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Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-Based Practice Centers (EPCs), sponsors the development of evidence reports and technology assessments to assist public- and private-sector organizations in their efforts to improve the quality of health care in the United States. The reports and assessments provide organizations with comprehensive, science-based information on common, costly medical conditions and new health care technologies. The EPCs systematically review the relevant scientific literature on topics assigned to them by AHRQ and conduct additional analyses when appropriate prior to developing their reports and assessments.

To bring the broadest range of experts into the development of evidence reports and health technology assessments, AHRQ encourages the EPCs to form partnerships and enter into collaborations with other medical and research organizations. The EPCs work with these partner organizations to ensure that the evidence reports and technology assessments they produce will become building blocks for health care quality improvement projects throughout the Nation. The reports undergo peer review prior to their release.

AHRQ expects that the EPC evidence reports and technology assessments will inform individual health plans, providers, and purchasers as well as the health care system as a whole by providing important information to help improve health care quality.

We welcome comments on this evidence report. They may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850, or by e-mail to epc@ahrq.gov.

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Structured Abstract

Objectives. To conduct a systematic review of the use and quality (including underuse, overuse, and misuse) of appropriate colorectal cancer (CRC) screening, including factors associated with screening, effective interventions to improve screening rates, current capacity, and monitoring and tracking the use and quality. Trends in the use and quality of CRC screening tests is also presented.

Data sources. We searched MEDLINE®, the Cochrane Library, and the Cochrane Central Trials Registry, supplemented by handsearches, for studies published in English from January 1998 through September 2009.

Review methods. We used standard Evidence-based Practice Center methods of dual review of abstracts, full text articles, abstractions, quality rating, and quality grading. We resolved disagreements by consensus.

Results. We found multiple problems of underuse, overuse, and misuse of CRC screening. We identified a total of 116 articles for inclusion into the systematic review, including a total of 72 studies qualified for inclusion for key question (KQ) 2, 21 for KQ 3, 12 for KQ 4, and 8 for KQ 5. A number of patient-level factors are associated with lower screening rates, including having low income or less education, being uninsured or of Hispanic or Asian descent, not being acculturated into the United States, and having less or reduced access to care. Being insured, of higher income or education, and non-Hispanic white, participating in other cancer screenings, having a family history of CRC or personal history of another cancer, as well as receiving a physician recommendation to be screened, are associated with higher screening rates. Interventions that effectively increased CRC screening with high strength of evidence include patient reminders, one-on-one interactions, eliminating structural barriers, and system-level changes. The largest magnitude of improvement came from one-on-one interactions and eliminating barriers. Purely educational small-media interventions do not improve screening rates. Evidence is mixed for decision aids, although certain designs may be effective. No studies tested interventions to reduce overuse or misuse of CRC screening. We found no studies that assessed monitoring systems for underuse, overuse, and misuse of CRC screening. Modeling studies, using various assumptions, show that if the United States were to adopt a colonoscopy-only approach to CRC screening and everyone were to agree to be screened in this way, it is likely that colonoscopy capacity would need to be substantially increased.

Conclusions. Both CRC screening and patient-physician discussions of CRC screening are underused, and important problems of overuse and misuse also exist. Some interventions hold promise for improvement. The research priority is to design and test interventions to increase screening and CRC screening discussions, building on the effective approaches identified in this review, and tailored to specific population needs. In addition, new interventions to reduce overuse and misuse should be designed and tested, along with studies of ongoing monitoring systems that are linked to feedback and continued improvement efforts.

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Appendixes and Evidence Tables for this report are provided electronically at **http://www.ahrq.gov/downloads/pub/evidence/pdf/crcuse/crcuse.pdf**.

Executive Summary

Introduction

Periodic screening of people at average risk for colorectal cancer (CRC) is recommended by three important national guideline groups, the United States Preventive Services Task Force (USPSTF), the American Cancer Society (ACS), and the U.S. Multi-Society Task Force on Colorectal Cancer (MSTF), as well as multiple professional societies. For CRC screening to contribute to a reduction in CRC mortality without unreasonable harms and costs, however, it must be offered to people who have a reasonable probability of net benefit, and it must be conducted effectively and efficiently. These issues of use and quality are especially salient for CRC screening because it is in some ways more complex (e.g., variation in timing and types of tests, invasiveness of most tests) than other screening programs. Underuse of CRC screening has been a clear problem for some years; evidence is now growing that overuse (i.e., screening people with little potential for net benefit) and misuse (i.e., conducting screening in ways that reduce net benefit) may also be important problems.

The RTI International-University of North Carolina Evidence-based Practice Center (RTI-UNC EPC) prepared this report, under the auspices of the Agency for Healthcare Research and Quality, for the National Institutes of Health (NIH) State-of-the-Science Conference on Enhancing Use and Quality of Colorectal Cancer Screening, which is scheduled for February 2010. This report is a systematic review of evidence about the use and quality of screening for CRC focusing on four primary key questions (KQs). It also includes an initial background section (KQ 1) on trends and the current situation of use and quality, and it presents a concluding discussion on needed research (KQ 6). The specific KQs of interest were as follows:

KQ 1. What are the recent trends in the use and quality of CRC screening?

KQ 2. What factors influence the use of CRC screening?

KQ 3. Which strategies are effective in increasing the appropriate use of CRC screening and followup?

KQ 4. What are the current and projected capacities to deliver CRC screening and followup at the population level?

KQ 5. What are the effective approaches for monitoring the use and quality of CRC screening?

KQ 6. What research is needed to make the most progress and have the greatest public health impact in promoting the appropriate use of CRC screening?

Methods

We searched MEDLINE®, the Cochrane Library, and the Cochrane Central Trials Registry for studies published in English from January 1998 through September 2009. We searched data sources using Medical Subject Heading (MeSH) terms when available or key words when appropriate. MeSH terms for our searches included colorectal neoplasms, colonoscopy, sigmoidoscopes (including flexible sigmoidoscopy [FS]); major headings included mass screening; and key terms included stool test, fecal occult blood test (FOBT), and DNA stool).

We used standard EPC methods of dual review of abstracts, full text articles, data abstraction for evidence tables, rating quality of articles, and grading strength of evidence. Specifically, we rated the internal validity of studies as good, fair, or poor. We used the AHRQ EPC program's approach to grading strength of evidence as high, moderate, low, or insufficient for KQs 3, 4, and 5. We resolved disagreements by consensus.

KQ 1: Background on Recent Trends in Use and Quality of CRC Screening

This section summarizes trends in the use of CRC screening tests, CRC screening discussions, and the quality of CRC screening. In some cases, data were insufficient to determine trends, but we present current status where possible.

Underuse of both CRC screening and patient-physician discussions of CRC screening is clear. Self-reported screening rates by national surveys, which are likely overestimates of actual screening, have increased from less than 25 percent in the late 1980s to about 50 percent to 60 percent in 2005 to 2006; an even smaller percentage of people had had a discussion about CRC screening with their primary care physician. The increased screening can be attributed entirely to an increase in the use of screening colonoscopy; screening with FOBT and sigmoidoscopy declined over this period. We found no data on the trends of use or quality of fecal immunochemical test, fecal DNA testing, or computed tomographic colonoscopy.

Few health care systems have developed monitoring systems to provide physicians with feedback on CRC screening rates, nor have they provided incentives to physicians for improving screening. The health care system of the Veterans Health Administration (VA), which relies more on FOBT than other modalities for screening and which has developed monitoring and incentive systems, has screening rates above 75 percent.

At the same time as the underuse documented above, screening can be overused when people who are unlikely to benefit are screened: for example, people older than 85 years and/or people with severe comorbidities. Surveillance colonoscopy and, probably, polypectomy for diminutive polyps less than 5mm where benefit is uncertain but increased risk is clear, may also be overused though research on this issue is still needed (i.e., the extent to which removal of small polyps is a greater or lesser harm to the patient compared to ignoring the polyps).

Finally, problems of misuse, screening in such a way as to reduce benefits and/or increase harms, are also clear. These include use of in-office rather than home FOBT; nonreturn of FOBT cards; lack of adequate followup of positive FOBT results; colonoscopy that does not reach the cecum, has too rapid withdrawal time, that misses important lesions, and colonoscopy with high adverse event rates.

Results

Our initial searches of electronic databases, along with handsearches and an updated search in October 2009 produced 3,029 unduplicated records. Ultimately, for the four main questions, we included the following numbers of articles that were rated either good or fair quality: 72 studies addressing KQ 2, 21 addressing KQ 3, 12 addressing KQ 4, and 8 addressing KQ 5. We excluded studies rated poor quality from our analyses.

KQ 2: Factors Influencing Colorectal Cancer Screening

We categorized studies examining factors associated with the use of CRC screening tests into five domains: patient factors, physician factors (including physician characteristics, physician-patient connectedness, and physician recommendations about screening), patient-physician communication factors, the periodic health examination, and system factors. We further categorized the patient factors into four groups: patient demographics, access to care, personal health or risk factors, and psychosocial factors.

All studies focused on factors associated with underuse of CRC screening. None focused on factors associated with underuse of CRC discussions or on factors associated with overuse or misuse of CRC screening.

Factors consistently and significantly associated with reduced CRC screening include

- low household income,
- no health insurance,
- being Hispanic or Asian,
- not being acculturated into the United States,
- limited access to care (i.e., lack of a regular source of primary care and no visits in previous year to provider), and
- no physician recommendation to be screened.

Factors positively associated with CRC screening include having private insurance, being non-Hispanic white, having a higher education level, participating in regular screenings for other cancers, having a family history of CRC or personal history of another cancer, having regular access to care, having effective patient-provider communication, and having a physician recommendation for screening. We found two studies that focused on patient factors that seem to influence followup rates after receipt of an abnormal result. We found one study each that examined the association between screening and specific physician characteristics, patient-physician connectedness, and periodic health examinations. Thus, we did not draw conclusions about these relationships because the evidence was insufficient. Studies on system level factors that might influence CRC screening did not consistently measure the same variables but seem to support counseling by nonclinicians, reminder systems, and assisting patients to keep appointments.

KQ 3: Effective Strategies for Increasing Appropriate Use of Colorectal Cancer Screening

We first categorized studies into three intervention targets: patients, physicians, and health care systems. Following similar categories recently used to develop recommendations for the Task Force on Community Preventive Services (TFCPS), we further divided the patient-level interventions into five categories: (1) patient reminders; (2) small media (with and without decision aids); (3) group education; (4) one-on-one interactions; and (5) eliminating structural barriers. All studies of interventions focused on reducing underuse of CRC screening and/or followup after receiving a positive FOBT. We found one study that examined an intervention to increase patient-physician discussions about CRC screening. No study tested an intervention to reduce overuse or misuse of CRC screening.

Interventions that provided patient reminders led to small to moderate increases in CRC screening, with high strength of evidence (5.0 to 15.0 percentage point increase). Studies of small media (educational print or video messages) to increase CRC screening showed no benefit, with high strength of evidence. Evidence concerning decision aids to increase screening was mixed. With two of three studies showing benefit, some types of decision aids may be effective for increasing screening (14.2 to 23.0 percentage point increase in screening rates reported in the two positive studies; 3.0 percentage point increase in the one negative study), although overall strength of evidence was low. Evidence was also mixed (i.e., low strength of evidence) concerning the effect of group education, with one study showing a negative effect on screening and another finding a small positive effect. One-on-one interactions, especially with intensive contact with patients by a nurse, a health educator, or on the phone, increased screening rates, sometimes to a large degree, with percentage point increases such as 14.6 percentage points in FOBT completion, 20.9 percentage points of any CRC test, and 41.9 percentage points in FOBT completion. Strength of evidence for this type of intervention was high. Interventions that eliminated structural barriers, such as by providing FOBT tests to use at home or providing access to individuals who can help to address barriers, also increased screening rates, with high strength of evidence (absolute rate change from 14.6 to 41.9 percentage points).

Two studies of physician-targeted reminder interventions found either no effect or a very small effect on appropriate screening, with low strength of evidence. More evidence was available for evaluating various system-level interventions (e.g., implemented changes to improve referral of patients for screening or identified a person such as a patient navigator or someone in a similar role (i.e., Prevention Care Manager or PCM) to help patients navigate the health care system). These studies found consistently positive effects on screening (7.0 to 28.2 percentage point difference in screening rates compared to control groups), with high strength of evidence.

KQ 4: Capacity to Deliver Colorectal Cancer Screening and Followup

Initially, we examined three aspects of this issue: current capacity to conduct CRC screening (six studies in seven articles), projected capacity (five studies), and ability to meet projected demand (i.e., nation's ability to meet the projected demand under various scenarios, such as screening the entire eligible U.S. population with a specific test). Several modeling studies, using various assumptions, addressed these issues.

These modeling studies found that if the United States were to adopt a colonoscopy-only approach to CRC screening and if everyone were to agree to be screened in this way, colonoscopy capacity would need to be substantially increased to do the "catch-up" screening required to screen people who have not been screened and to continue to screen in a steady state for all eligible people. The strength of evidence for all the data and estimates from these studies is low.

