider how their efforts could be better integrated with their other programs and activities in their clinic systems. For example, when they describe [clinic] workflows to us on these technical assistance calls, we try to prompt them to consider how these efforts may impact other efforts ongoing in their clinics, other screening activities...if they're going to look at, for example, whether or not a patient is due for colorectal cancer [screening as part of workflow processes], seeing if there are opportunities in their other cancer screening activities and workflows."

– Implementation partner staff

Governance Structure

Effective team-based care, a factor related to governance structure, ensured that CRC screening was integrated into clinic practice as part of comprehensive, coordinated patient care. For example, some clinics used "health hubs" comprised of clinic staff from CRCCP, WISEWOMAN, and NBCCEDP to implement coordinated EBIs across programs. Participants reported that effective teaming supports a shared sense of responsibility for providing comprehensive (such as multiple health topics), coordinated patient care. For example, participants described training all clinic staff—such as patient registration staff, lab technicians, and nurses—to address CRC and other health conditions with each patient encounter. Workforce development (e.g., learning collaboratives) also included clinic staff representing multiple chronic disease prevention areas. Additionally, participants described the integration of CRC screening with other services (e.g., coordinated patient enrollment with WISEWOMAN and NBCCEDP; coordinated patient and provider reminders) as being consistent with their commitment to applying a Patient Centered Medical Home (PCMH) model.

"So, every clinical person from our lab person to our [patient] registration staff to every nurse [and] medical assistant understands that they're required to address all of these [health topics] with every patient. It's just the way we train them when they come in...it's the way we do business."

– Clinic staff

“Going back to the PCMH [model] of having all staff [perform at] the highest ability that they’re able to. So, our frontline, our medical assistants, our front-desk staff are very involved and very engaged in these management activities, cancer screening activities.”

– Clinic staff

“We have a team medical assistant [who] is able to follow up on closing the loop to patients about, ‘Hey, I see you haven’t done this,’ or ‘Your [test] was high. We need you to come back in or follow up on those things.’ And then the RN is able to really take the time and educate the patients on different dietary concerns, different ways to manage whatever specific chronic condition that they have.”

– Clinic staff

Information Sharing

Access to and sharing of accurate patient information, including EHR data, were identified as other factors supporting integrated implementation of CRC screening. Identifying patients who are due for multiple preventive screenings, including CRC, was an example shared by participants. Once patients could be identified, referrals could be made and follow-up actions—such as appointment scheduling and confirming screening completion—could be carried out.

Participants indicated that clinic staff, particularly patient navigators and care coordinators, rely on the availability of accurate EHR reports to identify patients for screening and/or diagnostics for multiple chronic disease conditions. Clinic staff emphasized that the utility of the EHR data in supporting integrated implementation is contingent on data accuracy.

“The challenges we face with CRC, breast cancer, and cervical reporting [are] the same challenges we face with everything else. Making sure [EHR data] are entered correctly and data validation.”

– Clinic staff

Aside from EHRs, participants identified data dashboards and meetings of the quality improvement team as strategies for sharing information that facilitated integrated implementation. Electronic dashboards presented summary metrics on multiple cancer screenings in real-time for each provider and their respective patients. Through data sharing and making comparisons between physicians that invite friendly competition, the dashboards promote action on multiple conditions that contribute to integrated implementation. Similarly, data sharing among quality improvement (QI) teams promotes a collective understanding of where clinics stand on delivery of health promotion activities that can foster understanding of opportunities to potentially improve these metrics through integrated implementation.

“All of our staff have access to the provider dashboard, which is updated once a month and that shows where their particular provider is and what the [clinic] average is and then... they can go and look at any

other provider...it's just starting with the cancer screening metric, but eventually we'll put all of our metrics on that...it will give them more of a real-time feel of where they're at."

– Clinic staff

"We also...had monthly quality improvement meetings, where all of the clinic's leadership and the QI department got together, and we talked about things that we are working on, and things that could potentially be shared...beyond just cancer, or beyond just diabetes care, or whatever thing we were talking about."