KQ 5: Effective Approaches for Monitoring CRC Use and Quality

We found no studies that directly answered the question of how CRC screening use and quality have been effectively monitored and tracked in the past decade. Included studies addressed only one specific component of monitoring, namely data quality; we found no studies that described or compared other monitoring system attributes. Overall in our review we found that some national surveys (e.g., the National Health Interview Survey [NHIS], the Behavioral

Risk Factor Surveillance System [BRFSS]) monitor self-reported CRC screening by the U.S. population. Current national registries are inadequate to monitor accurately the CRC screening rates of medical practices, and few practices (with the exception of the VA system and the National Committee on Quality Assurance Healthcare Effectiveness Data and Information Set [HEDIS]) monitor their own CRC screening rates or the quality of CRC screening. No current national registries monitor either CRC discussions or overuse or misuse (including adverse events) of CRC screening. Registries for conditions other than CRC may provide some models for CRC screening.

Discussion

Although recent trends have shown a gradual increase in CRC screening, these increases still leave levels of CRC screening considerably below levels for breast cancer screening. Some differences between the rates for CRC screening and breast cancer screening may occur because of the nature of CRC screening, with several options for screening strategies, each with its own set of preparation and completion difficulties for the patient. The implications of this review are related primarily to the findings specific to the interventions tested to increase screening, and to three cross-cutting themes that underlie our findings: access to CRC screening; communication about CRC screening; and the organization of CRC screening.

Interventions to Improve Screening

The interventions reviewed in KQ 3 deserve further comment. Although we found high strength of evidence and positive effects for patient reminders, one-on-one interactions, eliminating structural barriers to screening, and system-level interventions, whether any specific set of interventions would effectively increase screening rates across the country remains unclear. First, whether we have the ability to implement these interventions on a broad scale within medical practices, and for the general population, is uncertain. To implement and maintain these interventions properly, an effective monitoring and feedback system (KQ 5) is needed. These systems are not in place in most primary care practices. Second, overcoming the focus in primary care practices on nonpreventive care, and overcoming the time and cost barriers to implementing and maintaining these types of screening systems within busy primary care practices, both present uncertainties. Partly because of the lack of positive incentives and the required time and effort from primary care practices, the durability of interventions that initially seem successful is uncertain. Finally, the cost effectiveness of the sometimes intensive interventions to gain disproportionately small increases in screening is also unknown. Until these more fundamental issues are dealt with, widespread implementation of any interventions may not have a large, sustained effect at reasonable costs (including time and effort of the patient, the physician, and the medical practice).

Access to CRC Screening

A critical underlying issue in this literature is access to care, a necessary precursor to access to CRC screening. Among the most striking findings from our review of factors associated with lower rates of CRC screening (KQ 2) is that people without health insurance, people with no source of usual care, people with no recent physician visits, and people with lower income status have quite low CRC screening rates. Improved communication can only be effective for people

who are connected (KQ 2) to a primary care provider. For CRC screening rates to improve dramatically, providing more standard access to this care for people who will benefit the most is essential.

Communication About CRC Screening

One positive finding of this report is the overall importance of communication specific to CRC screening between medical staff and patients in improving appropriate CRC screening (i.e., reducing underuse, overuse, and misuse). CRC screening requires a great deal of patient understanding and effort (e.g., knowing which tests to take and when, and how to get them done). Communicating such information to patients and guiding them in making decisions specific to their medical and family history all take time. To make appropriate decisions about individually optimal screening, to carry out the preparation and follow-through correctly, and to obtain screening at recommended intervals all require patient knowledge, motivation, and assistance from medical personnel. When few CRC discussions take place (KQ 1), when many eligible patients do not know that they should be screened (KQ 2), when medical personnel make few recommendations for screening (KQ 2), when many people do not receive periodic health exams [during which time might be devoted to discussions of CRC screening (KQ 2)], and when few intensive one-on-one or system level interventions exist, including those to eliminate barriers, to assist patients to decide, prepare, and follow-through (KQ 3), suboptimal screening rates should not be surprising.

Organization of CRC Screening and Monitoring

CRC screening in the United States requires the involvement of primary care physicians, most of whom receive no regular feedback on their CRC screening rates, as might occur in the VA or other integrated health care system. Few medical practices involve nonphysician office staff in discussing CRC screening with patients; few reach out to patients who have not been screened or who miss screening appointments. As suggested by the VA's success with CRC screening (KQ 1), by the association of use of nonphysician staff with higher CRC screening rates (KQ 2), and by randomized controlled trials (RCTs) of organizational change (KQ 3) to improve screening, organizational change supported by monitoring and feedback systems (KQ 5) could have a positive effect on screening. Nonetheless, drawing conclusions on how to reduce overuse and misuse will always be difficult without adequate monitoring of these outcomes.

A second important aspect of organization is external to the primary care practice, and involves coordination of various parts of the health care system involved in CRC screening. Because these parts of the health care system are often fragmented, barriers are set up that patients must navigate to complete screening. These same barriers work against monitoring the progress of patients as they move through the system, and providing assistance to those who are not able to surmount the barriers. Finally, these barriers create problems for providing consistent and timely information to patients, and for establishing systems to reduce overuse and misuse.

KQ 6: Future Research Directions

The priority for research should be RCTs of interventions to implement appropriate CRC screening (i.e., minimizing underuse, overuse, and/or misuse) and monitoring, which is then linked to improvement initiatives. In our review, we became aware of multiple studies of the

operating characteristics of potential new CRC tests. Although improving screening tests is a reasonable research agenda (especially in finding ways to reduce the need for the most invasive and expensive tests), a greater balance with research could help find ways to implement screening programs that we already know are effective. To focus research primarily on developing newer screening tests without placing higher priority on implementation of the effective existing tests leaves people with inadequate screening.

Our review suggests that three steps are required for achieving higher rates of appropriate screening: (1) increasing patient access to care; (2) improving effective communication about screening and screening options between trained educators (physicians or nonphysicians) and patients; and (3) simplifying and coordinating organizational structures to better facilitate patients in completing screening. At least as important as developing newer screening tests is research to test interventions to improve access, communication, and organization of health.

Not only must the organizational and system features needed to increase screening be understood, but research also needs to consider the interaction of system features with characteristics of the population. Several studies testing interventions (KQ3) were implemented within clinic settings, limiting the generalizability of the findings. More needs to be understood about how interventions work in increasing screening among those receiving services through different settings. Since studies show that people who have access to a regular source of care are more likely to be screened (KQ2), research should focus more on those without this facilitator. In addition, access, communication, and organizational requirements to increase appropriate screening will most likely differ depending on the population involved. The most efficient and cost-effective approaches to increase appropriate screening will probably include some tailoring of the intervention to these and other specific populations.

After determination of the effectiveness and cost effectiveness of various interventions, pragmatic trials focused on implementation of successful strategies within different types of health care systems and populations are needed. Different intensities of interventions, and even wholly different interventions, will likely be needed for different populations. Interventions should be targeted at the specific steps that are problems for specific populations (e.g., those who speak other languages than English at home could likely benefit from more basic interventions to increase awareness and discussions, whereas those who are already obtaining screening on an irregular basis may benefit most from patient reminders).

Further, we also need continued research into measuring current volume and projected demand for screening strategies. Finally, we found little evidence that adequate monitoring systems that assess the full spectrum of appropriate CRC screening (including overuse, underuse, and misuse) are in widespread use, and are being used to improve screening. Such monitoring systems are critically important for continued improvement of CRC screening, especially for reduction of overuse and misuse. There is a large and important research agenda in developing and testing interventions to increase discussions of CRC screening, and to reduce overuse and misuse.

Throughout this review, accurately describing results for the outcome of CRC screening has been a major challenge because of the inconsistencies in how it has been measured and/or operationalized. We see a need to develop standard measures for assessing the outcomes (and also for assessing factors associated with screening). While efforts have been completed in the past to standardize related measures for how CRC screening is to be assessed and then to develop valid measures, these measures have not been consistently used in all national surveys or studies, making it difficult to accurately assess current screening rates. Better application of these

existing measures would greatly improve the quality of the findings from studies to be done in the future, thereby expanding our understanding of what factors influence CRC screening that can actually be addressed through interventions and policy development.

This need for standard measures and mechanisms for collecting the data directly relates to the findings for KQ 5, in that we found no studies that directly answered the question of how CRC screening use and quality have been effectively monitored and tracked in the past decade. Without more information that is systematically collected through provider practices, hospitals, clinics, and other primary care organizations, our understanding of CRC screening will continue to be less than optimal.

Conclusions

Our review suggests that the United States is yet some distance from fully realizing the promise of appropriate and high-quality CRC screening. Problems of underuse, overuse, and misuse are not being adequately addressed at present. By focusing our research effort on the issues that matter most—access to screening, communication between patient and medical staff, the organization of care—and by further researching how to implement effective and cost-effective strategies into actual primary care practice, we will have the greatest opportunity to reduce the burden of suffering of CRC for the people of the United States.

Evidence Report

Chapter 1. Introduction

Periodic screening of people at average risk for colorectal cancer (CRC) is recommended by three important national guideline groups, the United States Preventive Services Task Force (USPSTF), the American Cancer Society (ACS), and the U.S. Multi-Society Task Force on Colorectal Cancer (MSTF),[3-4] as well as multiple professional societies. For CRC screening to contribute to a reduction in CRC mortality without unreasonable harms and costs, however, it must be offered to people who have a reasonable probability of net benefit, and it must be conducted in an effective and efficient manner. These issues of use and quality are especially salient for CRC screening because it is in some ways more complex than other screening programs. We understand "quality" to refer to "underuse," "overuse," and "misuse"[5] rather than simply test performance. Underuse of CRC screening has been a clear problem for some years; evidence is now growing that overuse (i.e., screening people with little potential for net benefit) and misuse (i.e., conducting screening in ways that reduce net benefit) may also be important problems.

This report is a systematic review of four key questions (KQs) concerning the use and quality of screening for CRC. As part of the first KQ, a background section on trends and the current situation of use and quality are presented. Literature was not systematically reviewed for this KQ but are instead summarized to provide the reader with a sense of the current status of trends in CRC testing. The purpose of the remaining five KQs is to inform recommendations for improving the use and quality of CRC screening. To achieve this goal, we provide information about factors associated with the use of CRC screening (KQ 2), effective strategies for increasing the appropriate use of CRC screening and followup (KQ 3), the current and projected capacity of the US health care system to deliver tests (especially colonoscopy) for the population needing screening (KQ 4), and approaches for monitoring the use and quality of CRC screening (KQ 5). We then conclude the review in Chapter 5 with a discussion that includes recommendations for research needed to make progress and have greatest public health impact in promoting the appropriate use of CRC screening (KQ 6). The RTI International-University of North Carolina Evidence-based Practice Center (RTI-UNC EPC) prepared this report for the National Institutes of Health (NIH) State-of-the-Science Conference on Enhancing Use and Quality of Colorectal Cancer Screening, which is scheduled for February 2010.

Development of Evidence and Recommendations for CRC Screening

Several screening tests for CRC are in current use, including guaiac-based fecal occult blood test (gFOBT, which can be either high or low sensitivity), fecal immunochemical test (FIT), flexible sigmoidoscopy (FS), and colonoscopy. Two other tests have been used in the past but are less used today: digital rectal examination and double contrast barium enema (DCBE). Two newer tests have been proposed but are not in widespread use: fecal DNA and computed tomographic colonography (CTC).[6] This report will focus on the current and newer tests.

Since the early 1990s, four randomized controlled trials (RCTs) of screening with gFOBT[7-10] have found a relative reduction of 16 percent to 33 percent in CRC mortality (absolute risk reduction = 2.9 deaths/1,000 over 13 years in the U.S. trial), first appearing 5 to 7 years after start of screening. Although the USPSTF found insufficient evidence to recommend screening in 1989,[11] before the RCTs had reported, it recommended screening with gFOBT or FS (supported

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by a good-quality case-control study) in 1996,[12] after several RCTs were published. The 1996 USPSTF recommendation, however, found insufficient evidence to recommend screening with colonoscopy, noting the lack of RCT evidence to determine the magnitude of benefit. In 2002, the USPSTF broadened its recommendation to include screening with any of several tests, including gFOBT, FS, and colonoscopy. The recommendation for colonoscopy was based on extrapolation of benefits from studies of FOBT and FS.[13-15]

In 2008, the USPSTF updated its recommendation again, recommending screening with any of several tests, including gFOBT, FIT, FS, and colonoscopy. It recommended that adults ages 76 to 85 not be screened routinely (i.e., screening should be determined by modeling a history of sufficient screening up until that point) and that adults ages 85 years and older not be screened at all. It found insufficient evidence to make any recommendation concerning screening with fecal DNA or CTC.[3]

The USPSTF placed emphasis on the need for discussion between providers and individual patients to determine the optimal screening strategy. As noted in the 2002 recommendation statement:

> The choice of specific screening strategy should be based on patient preferences, medical contraindications, patient adherence, and available resources for testing and follow-up. Clinicians should talk to patients about the benefits and potential harms associated with each option before selecting a screening strategy.[13]

The MSTF has issued three sets of guidelines over the past 12 years (1997, 2003, and 2008) on screening for CRC; they were joined in the 2008 guideline by the American Cancer Society (ACS) (which had developed its own guidelines over previous years) and the American College of Radiology (ACR). The 1997 guideline recommended screening using one of five options: annual FOBT, FS every 5 years, annual FOBT and FS every 5 years combined, double-contrast barium enema every 5 to 10 years, and colonoscopy every 10 years.[16] The 2003 recommendation repeated the same options, noting that "these guidelines offer screening options and encourage the physician and patient to decide together which is the best approach for them."[17] The 2008 recommendation suggested the same tests but added CTC and fecal DNA testing.[4] The 2008 guideline departed from the previous MSTF recommendations in that it separated screening tests into those that primarily detect CRC (gFOBT, FIT, fecal DNA) and those that detect both CRC and colonic polyps (FS, colonoscopy, CTC, barium enema). It recommended a test from the latter group most strongly but also approved screening with a test from the former group if the patient refused a test that detects both CRC and polyps. The guideline states "When possible, clinicians should make patients aware of the full range of screening options, but at a minimum they should be prepared to offer patients a choice between a screening test that primarily is effective at early cancer detection and a screening test that that is effective at both early cancer detection and removal of polyps". (p. 1570)[4] Because of the changes and, often, the inconsistencies in the national guidelines, and because of such issues as patient preferences, medical contraindications, patient adherence, and available resources,[13] a number of factors can affect whether or not a patient is screened. These factors are described and literature presented under KQ 2 in Chapter 4.

Four issues emerge from this brief review above. First, although only gFOBT has been tested in full RCTs of CRC screening, guideline groups have determined that other tests that find early CRC would also be effective in reducing CRC mortality. This allows a range of screening options, each with its own set of potential benefits and harms.

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Second, this range of options has presented problems in making recommendations, making screening for CRC more complex in some ways than screening for such conditions as breast cancer where fewer tests (mammography, clinical breast examination) are recommended. The solution proposed by both the USPSTF and the MSTF has been discussion with patients to make individualized screening decisions. The variation in potential benefits and harms of the range of options, however, makes it unlikely that brief discussions can achieve a truly informed decision. Longer discussions to fully address all related issues are problematic because of the limited time already afforded to the physician to address preventive care during a specific medical appointment.

Third, experts disagree about whether tests that detect polyps in addition to CRC (so-called "structural tests," such as colonoscopy) should be preferred over tests that primarily detect CRC ("nonstructural tests" such as FOBT and FIT, which are among the tests recommended by the USPSTF). Most of the mortality reduction in the RCTs of gFOBT (over 10 to 15 years of followup) has likely come from detection of early CRC rather than removal of polyps, although polypectomy has been shown to reduce the incidence of CRC by about 20 percent over 18 years of followup.[18] In addition, the primary structural test (colonoscopy) carries greater potential harm and cost than non-structural tests. Thus, the evidence is not clear that the net benefits (benefits minus harms) of structural tests are greater than those of non-structural tests.

Fourth, the USPSTF recommends stopping routine CRC screening after age 75 (and all CRC screening after age 85). The MSTF acknowledges that a different screening recommendation may be appropriate for older people, but they delayed comment in the current guideline.[4]

Implementation of Guidelines: Use and Quality

Although a substantial range of effective options exists, CRC screening cannot optimally reduce CRC mortality without unreasonable harms and costs unless two conditions are met: (1) screening is used by a large percentage of eligible people and (2) screening minimizes problems of quality such that patients are being screened appropriately, according to current national guidelines (i.e., underuse, overuse, and misuse are addressed). By underuse of CRC screening we mean that people who would likely derive a net benefit (in which benefits exceed risks or harms by a meaningful amount) are not screened at all or not screened at an appropriate frequency. Underuse is a common issue at the beginning of screening programs. Mammography screening for breast cancer, for example, took some years to become widespread; the 2005 Behavioral Risk Factor Surveillance System found that 74.6 percent of women ages 40 years and older reported having had a mammogram within the previous 2 years.[19] An important question is whether the greater complexity of CRC screening (e.g., variety of tests, timing of each, benefits/harms of each, invasiveness of most) will result in a lower percentage of eligible people being screened, a concern of special importance for disadvantaged populations where underuse is often most severe. In addition to the underuse of CRC screening tests, there is a parallel underuse of discussions between patients and clinicians about CRC screening, as recommended by both major guideline groups.

By overuse of CRC screening we mean the screening of people (or the use of screening techniques) with a low probability of net benefit. Among the common overuse issues are screening people with severe comorbidities and screening people over age 85 (as both groups would be unlikely on a population level to live long enough to benefit from screening). Another overuse concern is overly frequent surveillance colonoscopy after a previous polypectomy; the

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natural history of colonic polyps is that only a small percentage progress to invasive cancer, and this progression takes many years. Thus, the frequency of surveillance should be determined by the probability of a patient developing a lesion that needs to be detected to extend life. Finally, although little literature exists on this issue, another potential problem of overuse of polypectomy may involve small polyps less than 5 mm in size. Because the current colonoscopy policy is to remove all polyps regardless of size, removal of small, low-risk polyps may yield little benefit. Yet evidence is clear that any polypectomy increases the risk of such adverse events as colonic bleeding.[20]

By misuse of CRC screening we mean conducting screening in ways that reduce net benefit for the people being screened. For example, misuse occurs when positive FOBT screening tests are not followed up within a reasonable time by full colon examination (such as colonoscopy). Another misuse problem is high rates of adverse events (e.g., colonic bleeding) from colonoscopy. These adverse events occur more frequently in people who have biopsies or polypectomies and in older people.[20] Colonoscopy that misses clinically important lesions is also an example of misuse. This can result from such factors as lack of full insertion of the colonoscope, too rapid withdrawal time, poor bowel preparation, or lack of skill of the colonoscopist.

Scope of this Report

In Chapter 2, we begin by presenting an overview of the methods used to address each KQ, including a description of the analytical framework used to guide our review. It is in Chapter 2 that we present the inclusion and exclusion criteria used for developing the systematic review. We note that although this report draws on the literature of the effectiveness of CRC screening, it does not review specific benefits and harms of screening. The presented literature notes gaps in the evidence base at appropriate times and states uncertainties where they exist. It does not, for example, examine the evidence of the operating characteristics of various CRC screening tests.

The first KQ, "what are the recent trends in the use and quality of colorectal cancer screening?" is presented in Chapter 3 and provides background information relative to patterns of use of CRC screening tests. The other four KQs entailed formal systematic reviews of the literature and results are presented in Chapter 4. The following are the four KQs for which we systematically reviewed available evidence:

- KQ 2: What factors influence the use of colorectal cancer screening?
  - There are two ways that this information may assist policymakers in improving the use and quality of CRC screening. One way is by uncovering modifiable factors that could be targeted in a future intervention. Another way is to show that problems in use and quality are more prevalent in one population than another. This would allow interventions to be targeted to specific population groups.
- KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?
  - There are many types of interventions that could, and have been, considered to improve problems in use and quality of CRC screening. Policymakers need to know whether certain ones have been shown to be effective enough to implement immediately, and which ones are most promising for future research.

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- KQ 4: What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?
  - The primary issue here is whether screening capacity is adequate to meet expected demands, assuming that screening rates increase to optimal levels. This is a special concern with colonoscopy, which is used for both screening and surveillance. If colonoscopy capacity is inadequate for a screening policy that prioritizes structural tests, then other approaches will need to be considered.
- KQ 5: What are the effective approaches for monitoring the use and quality of colorectal cancer screening?
  - To improve any health care program, one must be able to measure the expected outcome to determine when various interventions are achieving their intended result. Thus, we need to know whether we have systems in place to monitor adequately appropriate use and quality.

The final KQ, KQ 6, addressed "what research is needed to make the most progress and have the greatest public health impact in promoting the appropriate use of colorectal cancer screening?" and is incorporated into the discussion in Chapter 5.

Organization of this Report

The remainder of this report describes our methods to review and synthesize the literature (Chapter 2) and then summarizes the background specific to trends in use and quality of screening (KQ 1 in Chapter 3) and presents our systematic review results for KQ 2-5 (Chapter 4). In the discussion (Chapter 5), we summarize the findings and discuss the implications for practice and further research. A complete list of references is located immediately following the discussion chapter, along with a glossary of terms and a list of abbreviations used throughout this report. This report also contains the following appendices: Appendix A contains the exact search strings we used; Appendix B is all of the data abstraction forms used; Appendix C are our evidence tables; Appendix D is a list of our excluded studies; Appendix E lists the members of our Technical Expert Panel as well as our Peer Reviewers of a draft report; Appendix F lists our poor quality studies; and Appendix G contains supplemental information for KQ 4.

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Chapter 2. Methods

In this chapter, we document the procedures that the RTI International–University of North Carolina Evidence-based Practice Center (RTI–UNC EPC) used to develop this comprehensive evidence report on use and quality of screening tests for colorectal cancer (CRC). To provide a framework for the review, we first present the key questions and their underlying analytic framework. We then describe our inclusion and exclusion criteria, search and retrieval process, and methods of abstracting relevant information from the eligible articles to generate evidence tables. We also discuss our criteria for rating the quality of individual articles and for grading the strength of the evidence as a whole.

Technical Expert Panel (TEP)

In designing the study questions and methodology at the outset of this report, we consulted several technical and content experts, seeking broad expertise and perspectives. We identified five technical experts, in addition to the chair for the National Institutes of Health State-of-the-Science Conference on Enhancing Use and Quality of Colorectal Cancer Screening, for a total of six members (Appendix E).[*] The TEP provided assistance throughout the project and contributed to the Agency for Healthcare Research and Quality (AHRQ's) broader goals of (1) creating and maintaining science partnerships as well as public-private partnerships and (2) meeting the needs of an array of potential customers and users of its products. Thus, the TEP was both an additional resource and a sounding board during the project.

Divergent and conflicting opinions are common; we perceive them as healthy scientific discourse that contributes to a thoughtful, relevant systematic review. Nonetheless, in the end, study questions, design, and/or methodologic approaches do not necessarily represent the views of individual technical and content experts.

To ensure robust, scientifically relevant work, we called on the TEP to provide reactions to work in progress and advice on substantive issues or possibly overlooked areas of research. Specifically, TEP members participated in conference calls and discussions through e-mail to:

- refine the analytic framework at the beginning of the project;
- discuss the preliminary assessment of the literature, including inclusion/exclusion criteria; and
- provide input on the information and categories included in evidence tables.

Because of their extensive knowledge of the literature, including numerous articles authored by TEP members themselves, and their active involvement in the field, we also asked TEP members to participate in the external peer review of the draft report.

Key Questions and Analytic Framework

Based on the key questions (KQs) described in Chapter 1, we developed an analytic framework to guide our systematic review. To recap, the KQs are as follows:

[*] Appendixes and evidence tables cited in this report are available at http://www.ahrq.gov/downloads/pub/evidence/pdf/crcuse/crcuse.pdf.

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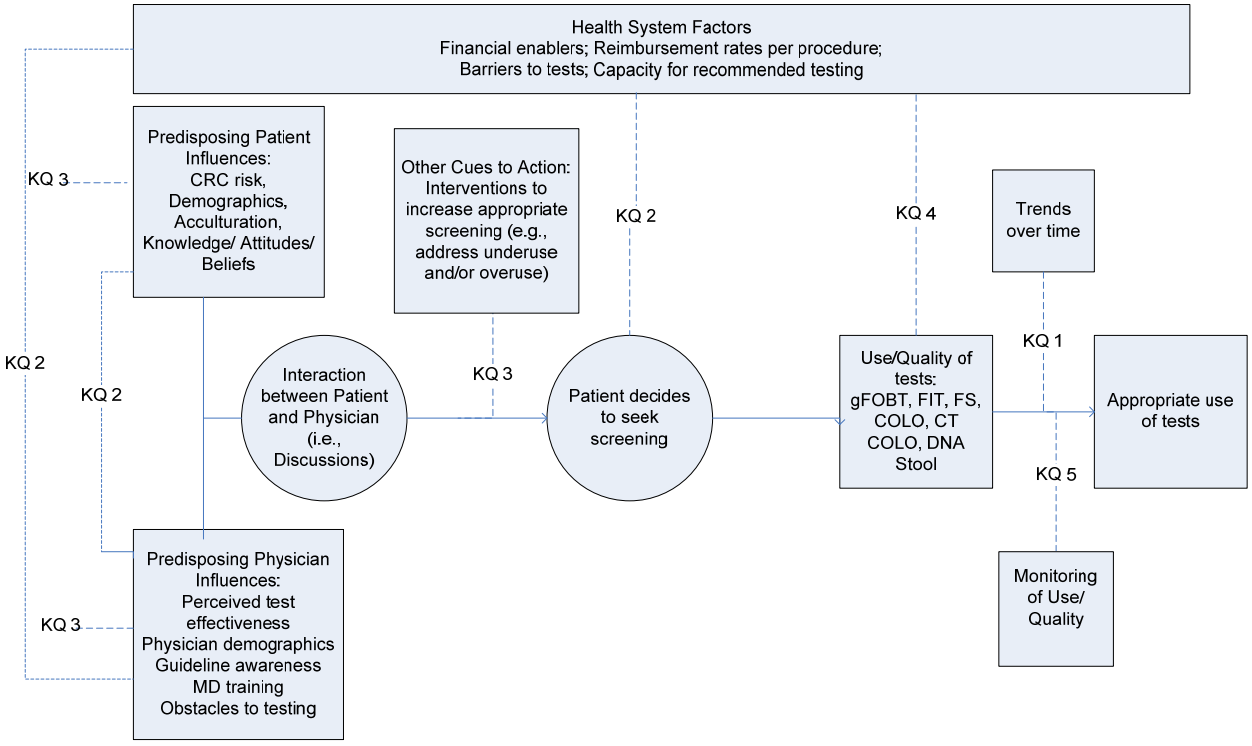
- KQ 1: Background (recent trends in the use and quality of CRC screening tests);
- KQ 2: Factors influencing use of CRC screening;
- KQ 3: Effective strategies for increasing appropriate use of CRC screening and followup;
- KQ 4: Current and projected capacities to deliver CRC screening and surveillance at the population level;
- KQ 5: Effective approaches for monitoring use and quality of CRC screening; and
- KQ 6: Needed research to make progress and have greatest public health impact in promoting the appropriate use of CRC screening.