– Clinic staff

Leadership Support

Clinic leadership plays a primary role in promoting integrated implementation by setting and reinforcing expectations. Participants indicated that strong and ongoing support from health system and clinic leadership establishes an expectation for integrating CRC EBIs and SAs within the clinic practice and incorporating CRC screening efforts with other chronic disease activities. Additionally, leaders are crucial in encouraging staff from across the clinic team to support these activities.

"Leadership support is critical.... It's evident, if you see the [screening] numbers of the teams that have the leadership support and the ones from the team that didn't [have leadership support], it's night and day."

– Implementation partner staff

"I'm the clinic manager and so I set the tone for the sense that the evidence-based interventions are important. We need to integrate them and so you talk about it, you bring it up frequently. As a group, we collectively talk about what we think works for us and what doesn't work for us."

– Clinic staff

Discussion

Our study examined the CRCCP, a public health program implemented in primary care clinics, to identify factors facilitating the integration of EBI and SA implementation with other screening and chronic disease management activities. Using the CFIR helped focus identification of factors that support integrated implementation of EBIs and SAs, including funding environment, governance, information sharing, and leadership.

We found that integration efforts in clinics were supported by programs consolidating their chronic disease funding into single contracts for partner clinics, rather than providing separate, "siloed" contracts for individual health conditions. In the CRCCP, this funding approach presents an opportunity for more efficient use of public health funding for delivering coordinated cancer screenings and other disease

management interventions to support more holistic, patient-centered care. Efficiencies are also achieved when clinic staff respond to a single, consolidated funding application rather than multiple applications. And the pooled funding provides both programs and clinics flexibility to leverage funds and share overhead costs, offering the opportunity to achieve more with their awarded funds [26]. At the program level, consolidated funding also supports efficiency by streamlining delivery of training and technical assistance to a smaller number of funding recipients; meaning that more in-depth support can be provided to trainees.

At the clinic level, a team-based approach was found to support more integrated care for a patient, including for CRC screening. Teams of clinicians are likely able to determine how best to integrate CRC screening efforts—such as identifying patients who are due for screening and determining how to deliver a reminder to a provider—into existing clinic workflows. This is consistent with coordinated delivery of interventions to ensure patient-centered care, which can ultimately lead to improved patient outcomes and quality of life, as demonstrated through the PCMH model [27, 28]. Patient-centered care also has shown promise toward reducing health care costs [29].

EHR systems, a reservoir of patient information, also were found to be important to integrated implementation. Although investing in functional EHR systems can be costly, they are recognized as essential to enable optimal, integrated, patient-centered care because they allow for abstraction of accurate clinical information. In 2011, the Centers for Medicare & Medicaid Services established an EHR incentive program to reward meaningful use of certified EHR systems to improve quality of care [30]. Since then, there has been a national push for health systems to adopt EHRs to support clinical practice transformation. Meaningful use of EHRs has been associated with quality improvement in Federally Qualified Health Centers (FQHCs) [31]. In 2012, 90% of FQHCs had adopted an EHR and about one-third had met core requirements for meaningful use [32]. The findings from our study indicate that EHRs also can help facilitate integrated implementation of EBIs to promote cancer and other chronic disease screenings. For example, once developed, data dashboards that display provider performance metrics for CRC screening can be replicated and/or expanded to produce monitoring data for other cancer or chronic disease screenings, placing patients at the center of care provided by multiple public health programs. Additionally, EBIs that can be enabled through the EHR system, such as automated patient and provider reminders or performance metrics to populate dashboards, may be more sustainable. Once these strategies are built into EHR systems, significant efficiencies could be achieved.

Finally, leaders' expectations for integrated implementation sets the tone for other staff and directs practice. CRC champions, individuals serving as internal advocates for screening, help maintain a focus on screening and were found to be associated with greater screening rate increases in CRCCP clinics [8]. Champions have been found to contribute to improved public health outcomes in many areas and efforts to sustain and support them as part of the CRCCP is critical [33]. Therefore, leadership support is essential for clinic champions to effectively promote and sustain integrated implementation.