Figure 1 depicts how we believe various factors interact to influence the appropriate use of CRC screening tests. The boxes are indicative of factors or outcomes of the process of obtaining appropriate tests; the circles are meant to depict some interaction or decision point in the process (i.e., the interaction between physician and patient and the patient's decision point). KQs 1-5 are called out in the figure (dotted lines); the societal and health system factors are assumed to affect all steps in the process.

Figure 1. Analytic framework for the appropriate use of colorectal cancer screening



COLO, colonoscopy; CRC, colorectal cancer; CT COLO, computed tomographic colonography; DNA Stool, Deoxyribonucleic acid fecal test; FIT, fecal immunochemical test; FS, flexible sigmoidoscopy; gFOBT, guaiac-based fecal occult blood test; KQ, key question; MD, medical doctor.

Specifically, both KQ 1, which pertains to trends in use and quality of colorectal cancer screening, and KQ 5, which pertains to monitoring the use and quality, are considered to be outcomes of the process depicted in Figure 1. In the remainder of this systematic review, we assess the changes in trends over time and how the use and quality of the specific tests (i.e., colonoscopy, sigmoidoscopy, computed tomography [CT] colonography, and stool tests) are

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monitored. This includes paying particular attention to issues such as the extent to which overutilization and/or underutilization of tests is evident.[21-22]

Many factors have been shown in the literature to influence both the use and quality of tests. Although the patient is ultimately the one to decide whether to obtain screening,[23] a discussion with the health care provider about screening needs and options can directly affect the decision.[24-25] This discussion is depicted in the analytic framework as the point at which an interaction between key patient and provider characteristics occurs to guide the discussion.

As shown in the two boxes on the far left of the analytic framework (Figure 1), both the patient and the provider bring characteristics to this interaction that are immutable yet likely to influence the provider's recommendations for CRC screening and the patient's ultimate decision to seek it. Termed "predisposing" by Green and Kreuter, these factors exert their effects before a behavior occurs by increasing or decreasing a person's or a population's motivation to undertake that particular behavior.[26] Predisposing patient characteristics that may influence the ultimate decision related to CRC screening include

- family history of CRC;
- perceived risk or understanding of whether they are likely to be diagnosed with CRC;
- education level, income, and other socioeconomic factors;[27] and
- location of residence (i.e., proximity to screening facilities and/or providers).[28]

Predisposing physician characteristics that have been shown to influence screening recommendations[24,29] include

- perceived effectiveness of each type of CRC screening test;
- physician demographic characteristics such as age, whether solo or group practice, and location of practice; and
  medical training and awareness of current screening guidelines.

Literature Search

To identify articles relevant to each KQ we searched three electronic databases—MEDLINE®, the Cochrane Library, and the Cochrane Central Trials Registry—for articles published from January 1998 through September 2009. We used either Medical Subject Headings (MeSH or MH) as search terms when available or key words when appropriate. MeSH terms for our searches included colorectal neoplasms, colonoscopy, sigmoidoscopes; major headings included mass screening; and key terms included stool test, FOBT, and DNA stool. The full search strategy of exact search strings is presented in Appendix A.[†]

Our initial searches of electronic databases produced 3,029 unduplicated records. We supplemented our electronic searches by manually searching reference lists of included studies, pertinent review articles, and editorials. Additional included studies were identified from recommendations of members of the TEP and by peer reviewers. We imported all citations into an electronic database (EndNote X.3).

[†] Appendixes and evidence tables cited in this report are available at http://www.ahrq.gov/downloads/pub/evidence/pdf/crcuse/crcuse.pdf.

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Study Selection Process

Inclusion and Exclusion Criteria

As noted in Chapter 1, this systematic review focuses on the use and quality of CRC screening procedures. We developed detailed eligibility criteria with respect to population, interventions, outcomes, time period, and study design (Table 1). We limited eligible studies to those conducted in the United States so that the data would reflect domestic health care concerns, practices, and guidelines. We also restricted our searches to studies published in 1998 or later to ensure that results had relevance to current trends and practice for CRC screening. We excluded studies that (1) were published in languages other than English, (2) did not report information pertinent to the KQs, (3) had fewer than 30 subjects for randomized or nonrandomized controlled trials or fewer than 100 subjects for observational studies, (4) were not original research, or (5) evaluated interventions that were conducted in academic settings that would not be applicable to most practice settings.

Table 1. Inclusion/exclusion criteria

Category	Inclusion Criteria	Exclusion Criteria
Study population	Humans, all races, ethnicities, cultural groups Asymptomatic for CRC and not at increased risk for CRC *OR* at increased risk for CRC because of a family history of CRC or polyps, or because of a history of polyps at prior colonoscopy	Studies that exclusively focus on CRC screening for patients with a family history Patients with diagnosis of any of the following: • Genetic diagnosis of FAP or suspected FAP without genetic testing evidence • Genetic or clinical diagnosis of HNPCC (also known as Lynch syndrome) or individuals at increased risk of HNPCC • Inflammatory bowel disease, chronic ulcerative colitis, or Crohn's disease • Colon and/or rectal cancer • Other hereditary polyposis syndromes Studies that assess whether certain groups are at greater risk for CRC than others (e.g., people with comorbidities such as diabetes, liver transplant)
Study outcomes	KQ 2: Factors influencing testing/screening rates only or CRC screening discussions (e.g., predisposing patient and provider characteristics, health system factors, interventions) or quality of CRC screening KQ 3: Interventions focused on changing appropriate CRC screening rates among a specified population and the rates are presented	KQ 2: Outcomes of knowledge, risk perception, providers' attitudes toward testing, and/or their referrals to testing (which include no screening outcome data) KQ 3: Changes in attitudes, beliefs, or intentions to obtain screening Other criteria specific to outcomes: Outcomes not directly addressing at least one KQ Cost-effectiveness, cost/benefit, or cost-utility of CRC screening for both included or excluded procedures

CAD, computer-aided detection; CRC, colorectal cancer; CT, computed tomography; CTC, computed tomographic colonography; DNA Stool, Deoxyribonucleic acid fecal test; FAP, familial adenomatous polyposis; FIT, fecal immunochemical test; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; gFOBT, guaiac-based fecal occult blood test; GI, gastrointestinal; FS, flexible sigmoidoscopy; HNPCC, hereditary nonpolyposis colorectal cancer; KQ, key question; MR, magnetic resonance; MRI, magnetic resonance imaging; N, number; PET, positron emission tomography; RCT, randomized controlled trial.

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Table 1. Inclusion/exclusion criteria (continued)

Category	Inclusion Criteria	Exclusion Criteria
Study outcomes (continued)	KQ 4: Available number of screening providers and related equipment/facilities and support personnel to conduct the tests (nurses, etc.) KQ 5: Existence and adequacy of systems for monitoring CRC screening, CRC screening discussions, quality of CRC screening	Assessment of whether a procedure (usually two procedures compared to each other) is better at diagnosing/more effective than other procedures (usually retrospective) Assessment of different risk factors for CRC (e.g., diet in relation to diagnosis of CRC, calcium supplements, women taking hormone replacement therapy) and relation to incidence and/or mortality Treatment of complications (e.g., perforation) Treatment of CRC itself
Study geography	United States	All other countries
Time period for data collection	1/1/1998–9/30/2009	Data collection began before 1/1/1998
Interventions	Colonoscopy Sigmoidoscopy (or FS) CTC (or virtual colonoscopy with only CT) Double Contrast Barium Enema (DCBE) Stool tests: • DNA stool • FIT • gFOBT (including Hemoccult® II and Hemoccult® SENSA®)	Office FOBT (unless described/tested along with one of the included interventions) • MRI colonoscopy (or virtual colonoscopy with MRI) • Genetic testing • Ultrasound Any other tests, including: • Any unapproved tests • Included procedures combined with others (CTC with stool tagging, CTC with CAD technology) • Carbon dioxide insufflation during colonoscopy • Whole colonic imaging • Chromoendoscopy • PET and/or PET in combination with CTC, etc. • Bidirectional endoscopy • Laparoscopy with colonoscopy • Molecular screening • Submucosal injection polypectomy • Upper GI scope/gastroscope Studies examining the use of any of the included tests for the monitoring or assessment of a condition or disorder (e.g., diverticulitis) and therefore not for screening or surveillance of abnormal screenings for CRC Studies reporting on the use of included procedures in the surveillance of CRC Use of any included procedures to stage cancer (e.g., CTC) Studies testing the differences in sedation, dyes, and bowel cleansing methods during included procedures
Publication language	English	All other languages

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Table 1. Inclusion/exclusion criteria

Category	Inclusion Criteria	Exclusion Criteria
Admissible evidence (study design and other criteria)	Original research that provides sufficient detail regarding methods and results to enable use and adjustment of the data and results; relevant outcomes must be able to be abstracted from data presented in the papers Eligible study designs: • RCTs • Nonrandomized controlled trials • Observation studies—prospective and retrospective cohort studies, case-control studies, and cross-sectional studies • Modeling studies Eligible sample sizes: • RCTs: N ≥30 • Nonrandomized controlled trials: N ≥ 30 • Observational studies: N ≥ 100	• Single case reports or small case series • Systematic reviews • Ecologic studies • Historical comparisons KQ 3: Studies without comparison group (e.g., pre/post only were excluded because they are generally unable to determine whether any changes in outcomes were due to a particular intervention as opposed to secular trends or other changes within a practice or setting)

We examined abstracts of all articles to determine whether studies met our eligibility criteria. Two members of our research team reviewed each abstract independently for inclusion or exclusion, using an Abstract Review Form (Appendix B).[‡] If one reviewer concluded on the basis of the abstract that the article should be considered in the review, we obtained the full text. Two members of our research team then independently reviewed each full-text article for inclusion or exclusion using a Full Text Review Form (Appendix B). The two relevant reviewers discussed disagreements; when they could not reach consensus, the team met and discussed the article to determine as a group whether the study met eligibility criteria. Articles that did not meet criteria for inclusion are listed in Appendix D along with reasons for exclusion.

KQs 1 and 6, although part of this report, are not part of the systematic review. Therefore, studies described or discussed for those KQs did not have to satisfy final inclusion/exclusion criteria; such articles are not included in the overall number of included studies for the systematic review. We developed a "Background" category for articles that could provide useful information for KQ 1, KQ 6, the introduction, or the discussion.

Literature Synthesis

Data Abstraction

We designed and used a structured data abstraction form. Trained reviewers abstracted data from each study and assigned an initial quality rating. A second reviewer read each abstracted article, evaluated the accuracy, completeness, and consistency of the data abstraction, and

[‡] Appendixes and evidence tables cited in this report are available at http://www.ahrq.gov/downloads/pub/evidence/pdf/crcuse/crcuse.pdf.

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confirmed the quality rating. If differences in quality ratings could not be resolved by discussion, a third senior reviewer was involved. The full research team met regularly during the article abstraction period to discuss global issues related to the data abstraction process.

The final evidence tables are presented in their entirety in Appendix C.[§] Studies are presented in the evidence tables alphabetically by the last name of the first author. A list of abbreviations and acronyms used in the tables appears at the beginning of Appendix C.

Rating Quality of Individual Studies

To assess the quality (internal validity or risk of bias) of studies, we used predefined criteria based on those described in the AHRQ Methods Guide for Comparative Effectiveness Reviews (ratings: good, fair, poor).[30]

Elements of quality assessment for trials included, among others, the methods used for randomization, allocation concealment, and blinding; the similarity of compared groups at baseline; maintenance of comparable groups; overall and differential loss to followup; and the use of intention-to-treat analysis. We assessed observational studies based on the potential for selection bias (methods of selection of subjects and loss to followup), potential for measurement bias (equality, validity, and reliability of ascertainment of outcomes), adjustment for potential confounders, and statistical analysis.

In general terms, a "good" study has the least bias and results are considered to be valid. A "fair" study is susceptible to some bias but probably not sufficient to invalidate its results. The fair-quality category is likely to be broad, so studies with this rating will vary in their strengths and weaknesses. A "poor" rating indicates significant bias (stemming from, e.g., serious errors in design, analysis reporting large amounts of missing information, or discrepancies in reporting) that may invalidate the study's results.

Studies that met all criteria were rated good quality. The majority of studies received a quality rating of fair. This category includes studies that presumably fulfilled all quality criteria but did not report their methods to an extent that answered all our questions. Thus, the fair-quality category includes studies with quite different strengths and weaknesses. Studies that had a fatal flaw (defined as a methodological shortcoming that leads to a very high probability of bias) in one or more categories were rated poor quality and excluded from our analyses. Poor-quality studies and reasons for that rating are presented in Appendix F.

Grading Strength of Evidence

We evaluated the overall strength of evidence for the questions addressing the main outcomes of our review (KQs 3, 4, and 5) based on an approach devised for AHRQ's Method Guide.[30-31] Developed to grade the overall strength of a body of evidence, this approach incorporates four key domains: risk of bias, consistency, directness, and precision. It also considers other optional domains that may be relevant for some scenarios, such as a dose-response association, plausible confounding that would decrease the observed effect, strength of association (magnitude of effect), and publication bias. The evaluation of risk of bias includes assessment of study design and aggregate quality of studies.[31]

[§] Appendixes and evidence tables cited in this report are available at http://www.ahrq.gov/downloads/pub/evidence/pdf/crcuse/crcuse.pdf.

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We graded evidence as consistent when effect sizes across studies were in the same direction and had a narrow range. When the evidence linked the interventions directly to our outcomes of interest, we graded the evidence as being direct. We graded evidence as being precise when results had a low degree of uncertainty. At least two members of our research team evaluated the overall strength of evidence for each outcome based on a qualitative assessment of strength of evidence for each domain and reconciled all disagreements.

The levels of strength of evidence are shown in Table 2. As mentioned, we present the strength of evidence assessments only for KQs 3, 4, and 5. These are the three KQs that are analytic and required an assessment of the body of literature available for this review. KQ 2 is descriptive and did not lend itself to an assessment of the strength of evidence. The strength of evidence tables appear in Chapter 4 as part of the presentation of results for KQs 3, 4, and 5.

Table 2. Strength of evidence grades and definitions

Grade	Definition
High	**High confidence that the evidence reflects the true effect.** Further research is very unlikely to change our confidence in the estimate of effect.
Moderate	**Moderate confidence that the evidence reflects the true effect.** Further research may change our confidence in the estimate of effect and may change the estimate.
Low	**Low confidence that the evidence reflects the true effect.** Further research is likely to change our confidence in the estimate of effect and is likely to change the estimate.
Insufficient	**Evidence either is unavailable or does not permit estimation of an effect.**

Source: Owens et al., 2009[31]

Applicability

We evaluated the applicability of the evidence based on a qualitative assessment of the population, intensity or quality of treatment, choice of the comparator, outcomes, and timing of followup. We based our parameters for evaluation on guidance provided by AHRQ's Methods Guide.[30] Specifically, we considered whether enrolled populations differ from target populations, whether studied interventions are comparable with those in routine use, whether comparators reflect best alternatives, whether measured outcomes are known to reflect the most important clinical outcomes, and whether followup was sufficient.

Peer Review

This draft report was subjected to external peer review by eight individuals who were experts in fields relevant to CRC screening or from various stakeholder and user communities (listed in Appendix E).[**] We provided the draft report to them on September 14, 2009. All eight provided thoughtful feedback on the report, including providing us with additional references that we should consider for inclusion in the final report. We reviewed all additional references and included those that were appropriate and within the scope of this report. We also addressed all comments and revised the report accordingly.

[**] Appendixes and evidence tables cited in this report are available at http://www.ahrq.gov/downloads/pub/evidence/pdf/crcuse/crcuse.pdf.

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Chapter 3. Overview of Trends in Use and Quality of CRC Screening

We present here the results of our summary of information specific to trends in the use and quality of colorectal cancer (CRC) screening. Based on instructions from the Office of Medical Applications of Research (OMAR) at the National Institutes of Health (NIH) and from the Agency for Healthcare Research and Quality (AHRQ), we treated this question as a background question rather than a question for systematic review. For that reason, we present our findings here, separate from the four key questions (KQs) for which we present our analysis and synthesis of literature (Chapter 4). The articles that inform this section came from the general search that we conducted for all KQs, from multiple hand-searches of reference lists in those articles, and from suggestions of our expert Technical Expert Panel (TEP) and Peer Reviewers.

KQ 1: What are the Recent Trends in the Use and Quality of CRC Screening?

Trends in Incidence and Mortality from Colorectal Cancer

Colorectal cancer is the third most common nonskin cancer among men and among women; an estimated 146,970 people in the United States were newly diagnosed with this disease in 2009.[32] The overall age-adjusted incidence rate for CRC has decreased in both men and women and in all ethnic groups since the mid-1980s, with an overall 3 percent annual decline between 1998 and 2005.[33] CRC incidence is higher among non-Hispanic blacks than among non-Hispanic whites; it is lower among Asian-Pacific Islanders and Hispanics than among non-Hispanic whites.

Colorectal cancer is the also the third-highest cause of cancer death among men and women; an estimated 49,920 deaths were attributed to this disease in 2009 in the United States.[32] The overall age-adjusted mortality rate from CRC has decreased in both men and women since the mid-1980s; the annual percent decline between 2002 and 2005 was 4.3 percent.[33] CRC mortality rates declined for non-Hispanic black, non-Hispanic white, and Asian-Pacific Islander men and women. The rates dropped for Hispanic men but not for Hispanic women.[33] CRC mortality is higher in non-Hispanic blacks than non-Hispanic whites; it is lower in Asian-Pacific Islanders and Hispanics than in non-Hispanic whites. The gap in CRC mortality between non-Hispanic blacks and non-Hispanic whites did not change between 1997 and 2005.[34]

Measures of CRC Screening

Several approaches have been used for measuring the percentage of a population that is up to date on CRC screening according to the national guidelines. Research studies of this question have most often used patient self-reports, but administrative databases, medical record reviews, and physician reports have also been used. A field study for the National Committee on Quality Assurance (NCQA) compared three different measurement approaches for assessing rates of CRC screening: patient surveys, administrative datasets, and a hybrid approach that performed medical record review for patients who did not have evidence of screening by administrative data.[35] Among the five health plans examined in the NCQA study, two did not show much

difference between administrative and hybrid approaches, but the other three plans had 5 percent to 15 percent higher rates by the hybrid approach than by administrative data alone.[35]

In all five plans, patient surveys (surveys patterned on the standard questions used by the Behavioral Risk Factor Surveillance System [BRFSS] from the Centers for Disease Control and Prevention [CDC]) gave screening rates higher than the hybrid and administrative approaches; the differences ranged from 2.4 percent to 23.3 percent for the hybrid approach and from 7.9 percent to 34.8 percent for the administrative approach. The differences between the survey and administrative approaches were lower for fecal occult blood test (FOBT) screening (difference ranged from 0.4 percent to 11.3 percent) than for flexible sigmoidoscopy (FS) and colonoscopy (difference for colonoscopy ranged from 7.1 percent to 26.9 percent).

One major reason for higher estimates from surveys is that nonrespondents are likely to have had less screening over time than respondents. Thus, one would expect that surveys would overestimate screening when response rates are low. When response rates are high, other studies have found a smaller degree of overestimation of screening rates, although some overestimation is still present.[36-38] Other studies have found that self-report overestimates screening rates more with FOBT than with colonoscopy.[39-40] Ultimately, because of changes in guidelines, as well as how questions are asked and current use is operationalized, measures of CRC screening have been challenging to standardize. For this reason, drawing valid conclusions on use is problematic.

Changes in Medicare Coverage of CRC Screening

In January 1998, the Centers for Medicare and Medicaid Services started covering CRC screening for Medicare beneficiaries; the tests included FOBT and FS as recommended by the American Cancer Society (ACS). On July 1, 2001, Medicare extended coverage for screening to colonoscopy every 10 years.

Changes Over Time in National Surveys of Screening

We found reports of screening rates from large, national surveys in two major sources: the National Health Interview Survey (NHIS), administered by the National Center for Health Statistics (NCHS), and BRFSS. NHIS is a personal household interview that contains a core set of questions plus additional supplements on specific topics. The CRC screening questions were revised in the late 1990s. [41] Before 2000, the NHIS did not distinguish between home and office FOBT and did not distinguish among endoscopic tests (e.g., proctoscopy, FS, colonoscopy). In addition, the 2000 NHIS asked about screening longer than 3 years before the survey. [42] Thus, screening rates before 2000 included some number of office FOBTs within the previous 1 or 2 years and proctoscopy (as well as FS and colonoscopy) within the previous 3 years. Starting in 2000, up-to-date screening is defined as home FOBT within the previous year, FS within the previous 5 years, or colonoscopy within the previous 10 years. The earlier rates from NHIS are thus likely an overestimate of the actual screening rates at the time (because of including in-office FOBT and proctoscopy, and how questions were asked) compared with rates starting in 2000. Also, since respondents had been asked about endoscopy use in the past 3 years only, this rate could be an underestimate of screening for these tests. NHIS interviewers read test descriptions to all eligible respondents for the first time in 2003. [43]

BRFSS is a national, random-digit-dial telephone survey administered in the United States to respondents 18 and older. BRFSS asked about FS and proctoscopy (not distinguishing between

them) until 1999, when the question was changed to ask about FS or colonoscopy (again, not distinguishing between them). Before 2001, BRFSS did not allow for screening intervals longer than 5 years. Thus, BRFSS estimates before 2001 are for FOBT within the past year or lower endsocopy within the past 5 years. Starting in 2001, most estimates are for FOBT in the past year or lower endoscopy within the previous 10 years.

BRFSS response rates vary by state. For 1997, the overall median response rate by state was 62.1 percent, in 1999 it was 55.2 percent, and in 2001 it was 51.1 percent (range 33.3 percent to 81.5 percent). In 2002, the median response rate was 58.3 percent; in 2004 it was 52.7 percent, and in 2006 it was 51.4 percent. Thus, not all state estimates have the same validity.[44] About 3 percent of respondents were eliminated from the 2002 and 2004 analyses because they refused to answer or did not know the answer; in 2006, 4.5 percent were eliminated.[45]

Estimates from NHIS and BRFSS

In 1987 by NHIS data (Table 3), 22 percent of men and 24.2 percent of women had had an FOBT within the previous 2 years or FS, proctoscopy, or colonoscopy within 3 years.[41] For women, these screening rates increased to 28.2 percent in 1992 and 30.2 percent in 1998. For men, rates increased to 29.4 percent in 1992 and 37.1 percent in 1998.[41] In 2000 (using the more restrictive definition of screening), 37.1 percent of both men and women had had at least one of these tests.[42] In 2003, NHIS found that 46.5 percent of men and 43.1 percent of women had been screened[43] and in 2005, 50.0 percent of both men and women had been screened.[46]

Table 3. Trends in screening according to the National Health Interview Survey

Year	Men	Women	Combined
1987[a]	22%	24.2%	NR
1992[a]	29.4%	28.2%	NR
1998[a]	37.1%	30.2%	NR
2000[b]	NR	NR	37.1%
2003[b]	46.5%	43.1%	NR
2005[b]	NR	NR	50.0%

NR, not reported.
[a] Any fecal occult blood test (FOBT) within past 2 years or flexible sigmoidoscopy (FS), proctoscopy, or colonoscopy within past 3 years.
[b] Home FOBT within the past year, FS within the past 5 years, or colonoscopy within the past 10 years.

The 1997 BRFSS (Table 4) found that 41 percent of respondents ages 50 years and older had had either an FOBT in the previous year or lower endoscopy (either FS or proctoscopy) in the previous 5 years. In 1999, this percentage had increased to 44 percent.[47] The 2001 BRFSS found that 53.1 percent of people in this age group reported having either an FOBT within the previous year or lower endoscopy (either FS or colonoscopy) within the previous 10 years.[44] In 2002, this percentage was 53.9 percent; in 2004, it was 56.8 percent and in 2006, it was 60.8 percent.[45]

Table 4. Trends in CRC screening according to the Behavioral Risk Factor Surveillance Survey

Year	Men	Women	Combined
1997[a]	NR	NR	41%
1999[b]	NR	NR	44%
2001[c]	NR	NR	53.1%
2002[c]	55.3%	53.1%	53.9%
2004[c]	58.0%	55.9%	56.8%
2006[c]	61.5%	60.4%	60.8%

NR, not reported.
[a] Any fecal occult blood test (FOBT) within the past year or lower endoscopy (proctoscopy or flexible sigmoidoscopy [FS]) within the past 5 years.
[b] Any FOBT within the past year or lower endoscopy (FS or colonoscopy) within the past 5 years.
[c] Home FOBT within the past year or lower endoscopy (FS or colonoscopy) within the past 10 years.

Population Subgroups

The changes in definitions of tests and testing intervals noted above cloud the data concerning CRC screening rates among population subgroups, including racial, ethnic, age, sex or gender, income, and educational groups. One BRFSS study used common coding and standard definitions over the years 2002 to 2006 for the data in Table 5.[45] Although the absolute percentages here are slightly higher than those from the NHIS (partly because of higher response rates in NHIS and the use of telephone rather than in-person interviews), the

trends are the same in both surveys. Higher overall absolute screening rates are seen in older versus younger people, in white versus black populations, and in non-Hispanic versus Hispanic people. Higher education, higher income, and health insurance coverage are also associated with higher screening rates.