Our findings highlight elements and practices of integrated implementation that can support clinics in achieving desired short-term outcomes, including efficient, coordinated delivery of interventions to ensure patient-centered care, which can ultimately lead to improved patient outcomes and quality of life as well as reduced health care costs [27, 28].

CDC, through the CRCCP Learning Collaborative, is working with programs and clinic partners to systematically evaluate the cost and cost-effectiveness of combined implementation of EBIs for cancer screenings [7]. Lessons learned from the integrated implementation platform for CRC screening through the CRCCP might be applied to enhance other public health and primary care partnership programs, such as CDC's National Breast and Cervical Cancer Early Detection Program. For example, findings might be applied to inform the structure of public health department partnerships with clinic and non-clinic partners; inform the nature of training and technical assistance provided to primary care clinics; encourage early efforts to seek leadership buy-in to setting the stage for integration; and reiterate the value of capturing and sharing high-quality data to support integrated programs.

There are certain limitations for our findings. First, because the study was qualitative and engaged a subset of current and former CRCCP programs and their primary care clinic partners, these findings are not generalizable to all CRCCP programs or primary care clinic sites. Second, the findings reflect a relatively small number of participants included in the data collection. Third, this study was framed around exploration of four theory-driven constructs. Future analysis that incorporates a broader set of constructs may generate additional insights regarding factors that support integrated implementation of interventions for multiple conditions within primary care. Finally, we did not track outcomes in this analysis but plan to engage in such assessments in future analyses.

Conclusion

In this study, we identify factors, at the CRCCP program and clinic levels that support integrated implementation of EBIs and SAs within clinic settings to promote CRC screening and screening/management of other chronic diseases. We present our findings within the frame of four theory-based implementation constructs. The findings provide insights into how public health programs and primary care clinics can collectively support integrated implementation of interventions and activities into clinic workflows to support efficient, coordinated delivery of patient-centered care. The next step is for further research to explore the impact of these public health and primary care partnerships and related activities on patient and program outcomes.

Abbreviations

CDC: Centers for Disease Control and Prevention

CFIR: Consolidated Framework for Implementation Research

CRCCP: Colorectal Cancer Control Program

EBIs: evidence-based interventions

EHR: electronic health record

FQHC: Federally Qualified Health Center

PCMH Patient Centered Medical Home

SAs: supporting activities

Declarations

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Authors' Contributions

All authors contributed to the development of the research and evaluation questions. CS and LA developed the interview guides, with feedback from SS, SH, AD, FT, DS and SM. CS, LA, and SH conducted the interviews. LA, CS, DS, and SM conducted the qualitative coding and performed the thematic analysis. CS drafted and revised the manuscript based on comments from the coauthors. All authors read and approved the final manuscript.

Authors' Information

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Availability of Data and Materials

The qualitative data generated and/or analyzed during the current study are not publicly available because they were generated in interviews conducted by the research team, with the expectation that participant identity would be kept confidential.

Ethics Approval and Consent to Participate

The RTI Institutional Review Board determined that this study did not constitute human subjects research and therefore did not require review. Verbal consent to participate was obtained from all individuals who participated in interviews.

Consent for Publication

Consent for a de-identified summary of findings was obtained from individuals who participated in the interviews.

Competing Interests

The authors declare that they have no competing interests.

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Tables

Table 1. Guiding Consolidated Framework for Implementation Research (CFIR) and integrated implementation construct descriptions

CFIR Construct and Definition	Integrated Implementation Construct	Integrated Implementation Construct Description
<p>Readiness for Implementation: Available Resources</p> <p><i>The level of resources dedicated for implementation and on-going operations, including money, training, education, physical space, and time.</i></p>	Funding environment	Integrated health and social services are supported by financing mechanisms that fund services and allow braiding or blending of funds with flexibility in the use of funds to achieve population health goals [3, 11-14]. Integrated services also may be supported by partner agencies that receive funding to provide training and technical assistance to assist clinics to adapt clinical workflows.
<p>Networks and Communication</p> <p><i>The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organization.</i></p>	Governance structure	Cooperation between and within organizations to support integrated health care delivery requires governance structures that promote coordination, joint planning, shared priorities, and a common understanding of accountability among staff [11, 15-17].
	Information sharing	Information flow in a clinical setting is necessary for integrated health care delivery and is supported by the presence of a secure, accessible platform for storing and sharing health care information, consistent documentation, and a structured plan to facilitate seamless communication among health system care providers [11, 13, 18].
<p>Readiness for Implementation: Leadership Engagement</p> <p><i>Commitment, involvement, and accountability of leaders and managers with the implementation.</i></p>	Leadership support	Leadership recognition of the importance of integration and provision of tangible support and resources are influential in adoption and implementation of care integration [19-24].

Table 2. Interviews by program site^a and respondent type and site

State	Program Staff	Clinic Partner Staff	Implementation Partner Staff	Total Interviewees
Kentucky	2	2	2	6
Nebraska	2	2	2	6
Rhode Island	2	2	2	6
Washington	2	1	2	5
Total				23

^a Kentucky Department of Public Health, Nebraska Department of Health and Human Services, Rhode Island Department of Health, Washington State Department of Health

Supplementary Information

Additional File 1. Supplemental Appendix 1. Primary Evaluation Questions. This document presents additional evaluation questions related to each of the key constructs in Table 1.

Additional File 2. Supplemental Appendix 2. Sample Interview Questions (Table of sample questions related to each construct). This document presents sample questions for the qualitative interviews.

Additional File 3. Supplemental Appendix 3. Standards for Reporting Qualitative Research checklist. This document contains the completed Standards for Reporting Qualitative Research checklist for the reported study.

Additional File 4. Supplemental Appendix 4. Coding Structure (23 Codes developed based on evaluation questions). This document provides a coding dictionary based on the evaluation questions.

Additional File 5. Supplemental Appendix 5. Brief Description of Clinic Partner Integrated Implementation Approaches, by Site. This document provides brief descriptions of clinic partner approaches to integrated implementation of CRCCP activities.

Additional file 1. Primary evaluation questions

Primary Evaluation Questions	
Governance structure	<ul style="list-style-type: none"> · How are programs and clinics structured to support integrated implementation of EBIs and SAs? · How are health teams being used as part of integrated implementation of EBIs and SAs? · What does integrated implementation of EBIs and SAs look like in terms of clinic workflow? · What activities are conducted at the clinic to facilitate integration of EBIs and SAs implementation with clinic processes?
Leadership support	<ul style="list-style-type: none"> · How is clinic leadership supporting integrated implementation of EBIs and SAs? · How is program leadership supporting integration?
Funding environment	<ul style="list-style-type: none"> · How are multiple lines of funding (e.g., CRC, NBCCEDP) to clinics coordinated to support integrated implementation of EBIs and SAs? · To what extent are the programs and/or their partners (clinic and implementation partners) sharing resources (monetary and other) to support integrated implementation of EBIs and SAs? · In what ways do programs incentivize or encourage integrated implementation of EBIs and SAs at the clinic level?
Information sharing	<ul style="list-style-type: none"> · How is information shared within clinics and health systems to support integrated implementation of EBIs and SAs? · What challenges and benefits have clinics encountered in coordinating data entry and reporting around integrated implementation of EBIs and SAs? · How does a clinic's EHR system facilitate/hinder efforts to integrate implementation of EBIs/SAs?

Note: NBCCEDP, National Breast and Cervical Cancer Early Detection Program; CRC, colorectal cancer; EBI, evidence-based interventions; EHR, electronic health record; SAs, supporting activities.