Table 5. Percentage of respondents 50 years of age or order who reported receiving a fecal occult blood test within 1 year and/or a lower endoscopy* within 10 years, by selected characteristics—BRFSS, United States, 2002, 2004, and 2006[†]

Characteristic	2002		2004		2006[‡]	
	%	(95% CI)	%	(95% CI)	%	(95% CI)
Total	53.9	(53.4 – 54.5)	56.8	(56.3 – 57.3)	60.8[§]	(60.4 – 61.3)
Age Group (years)						
50–64	47.9	(47.1 – 48.6)	50.2	(49.6 – 50.9)	54.7	(54.1 – 55.4)
≥65	62.3	(61.5 – 63.1)	65.9	(65.2 – 66.6)	69.3	(68.6 – 69.9)
Sex						
Male	55.3	(54.4 – 56.1)	58.0	(57.2 – 58.8)	61.5	(60.8 – 62.3)
Female	53.1	(52.4 – 53.8)	55.9	(55.3 – 56.5)	60.4	(59.8 – 61.0)
Race						
White, non-Hispanic	55.4	(54.9 – 55.9)	58.4	(57.9 – 58.8)	62.6	(62.1 – 63.0)
Black, non-Hispanic	52.0	(49.8 – 54.2)	55.2	(53.3 – 57.1)	59.0	(57.3 – 60.6)
Asian/Pacific Islander	42.7	(36.4 – 49.1)	47.6	(41.0 – 54.4)	55.9	(51.0 – 60.7)
American Indian/Alaska Native	51.2	(45.6 – 56.8)	47.0	(41.7 – 52.4)	48.4	(43.5 – 53.2)
Other	43.3	(39.4 – 47.2)	46.2	(42.1 – 50.3)	46.2	(42.7 – 49.8)
Ethnicity[‖]						
Non-Hispanic	54.8	(54.3 – 55.4)	57.8	(57.3 – 58.2)	62.0	(61.5 – 62.4)
Hispanic	43.9	(40.6 – 47.3)	46.2	(43.2 – 49.2)	47.2	(44.5 – 49.9)
Education level						
Less than high school diploma	41.0	(39.3 – 42.7)	43.9	(42.1 – 45.6)	45.5	(43.8 – 47.2)
High school diploma or equivalent	50.7	(49.7 – 51.6)	52.9	(52.1 – 53.8)	56.7	(55.9 – 57.4)
Some college/technical school	56.5	(55.5 – 57.5)	58.5	(57.5 – 59.4)	62.6	(61.8 – 63.5)
College degree	62.0	(61.0 – 63.0)	64.8	(63.9 – 65.6)	68.7	(67.9 – 69.5)
Annual household income						
<$15,000	43.4	(41.5 – 45.2)	45.0	(43.3 – 46.7)	48.4	(46.8 – 50.1)
$15,000–$34,999	49.1	(48.1 – 50.1)	51.2	(50.2 – 52.2)	53.9	(53.0 – 54.9)
$35,000–$49,999	56.0	(54.7 – 57.4)	58.6	(57.4 – 59.8)	62.0	(60.8 – 63.1)
$50,000–$74,999	59.4	(57.5 – 61.3)	62.1	(60.7 – 63.5)	67.2	(66.1 – 68.3)
≥$75,000	64.8	(63.2 – 66.4)	68.1	(66.8 – 69.3)	70.4	(69.3 – 71.4)
Health insurance coverage						
Yes	55.9	(55.3 – 56.5)	58.9	(58.3 – 59.4)	63.0	(62.5 – 63.5)
No	33.1	(30.8 – 35.5)	34.7	(32.2 – 37.3)	36.7	(34.3 – 39.1)

BRFSS, Behavioral Risk Factor Surveillance System; CI, confidence interval.
* Sigmoidoscopy or colonoscopy.
† Adapted from Use of colorectal cancer tests—United States, 2002, 2004, and 2006"; *Morbidity and Mortality Weekly Report;* 2008 March 14; 57(10);253-258.
‡ Age standardized to the 2006 BRFSS population ages 50 years or older.
§ Wald F-test of significance for differences across the three survey years, $P < 0.001$.
‖ Race and ethnicity are not mutually exclusive.

Medical Practice Rates

Several studies provided information about CRC screening rates in medical practices, although we found no practice with uniform methods that could provide trend data over time. One chart review study of a sample of 12 diverse primary care practices in Michigan in 2003 found that CRC screening rates varied from 24 percent to 60 percent of eligible patients being up to date (FOBT in the past year, FS in the previous 5 years, or colonoscopy in the previous 10 years).[48] Another study examined CRC screening for 21,833 patients who were continuous members of an integrated health plan in the Midwest for the 5-year period ending December 31,

2003. Using automated records, the authors classified 54 percent of patients as being up to date for CRC screening (having received at least three FOBT kits, one FS, one colonoscopy, or one barium enema over that period).[49]

Frequency of Discussions about CRC Screening

We found no trend data about this topic, but we did find several relevant articles. One study from 1998 to 2006 in southern California collected data from surveys with 191 physicians and 5,978 patients, asking about previous screening and discussions about several conditions, including FOBT and FS.[50] In this study, 37 percent of patients had discussed FOBT with their physician and 31 percent had discussed FS.

A second study audiotaped interactions between patients of the Veterans Health Administration (VA) eligible for CRC screening and their physicians.[51] The study defined nine elements of informed decisionmaking and scored the occurrence of each element in 91 audiotapes of patients who had a CRC screening test ordered during that visit. Informed decisionmaking elements included such issues as discussion of the patient's role in decisionmaking, discussion of alternatives, discussion of uncertainties, assessment of patient understanding, and asking for patient preferences. The median number of elements addressed was 1. No single element was addressed in more than 50 percent of interactions. Only 6 percent of interactions discussed uncertainties or patient understanding. A telephone and in-person survey asked 65 academic and community primary care physicians to present CRC screening to the investigator as if the investigator were a patient.[52] Only 33.8 percent of respondents discussed the patient's role in the decision, 16.9 percent discussed benefits and risks of screening strategies, and 10.8 percent provided alternative screening strategies.

A 2005 survey asked 270 primary care physicians connected with Northwestern University Feinberg School of Medicine to rate the importance of various general communication tasks relevant to CRC screening and to report how often they accomplish those tasks with screening-eligible patients.[53] Talking with patients was rated 9.5 out of 10 in importance; physicians reported that they accomplished this with 84.4 percent of patients. Discussing colonoscopy was rated 9.2; physicians reported accomplishing this with 84.8 percent of patients. Explaining test benefits was rated 9.0; physicians reported that they accomplished this for 79.3 percent of patients. Explaining test risks was rated 8.1; physicians reported this behavior for 63 percent of eligible patients. Eliciting patient views or preferences was rated 8.0; physicians reported accomplishing this for 65.7 percent of patients. Presenting more than one option was rated only 6.4 on the same scale and discussing FOBT was rated as 5.0; physicians reported accomplishing an FOBT discussion with 54 percent of eligible patients.

This same study also examined videotapes from an existing dataset of primary care encounters.[53] The authors found 18 videotaped encounters from a database of 271 interactions with patients' ages 49 to 80 years in which the physician discussed CRC screening for the first time. Two authors viewed each videotape to determine to what extent physicians achieved the tasks they rated in the survey above. The benefits of the screening test were described in 28 percent of encounters; the risks were described in 0 percent of the encounters. In 28 percent of videotaped encounters in which CRC screening was discussed, physicians elicited patient views or preferences for CRC screening.

A survey of 2,501 patients of an integrated health care delivery system in southeastern Michigan who were continuously enrolled from 1999 to 2003 was able to link patients' responses to an automated health record system to determine CRC screening over the 5-year

study period.[54] Only 54 percent of this cohort was screened during the 5 years. About 80 percent of respondents (50.4 percent response rate) reported having a discussion with their physician about CRC screening. Of those having a discussion, 71 percent reported discussing colonoscopy and 41 percent FOBT. About 66 percent of patients reported that their physician discussed the pros and cons of different tests; 33 percent said that they had been asked about their preference for different types of tests and 39 percent were offered a choice among available tests. The association between those who had been offered a choice and receipt of a CRC screening test was negative; in this case, being offered a choice was associated with a lower screening rate. The usual length of these discussions and the relationship between patient report and actual discussion was not reported.

In this report, we distinguish between discussions of CRC screening between physicians and patients (covering such areas as pros and cons of screening options and eliciting patient preferences) as opposed to a simple physician recommendation of CRC screening (which is discussed in KQ 2). Although discussion and recommendation are not the same, recommendation would likely be a part of most discussions of CRC screening between physician and patient. Patient awareness of CRC screening is another likely result of CRC discussions. When there has been no physician recommendation and when patients are unaware of CRC screening, it is likely that there have been no discussions. Thus, lack of awareness and lack of a physician recommendation are two of the more frequent reasons that people who have not been screened give for not having obtained such tests.[21,55-57]

Test-Specific Trends

Over time, the percentage of eligible people screened with FOBT and FS has declined while the percentage screened with colonoscopy has increased. For example, the proportion of BRFSS respondents who had had an FOBT within 1 year declined from 2002 to 2006: 21.6 percent in 2002, 18.5 percent in 2004, 16.2 percent in 2006. The percentage who had had a lower endoscopy (either FS or colonoscopy) in the previous 10 years increased over the same period: 44.8 percent in 2002, 50.1 percent in 2004, and 55.7 percent in 2006.[45]

One national study examined the Medicare administrative database to determine trends in the use of various CRC screening tests between 1995 and 2003. Medicare started reimbursing for screening colonoscopy on July 1, 2001.[58] In 1995, 18.0 percent of Medicare beneficiaries received FOBT; in 2003, the figure was 14.3 percent. The percentage of people who received FS in 1995 was 3.9 percent, decreasing to 1.2 percent in 2003. The rate for colonoscopy, by contrast, rose: in 1995, 3.9 percent of Medicare beneficiaries received colonoscopy; in 2003, the figure was 9.4 percent. The relative decline in FS and the relative increase in colonoscopy was greater in white patients than in nonwhite patients. These changes were most pronounced after July 2001. These percentages are for screening received within a 1-year period, rather than the percentage of people who are up to date. A second analysis examined the test-specific trends within the Medicare population from 1998 to 2005, with similar findings.[59]

Other studies using information from the administrative databases of health plans or large gastroenterology practices have also found increased use of screening colonoscopy after July 2001.[49,60-62]

In an important study of trends in specific CRC screening test use between 1992 and 2002 in the Medicare population, use of FS increased from a mean rate per calendar-year quarter per 100,000 beneficiaries of 570.6 in 1996-1997 to 691.9 in 1999-2000 (after it was covered by Medicare in 1998) and then decreased to 267.5 in 2002-2003, after colonoscopy coverage started

in 2001.[63] Colonoscopy use, by contrast, increased from a mean rate per quarter per 100,000 beneficiaries of 284.6 in 1996-1997 to 1,918.9 in 2002-2003. This study also found that the percentage of CRCs diagnosed at an early stage rose for proximal but not distal cancers after 2001, indicating the effect of colonoscopy in detecting proximal cancers. Even with this increase in screening associated with Medicare reimbursement, many Medicare beneficiaries remained unscreened.

A study of CRC screening test use from 1998 to 2003 in the VA system, in which physicians have no financial incentives to perform colonoscopy, found an increase in overall screening, driven primarily by an increased number of FOBTs.[64] FOBT as a proportion of all screening tests increased from 81.7 percent to 90.4 percent over the study period while screening colonoscopy declined from 5.7 percent to 4.7 percent and FS declined from 8.3 percent to 3.6 percent. A 2007 study of 17,252 patients in the Western Region Tricare Insurance system of the Department of Defense found that 71 percent of these beneficiaries were up to date with standard CRC screening guidelines, and 83 percent of those who were up to date had had a colonoscopy within the previous 10 years.[65]

Trends toward screening colonoscopy may be less pronounced among disadvantaged groups than among the more advantaged. Although disadvantaged people (e.g., those without health insurance) are less up to date with screening, those who are screened may be more likely to be screened with FOBT than colonoscopy. One study conducted telephone interviews with 570 users of private physician offices (3 percent without insurance) and 500 registrants of county health centers (44 percent without insurance) in a single geographic area of New York State. Fifty-four percent of users of private physician offices and 28 percent of county health center registrants had had colonoscopy within the previous 10 years, while more county health center registrants had had an FOBT in the past year (31 percent private physician users versus 37 percent county health center registrants). Seventy percent of the private physician users and 55 percent of county health center registrants were up to date with national guidelines for CRC screening.[66]

Beyond the United States, the International Colorectal Cancer Screening Network surveyed CRC screening programs that started before May 2004.[67] They found 10 organized CRC screening programs in seven countries. Of these, five used FOBT only, three used FS only, one used FOBT and FS, and one offered colonoscopy only. The program offering only colonoscopy was in Poland; the United States was not listed as having an organized program. The FOBT programs were split between gFOBT and iFOBT. A variety of pilot programs and research initiatives were also listed.

Patient Preferences for CRC Screening Tests

We found several studies that asked people about their preferences for CRC screening tests. In general, the studies found diversity of opinion, with some people preferring colonoscopy (often because of its accuracy) and others favoring FOBT (often to avoid the discomfort and inconvenience of colonoscopy).

One study recruited 323 colonoscopy-naïve supermarket shoppers from a low-to-middle-class neighborhood in Denver, Colorado.[68] About half of respondents were non-Hispanic white with most of the rest evenly split between African-Americans and Latinos. After a description of the tests, 53 percent preferred FOBT and 47 percent preferred colonoscopy. Another study recruited 212 primary care patients from the waiting rooms of 3 community health centers and one academic medical center.[69] Patients were divided nearly equally among white, African-

American, and Hispanic people. Of the guideline-recommended tests, 37 percent preferred colonoscopy, 31 percent FOBT, 15 percent barium enema, and 9 percent sigmoidoscopy. One further study recruited 4,042 people who were participating in a multi-center study (84 sites) comparing fecal DNA testing with FOBT and colonoscopy.[70] Eighty-nine percent of participants were white. The participants were asked to complete a questionnaire after completing all three study tests. When asked which test they preferred for routine testing, 45 percent selected the fecal DNA test, 32 percent FOBT, and 15 percent colonoscopy.

Geographic Differences

We found no data on trends about differences in CRC screening rates by geographic factors; we did find several relevant reports. Using 2001 BRFSS estimates, states varied dramatically in the percentage of people having had an FOBT within the previous 2 years and in the percentage of people ever having had FS or colonoscopy.[71] For FOBT for white men, the rates ranged from 14.3 percent in Alabama to 43.7 percent in Vermont. For FS/colonoscopy for white men, the rates ranged from 33.5 percent in Oklahoma to 63.5 percent in Delaware. For FOBT for white women, the rates ranged from 11.6 percent in Alabama to 46.7 percent in North Carolina. For FS/colonoscopy for white women, the rates ranged from 38.3 percent in Kentucky to 62.1 percent in North Dakota.