Additional file 2. Sample interview questions (table of sample questions related to each construct)

Construct	Sample Interview Questions
Governance structure	<ul style="list-style-type: none"> · In what ways does staffing structure at the health department support integrated implementation of CRCCP activities with those of other cancer or chronic disease area programs? · In what ways does staffing structure at the clinic support implementation of EBIs across multiple cancer or chronic disease area programs? · To what extent is integrated implementation reflected in clinic standard operating procedures? · Based on your experience, what do programs or clinics need in terms of infrastructure to be able to successfully integrate implementation of EBIs?
Leadership support	<ul style="list-style-type: none"> · In what ways does your health department leadership support integration of CRCCP with other cancer or chronic disease area programs? · In what ways does your health department leadership support integrated implementation of EBIs at the clinic level? · In what ways does the health department support integrated implementation of EBIs at your clinic? · In what ways is clinic leadership supporting integrated implementation of EBIs?
Funding environment	<ul style="list-style-type: none"> · To what extent are multiple lines of funding (e.g., colon cancer, breast, cervical, heart disease, and diabetes screenings) to clinic sites coordinated to support integrated implementation of EBIs? · In what ways does the health department incentivize or encourage integrated implementation at the clinic level? · How have you used funding from the health department to support integrated implementation of EBIs? · What influence do policies and/or incentives (national quality incentive programs) have on improvement of integrated implementation of EBIs? · Does the health department provide your organization with funding for your role in supporting integrated implementation of EBIs in their clinic partners?
Information sharing	<ul style="list-style-type: none"> · How is programmatic information, such as clinical or financial information, shared between your program and other chronic disease programs with which you're collaborating at the health department? · How is information shared within clinics and health systems to support integrated implementation of EBIs? · Thinking about the logistics of documentation—such as reporting requirements to the health department, HRSA, your health system, or other entities—have there been any challenges in terms of documentation or data reporting due to integrated implementation of EBIs? Any benefits?

Note: CRCCP, Colorectal Cancer Control Program; EBIs, evidence-based interventions; HSRA, Health Services Research Administration.

Additional file 3. Completed Standards for Reporting Qualitative Research Checklist

Standards for Reporting Qualitative Research (SRQR)*

<http://www.equator-network.org/reporting-guidelines/srqr/>

	Page/line no(s).
Title and abstract	
Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	1 / 1-2
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	2-3 / 12-39
Introduction	
Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	3-4 / 55-84
Purpose or research question - Purpose of the study and specific objectives or questions	5 / 84-89
Methods	
Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/interpretivist) is also recommended; rationale	5-6 / 91-104
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	6-7 / 117-134
Context - Setting/site and salient contextual factors; rationale	7 / 130-134
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale	6 / 105-115
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	7 / 128-130
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale	7 / 130-134
Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	6-7 / 117-134
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	6 / 130-140

	Page/line no(s).
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	7-8 / 135-146
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale	7-8 / 135-146
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale	7-8 / 138-146
Results/findings	
Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	8 / 147-151
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	8-12 / 152-288
Discussion	
Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	13-16 / 289-361
Limitations - Trustworthiness and limitations of findings	15-16 / 353-361
Other	
Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	23 / 469-470
Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	23 / 454-457

Source: O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med*, 2014; 89(9):1245-51.

Additional file 4. Coding structure (23 codes developed based on evaluation questions)

Construct	Codes
Implementation	<ul style="list-style-type: none"> · Program Role: How programs (i.e., funded health departments) interact with clinic sites and/or non-health system partners, and how programs support integrated implementation in clinics. · Partner Role: How non-health system partners interact with programs and/or clinic sites, length of relationship with the program, and how the partner organization supports the program's efforts to encourage integration in clinics. · Program Integration Description: How programs are integrating CRCCP with other cancer or chronic disease area programs within the health department. · Clinic Integration Description: How clinic sites are integrating implementation of CRC EBIs with breast, cervical, heart disease, diabetes, and/or other screenings within the clinic. · Integrated Implementation Challenges and Solutions: Challenges related to integrating cancer and chronic disease prevention programs at the health department and strategies for overcoming challenges. · Integrated Implementation Facilitators: Factors that facilitated integrating cancer and chronic disease programs at the health department. · Integrated Implementation Benefits: Benefits of integrating implementation of EBIs. · Lessons Learned/Recommendations for Programs: Lessons learned or recommendations for other health departments that want to move toward or sustain integration of cancer and other chronic disease programs. · Lessons Learned/Recommendations for Clinics: Lessons learned or recommendations for clinics that want to move toward integrated implementation of EBIs to promote cancer and other chronic disease screenings.
Governance structure	<ul style="list-style-type: none"> · Program Staffing and Infrastructure: Discussion of health department staffing structure and how it supports integrated implementation of CRCCP activities with those of other cancer or chronic disease prevention programs. · Clinic Staffing and Infrastructure: Clinic staffing structure and how it supports integrated implementation of EBIs to promote cancer and chronic disease screenings.
Leadership support	<ul style="list-style-type: none"> · Program Leadership Support: How health department leadership supports integration of CRCCP with other cancer or chronic disease prevention programs. · Clinic Leadership Support: How clinic leadership supports integrated implementation of EBIs to promote cancer and other chronic disease screenings.
Funding environment	<ul style="list-style-type: none"> · Coordination of Funding Streams: How the health department coordinates funding from various sources to support integrated implementation of EBIs in clinics. · Internal/External Incentives for Integrated Implementation: Any incentives that the health department provides to clinics to encourage integrated implementation. How external policies and incentives (e.g., National Quality Incentive Programs) affect integrated implementation and/or improvement of integrated implementation of EBIs in clinics.

Construct	Codes
Information sharing	<ul style="list-style-type: none"> · Program Information Sharing: How health department staff share information between CRCCP and other cancer/chronic disease prevention programs. · Clinic Information Sharing: How staff within clinics/health systems share information. · Clinic Reporting: Any reporting challenges and/or benefits that are a result of integrating implementation of EBIs in clinics.
Sustainability	<ul style="list-style-type: none"> · Sustainability Plans: Clinic systems, infrastructure, and/or policies/procedures that are in place to sustain integrated implementation of EBIs. · Sustainability Challenges: Challenges related to sustaining integration of cancer and chronic disease prevention programs at the health department. · Clinic Champions: The role of champions in supporting integrated implementation of EBIs in clinics. · Role of Funding: Resources available to sustain integrated implementation of EBIs in clinics without CDC funding. · Program Improvement: Systems, efforts, or processes that support improvement of integrated implementation of EBIs in clinics.

Note: CDC, Centers for Disease Control and Prevention; CRC, colorectal cancer; CRCCP, Colorectal Cancer Control Program; EBIs, evidence-based interventions.

Additional file 5. Brief description of clinic partner integrated implementation approaches, by site

Site	Approaches to integrated implementation by program clinic partners
Rhode Island	Used a chronic care delivery model that integrates CRC screening with other cancer and chronic disease screenings. Integration of CRC with other chronic disease screenings is reflected in workforce development, clinical practice guidelines, EHR prompts with physician reminders, and patient navigation.
Nebraska	<p>Integrated CRC screening within an EHR-based provider reminders system (clinical decision support rules) used for multiple screenings.</p> <p>Used a FluFIT program to integrate CRC screening (FOBT kits or colonoscopy referral) with flu shots.</p>
Washington	<p>Integrated CRC screening within EHR-based patient and provider reminders that are used for multiple screenings.</p> <p>Expanded interventions focused on reducing structural barriers (e.g., providing mobile mammography and transportation vouchers) to include barriers for CRC screening (e.g., mailing FIT kits to patients due for CRC screening).</p>
Kentucky	<p>Integrated CRC screening into an existing patient reminder system (i.e., phone calls to remind patients about need for CRC screening, other cancer screenings).</p> <p>Reduced structural barriers for CRC screening by including screening as part of “max packing” appointments that also included flu shots and/or mammograms.</p>

Note: CRC, colorectal cancer; EHR, electronic health record; FIT, fecal immunochemical test; FOBT, fecal occult blood test.

Figures

- Integrate public health and primary care
- Use evidence-based strategies to maximize limited public health dollars
- Establish partnerships to support implementation
- Implement sustainable health system changes
- Focus on defined, high-need populations
- Encourage innovations in adaptations of evidence-based interventions
- Use data for program improvement, performance management, and reporting

Figure 1

Tenets of the Colorectal Cancer Control Program

Figure 2

Methodological Approach

Figure 3

Program and clinic partner factors supporting integrated implementation