For FOBT for black men, the rates ranged from 4.7 percent in Alabama to 48.6 percent in North Carolina. For FS/colonoscopy for black men, the rates ranged from 13.7 percent in Tennessee to 56.4 percent in California. For FOBT in black women, the rates ranged from 10.5 percent in Alabama to 43.3 percent in Massachusetts. For FS/colonoscopy in black women, the rates ranged from 35.6 percent in New York to 59.2 percent in Virginia.

The 2004 BRFSS found variation among the states in the percentage of respondents ages 50 years and older reporting having had either an FOBT within the previous year or lower endoscopy within the previous 10 years.[72] Rates ranged from 47.9 percent in Mississippi to 68.2 percent in Minnesota.

Health System Rates

The VA has a performance measure from medical record review for screening for people ages 50 to 80 years (FOBT within the past year, FS within the past 5 years, or colonoscopy within the past 10 years). With respect to being up to date on CRC screening, 78 percent of patients were up to date in 2007 and 79 percent in 2008.[73] The VA system has annual CRC screening rates from 1996 to the present. A few representative years are the following: 1996: 34 percent; 2000: 68 percent; 2004: 72 percent; and 2006: 76 percent.

NCQA, for its Healthcare Effectiveness Data and Information Set (HEDIS) commercial plans and using the same definition for being up to date as the VA, reported for 2007 that 55.6 percent of patients were up to date. The HEDIS measure is calculated from administrative data followed by a chart review for patients with no evidence of screening. No HEDIS trend data were available to us.

Overuse of CRC Screening

Although most of the previous discussion concerns underuse of CRC screening, overuse is also a concern. The two aspects of overuse for which we found evidence in the literature are

overuse in people who, because of severe comorbidity or advanced age, have little potential to benefit and overuse of surveillance colonoscopy. By surveillance colonoscopy, we are referring to colonoscopy for patients who have had a previous colonic polyp (and, usually, polypectomy).

Overuse among persons unlikely to benefit. We found no data concerning trends for overuse but did find several relevant reports. Overuse of CRC screening has been documented in three studies in the VA system, questioning whether some patients are being screened inappropriately.[74-76] Some patients are less likely than others to survive for the 5 to 10 years necessary to have a chance of benefit from screening. In one study, 18 percent of patients given an FOBT kit at a single VA facility had severe comorbidities.[76] In the other two studies, of multiple VA system sites, people with severe comorbidities were screened as often as people with no co-existing illnesses.[74-75]

Recently, the US Preventive Services Task Force (USPSTF) recommended that people over age 75 not be screened routinely and that people over age 85 not be screened at all.[3] Thus, screening people over age 85 may also be considered overuse of screening.

Overuse of surveillance colonoscopy. Another potential for overuse is the frequency of surveillance colonoscopy after polypectomy. A 1999-2000 survey of a nationally representative sample of 317 gastroenterologists and 125 general surgeons active in colonoscopy surveillance (response rate 83 percent) asked for their suggestions for surveillance colonoscopy for four clinical scenarios.[77] One scenario, the finding of a hyperplastic polyp, confers no additional CRC risk and requires no surveillance over routine screening. Yet 24 percent of gastroenterologists and 54 percent of general surgeons recommended surveillance colonoscopy, most of them at a frequency of 5 years or less. A second scenario, finding a single small adenoma less than 1.0 cm in size, is generally classified as a "low risk" situation, and the MSTF guideline is surveillance colonoscopy at 5 to 10 years.[78] Yet 52 percent of gastroenterologists and 77 percent of general surgeons recommended surveillance colonoscopy every 3 years or more often. The authors concluded that "these findings suggest considerable over-performance of surveillance colonoscopy."[77] A similar study of primary care physicians found even more frequent recommendations for surveillance of low-risk patients.[79] A study of endoscopists' recommendations for repeat colonoscopy in 10 primary care practices in Virginia and Maryland found that endoscopists often recommend colonoscopy more frequently than guidelines recommend.[80] The mean number of years in which repeat colonoscopy was recommended by endoscopists was 7.8 years following normal colonoscopy, 5.8 years following the finding of a hyperplastic polyp, and 4.4 years following the finding of 1 or 2 small adenomas.

An innovative followup study of 1,297 participants in the Polyp Prevention Trial (an RCT of a dietary intervention to prevent colorectal adenomas) found evidence of both underuse and overuse of surveillance colonoscopy. Among patients with high-risk adenomas (who, according to national guidelines, should receive surveillance in 3 years[81]), only 36 percent had received surveillance within 3 years, and only 65.2 percent had had a surveillance examination within 5 years. Among patients with low-risk adenomas (who should receive surveillance only between 5 and 10 years of initial screening), however, 39.7 percent had had a surveillance examination within 4 years.[82]

Misuse Rates

We define misuse as performance of screening tests in such a way that benefits are reduced or harms are increased compared with optimal performance. "Optimal" performance is

sometimes difficult to define. Thus, we provide frequencies for clearly suboptimal performance and harms that could be potentially reduced by improved procedures.

We found literature on three types of misuse regarding FOBT: use of in-office FOBT when the literature is clear that home FOBT is preferable, nonreturn of FOBT cards given to patients, and nonfollowup of positive FOBT results with a full colon examination. We also found literature on two types of misuse of colonoscopy: high rates of adverse events such as colonic perforation and bleeding and nondetection of important colonic lesions. We found little data concerning trends for these problems and thus present the current situation as documented in the literature.

Reliance on in-office FOBT is clearly a problem of misuse, substituting a less effective test for a more effective one.[83] A 1999-2000 national survey of primary care physicians found that 32.5 percent of physicians used in-office FOBT exclusively; another 41.2 percent used a combination of in-office and home-based FOBT.[84] Nearly one-third of patients in the 2000 NHIS who reported having an FOBT said that the only test they had had was an in-office FOBT.[84] Whether these percentages have changed after this study was done remains unclear.

Another type of misuse of CRC screening tests is nonreturn of FOBT cards given to patients. We found only one study concerning this issue, an RCT of an intervention to improve return of FOBT cards in a VA primary care clinic.[85] In the control (usual care) arm of this study, 51.3 percent of patients returned the FOBT cards they were given (mean time to return cards in this group was 143 days).

Still another type of misuse is nonfollowup of positive FOBT screening results. We found one study in an integrated health care system that examined trends between 1993 and 2005 in the percentage of positive FOBTs that were followed by a complete diagnostic examination within 1 year.[86] This percentage increased from between 57 percent and 64 percent in 1993-1996 to between 82 percent and 86 percent in 2000-2005. The authors noted the introduction during those periods of tracking systems and screening guidelines.

Other studies provided information about follow-up rates for positive FOBTs but not trends over time. Two studies from the VA (data from 2000-2002) have documented lack of followup of positive FOBTs. One study of national VA data found that 41 percent of patients with a positive FOBT had not received or been referred for a follow-up test (either colonoscopy or barium enema) within 6 months.[87] A second study at a single VA center examined chart reviews on 538 men who had had a positive FOBT. About 77 percent were referred to gastroenterology; only 44 percent underwent full colon examination within 12 months.[88] In a study of positive FOBTs (76 percent from a screening FOBT) in a large integrated health care system (data from 2004-2006), fewer than 10 percent of patients had no action taken; colonoscopy was completed in 62 percent within a year.[89] Three older single-institution studies[90-92] (one using 1986 data, one using 1998 data, and one using 1993 data) and one study of community medical practices (using 1994-1996 data)[93] examining positive FOBTs from screening programs found from 23 percent to 46 percent of patients had no follow-up colon evaluation.

A 1999-2000 survey of 182 health plans (52 percent response rate) by the National Cancer Institute found that only 41 percent of plans had any system for delivering and/or monitoring CRC screening use; 25 percent had a mechanism for reminding patients when they are due for screening; 16 percent had a system for reminding physicians when a patient is due. Fewer than 15 percent of plans monitored receipt of follow-up care after a positive FOBT.[94]

Another form of misuse is a high rate of adverse events during or after colonoscopy. We found no data on trends for this topic, but we did find two important reports to highlight. One

study examined the Medicare database to count adverse events requiring an emergency department visit or hospitalization within 30 days of a colonoscopy.[20] The risk of colonic perforation was about 0.6 per 1,000 colonoscopies. The risk of gastrointestinal bleeding or transfusions was 2.1 per 1,000 in a group that was screened and did not have a polypectomy and 8.7 per 1,000 in a group that had a polypectomy. Some patients also suffered a cardiovascular event within 30 days: 9.9 per 1,000 procedures in the screening but no polypectomy group and 23.4 per 1,000 in the polypectomy group. Adverse events increased with age; people over age 85 suffered more than twice as many adverse events as people ages 66 to 69. A systematic review that pooled US studies before January 2008 found a combined rate of serious complications of screening colonoscopy of 2.5 per 1,000 procedures, with 85 percent of the complications occurring in patients who had had a polypectomy.[95]

Misuse of colonoscopy also includes lack of detection of important lesions. Studies have found that from 2.1 percent to 5.9 percent of people diagnosed with CRC had had a colonoscopy within 3 years of the cancer diagnosis,[96-98] raising the issue of missed cancers. One study of back-to-back colonoscopies done on the same day found that 6 percent of adenomas at least 1 cm in size and 13 percent of adenomas 6 to 9 mm in size were missed on the first colonoscopy.[99] Other studies of CRC found by short-term follow-up colonoscopy after previous colonoscopy have raised the same question.[81,100]

One variable that has been studied to provide insight into important missed lesions at colonoscopy is the adenoma detection rate. Several studies have shown variation among endoscopists in this rate. One factor associated with adenoma detection rates at colonoscopy is withdrawal time, which is the time required for the endoscopist to withdraw the colonoscope after full insertion.[101-103] Although longer withdrawal times are associated with increased detection of advanced adenomas (i.e., adenomas greater than 1 cm in size, or with dysplastic or villous components), longer times are also associated with increased detection and removal of small, low-risk polyps of uncertain clinical importance. A follow-up study found that instituting a practice-wide policy of at least 8 minutes for withdrawal reduced variation in adenoma detection rates among endoscopists; specifically the new policy increased detection of any neoplasia from 23.5 percent to 34.7 percent and increased detection of advanced adenomas from 5.5 percent to 6.3 percent of subjects.[104] Thus, most of the increase in adenoma detection was due to detection of nonadvanced adenomas.

Another factor associated with lower adenoma detection rates is depth of insertion, in particular the percentage of colonoscopies in which the cecum was reached. One study used an Ontario, Canada, database to explore the percentage of colonoscopies that were coded as incomplete (i.e., did not reach the cecum), finding variation in incomplete rates.[105] Colonoscopies performed in a clinician's office were more likely to be incomplete than ones performed in an academic center (24.6 percent versus 12.6 percent). The percentage of incomplete colonoscopies declined over time (18.9 percent in 1999 to 10 percent in 2003). Similar data are not available from the United States.

Summary

National surveys show that CRC screening rates have been slowly increasing since 2000, reaching 50 percent to 60 percent in 2006. Screening rates in medical practices are also at about the same level. There are disparities in screening between white people and other racial and ethnic groups; Hispanic people have some of the lowest screening rates. Low income, low

educational level, and lack of health insurance are also associated with lower screening rates. States vary greatly in CRC screening rates.

The increase in CRC screening since 2001 has come primarily from increasing rates of colonoscopy; use of FS and FOBT has declined. This national trend toward increased colonoscopy and reduced FOBT is different than trends within the US VA program and in other countries, where FOBT remains the most common screening test.

In addition to underuse of CRC screening, good evidence suggests underuse of adequate discussions about CRC screening. For some patients, discussions do not provide comparative information about the benefits and risks of alternative strategies or do not allow patient participation in decisionmaking. For other patients, likely no discussion with their clinicians takes place at all.

In addition to the evidence of underuse of CRC screening and discussion is evidence of overuse. Some people are screened who have severe comorbidities and are unlikely to benefit. Older people above an age at which benefits are limited are also likely being screened. Surveillance colonoscopy after polypectomy is probably also occurring too frequently, thus reducing capacity for screening colonoscopy and increasing discomfort, inconvenience, and risk for many people.

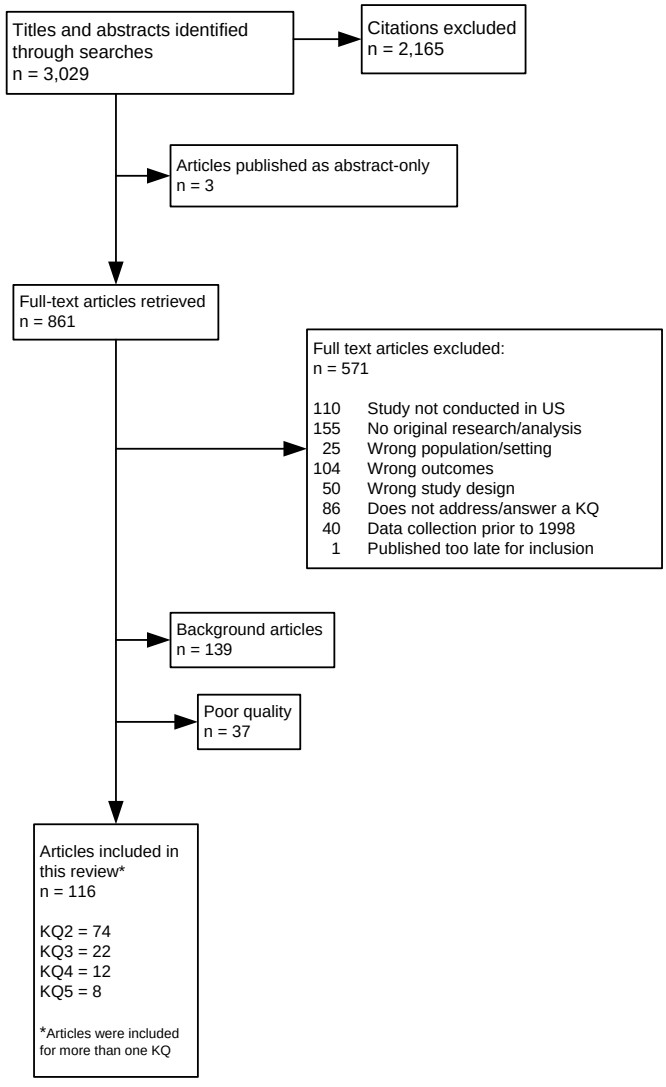
Misuse of screening is also a problem. Some people receiving in-office rather than home FOBT, others not returning FOBT cards, and people with positive FOBTs not getting appropriate followup. Few health plans have systems for monitoring and improving these problems. Misuse of colonoscopy occurs because adverse events occur (e.g., bleeding or colonic perforation) and because endoscopists miss important lesions (and perhaps find and remove unimportant lesions).

Chapter 4. Results

This chapter presents the results of our evidence review for the following four key questions (KQs): KQ 2, factors associated with colorectal cancer (CRC) screening; KQ 3, interventions that have been tested to increase CRC screening; KQ 4, current capacity in the United States to increase CRC screening; and KQ 5, methods for tracking and monitoring the use and quality of CRC screening. As noted in Chapter 2, we identified 3,029 citations from our searches (Appendix A).[††] Figure 2 documents the disposition of articles for the review. Working from 861 articles retrieved for full text review, we included 139 for background and excluded 571 at this stage. A total of 72 studies (74 articles) qualified for inclusion for KQ 2, 21 studies (22 articles) for KQ 3, 12 studies for KQ 4 and 8 studies for KQ 5.

Appendix C-1 provides the detailed evidence tables for KQs 1, 2, and 3. Appendixes C-2 and C-3 present individual quality ratings for randomized clinical trials (RCTs) and observational studies, respectively. Appendix C-3 provides detailed abstractions for KQ 4. Appendix C-4 provides detailed abstractions for KQ 5. Evidence tables for each key question are presented in alphabetical order by last name of the first author.

Figure 2. Quorum tree/disposition of articles



As noted in earlier chapters, an overall assessment of the CRC screening and related factors requires evaluation of sources of heterogeneity, including clinical context, population served, and for the randomized control trials (RCT), the type of comparator. CRC screening is conducted in a variety of clinical contexts and assessed through the completion of one or several tests (i.e., fecal occult blood test (FOBT), done at home or in the office, and/or some type of endoscopy (i.e., flexible sigmoidoscopy [FS], colonoscopy, or double contrast barium enema [DCBE]). Most studies we assessed measured the outcome of screening by completion of a FOBT at home, and included one or more of these endoscopy tests. However, since national guidelines about which tests should be used and when have been altered several times over the period of time for which we were

[††] Appendixes and evidence tables cited in this report are available at http://www.ahrq.gov/downloads/pub/evidence/pdf/crcuse/crcuse.pdf.

reviewing studies (i.e., 1998-present day), the assessment of screening rates has also changed over time and is somewhat problematic to analyze. For the studies assessed under KQs 2, 3, and 4, there is a strong reliance on self-reported screening rates, with fewer studies incorporating claims data analysis in the assessment of CRC screening.

An additional source of heterogeneity is the type of studies conducted for each type of KQ and the descriptive or analytic nature of the literature. For KQ 2, we found the largest number of studies but all are based on observational data, primarily collected retrospectively through cross-sectional or cohort designs. Because of the extensive variables explored in relation to CRC screening, we present the findings for this KQ in much less detail than the other KQs, focusing on the study characteristics and overall results specific to each type of factor that may be associated with screening.

This literature is characterized by a few articles together constituting a single study. We refer to studies in the text and cite all relevant articles for each study; article and study counts, therefore, frequently do not match. Our summary tables below feature groups of studies organized by the factors that may be associated with CRC screening (KQ 2), the different types of interventions that have been tested to increase screening (KQ 3), or the types of studies that have been done to assess capacity for screening (KQ 4) and monitoring of use and quality of screening (KQ 5). We have organized the studies in each summary table such that those rated as good quality are listed first and organized alphabetically by the first author's last name, followed by fair quality studies organized in the same way. The summary tables also provide information to identify the study (author, and date of publication), study design, population and setting, sample size, study quality, intervention (when relevant), comparators, and results.

KQ 2: What Factors Influence the Use of Colorectal Cancer Screening?

Key question (KQ) 2 focuses on the factors that are associated with the use of CRC screening. These factors can relate to either patient or provider characteristics and to the interaction between the provider and patient. Other factors that could be associated with the use of CRC screening may be system-level characteristics, such as involvement of nonclinician staff in screening, use of reminder or recall systems, having an organized referral system, or the size or type of the medical practice.

We identified a total of 72 studies (74 articles) rated good or fair quality that examined different factors that are associated with the use of CRC screening[1-2,21,42,46,55-57,65-66,88,106-168] rated good or fair quality. For these studies, we categorized the factors into five topic areas: 1) patient level factors that influence CRC screening; 2) physician factors (physician characteristics, physician-patient connectedness, and physician recommendations); 3) patient and physician communication; 4) periodic health exams or annual checkups; and 5) system level factors that may be associated with screening rates. We also identified two articles that focused on patient level predictors of followup among patients who have received a positive FOBT result and present them separately under the patient factors section of this chapter.[88,168]

Studies for this KQ are presented somewhat differently than those for the other KQs. Because of the vast number of studies this section includes, we start by presenting findings from three nationally representative samples of respondents where the investigators present overall findings that are not stratified by some factor (e.g., race, sex). For these three studies,[21,46,151] we present the absolute screening rates in order to provide benchmarks for assessing how screening rates change when other factors are presented separately in the remainder of this section. We

then present the results of the four primary patient characteristics of demographics, access to care, personal health or risk factors, and psychosocial factors that are associated with CRC screening. For each of these characteristics, we then summarize the findings from the three national studies and present adjusted odds ratios (AOR) and other statistics as appropriate. After presentation of the three national 'overview' studies, we follow that section with all additional studies that present findings for each of the seven topic areas that may be associated with screening. In each of these sections, we provide summary tables of the key studies that examined the corresponding factor. In each table, we also present the overarching results by using the symbols of "↑" or "↓" to provide a quick assessment of each study's findings specific to the key variables and the outcome of CRC screening (i.e., the "↑" means there is a positive association between the variable and CRC screening, and the "↓" means there is a negative association). Because this KQ includes so many studies, we think the use of these symbols helps the reader to understand what the overall results convey. Since this KQ presents descriptive findings from observational studies, we have not provided an assessment of the strength of evidence here.

The following presents the study characteristics and overview of results for each of the seven topic areas potentially associated with CRC screening.

Patient Factors: Overview

The majority of studies that have examined factors that predict the likelihood of CRC screening have focused on patient characteristics. We identified a total of 56 studies that we rated as good or fair quality that reported findings related to this topic.[1-2,21,42,46,55-56,65,106-109,111-126,128-134,136-138,141,144-147,149-151,155-158,160-163,165-166] that we rated as good or fair quality that reported findings related to this topic. We also included two studies that examined patient level factors that predict followup after a positive FOBT result.[88,168]

For patient factors, we categorized studies into four primary topics:

- patient demographics: studies that explore the relationship between characteristics such as age, sex, income, insurance status, race, ethnicity, and acculturation and the completion of various CRC screening tests.
- access to care: studies that explore the impact on CRC screening rates of having a regular source of care, recently visiting a provider at least once, and proximity to health care facilities.
- personal health or risk factors: studies that focus on the relationship of health factors (e.g., health status, obesity) or healthy behaviors (e.g., obtaining screenings for other cancers); or risk factors (e.g., family history of CRC, personal history of other cancers) or risky health behaviors (e.g., smoking, sedentary lifestyle, alcohol use) to the outcome of CRC screening by any test.
- psychosocial factors: studies on patient knowledge, attitudes, beliefs, and perceptions related to either CRC or screening for that type of cancer.

All the studies for KQ 2 present observational data collected either through surveys of self-reported screening rates or through analysis of claims data. These studies include those that report on national, state, regional, and local samples of respondents or patients. These studies yield a broad array of findings in a variety of populations and examine a large number of patient factors and their relationship to CRC screening; dealing with all of them simultaneously risks presenting an unnecessarily complex synthesis. For that reason, we have adopted an analytic strategy for this KQ in which we initially describe the three studies that have the most nationally representative samples and that did not stratify their results by any factors (e.g., race,

ethnicity).[21,46,151] In our view, these studies provide a broad overview of the issues and findings and provide a robust basis for then analyzing studies with a narrower focus.

Patient Factors: Three Nationally Representative Studies

Overview of national studies of patient characteristics. *Study characteristics*. Three studies examined the overall patient characteristics that seem to predict CRC screening in a national sample.[21,46,151] We rated all three studies as good quality. All relied on national survey data for their analysis; specifically, all used National Health Interview Survey (NHIS) data, with two presenting findings from 2000[21,151] and one from 2005.[46] All three presented findings for respondents ages 50 or older.[21,46,151] All three explicitly excluded from their analysis people reporting a prior diagnosis of CRC.[21,46,151]

The studies varied slightly on how they assessed the outcome of CRC screening. Two studies used the same definition (that respondents who reported an FOBT within the past year or an endoscopy within the past 10 years were adherent with national screening guidelines).[21,46] The remaining study defined adherence to screening as obtaining an FOBT in the past year, an endoscopy within the past 10 years, or both, for screening purposes. They defined this variable as "time-screening adherence" and included those who reported being screened as part of a routine physical examination, because of a specific problem, as a followup to another screening test, or because of family history of CRC.[151]

Overview of results. For the three studies, we present the overall findings for each of the categories of patient characteristics that may influence screening rates: demographics, access to care, personal health or risk factors, and psychosocial factors (Table 6). For each set of findings, we present only those screening rates or adjusted odds ratios (AORs, with 95 percent confidence intervals or significance levels) specific to being current with any CRC test (per the authors' computation of their outcomes variables); we do not present findings for specific tests in this section unless the authors limited their measurement of CRC screening to only one or two tests. "Significant" in this discussion means statistically significant at least a $P = 0.05$ level.

Table 6. Overall findings from the three national studies for each category of patient characteristics

Patient Characteristic	Overall Findings
	Patient demographics
Age	All 3 studies reported that CRC screening rates increase for each age group, until the older age range (≥ 75 for 1 study[151] and ≥ 80 for the other 2 studies[21,46]), at which point screening rates appear to decline slightly.
Sex	Findings from both studies of 2000 NHIS data indicated that females were slightly less likely to be screened than males (AOR, 1.16 of males compared with female; 95% CI, 1.03-1.31[151] and AOR, 0.89 of females compared with male; 95% CI, 0.80-0.99[21]). By 2005, screening rates did not differ on this variable.[46]

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; NHIS, National Health Interview Survey.

Table 6. Overall findings from the three national studies for each category of patient characteristics (continued)

Patient Characteristic	Overall Findings
Race	Blacks and whites did not differ significantly in adjusted screening rates in any of the three studies, though they did in absolute rates.[21,46,151] When the race category of "other" was included, 1 study reported that this group was less likely to be screened when compared with whites (AOR, 0.67; 95% CI, 0.50-0.92[21]); another study found no difference in screening rates in the "other" race group compared with whites.[46]
Ethnicity	Hispanics were less likely to report being screened than non-Hispanic whites in 1 study using 2000 NHIS data (AOR, 0.73; 95% CI, 0.58-0.92),[151] but the other 2 studies had no significant differences for this factor (after adjustment). One study reported a nonstatistically significant trend that Asians were less likely than whites to report being screened (41.7% and 50.0%, respectively; *P* = 0.07).[46]
Income	Only 2 studies reported findings by income. One reported a significant difference in screening rates between respondents living in higher income households and those in lower income households (a 45.5% screening rate for those reporting an income < $20,000 and a 53.2% screening rate for those with incomes at or above $75,000; *P* = 0.006).[46]
Insurance	All 3 studies reported findings based on whether respondents had health insurance or not. Each demonstrated that persons with no insurance were significantly less likely to report being screened than those who had any type of insurance (10.1% to 24.1% of those with no insurance had been screened compared with 40% to 68.2% of those with insurance).[21,46,151]
Other factors (education level and marital status)	All 3 studies reported findings indicating that subjects with higher education and those who were married were more likely to have completed CRC screening.[21,46,151]
Access to care	
Access to care	Both having a usual source of care and visiting that provider at least once in the past year were consistently associated with CRC screening.[21,46,151]
Personal health or risk factors	
Personal health/ risk factors	Family history of cancer, particularly CRC; personal history of another (non-CRC) cancer; use of other cancer screening (i.e., mammogram, Pap test); and never or former smokers were positively associated with CRC screening in all three studies.[21,46,151] General health status, alcohol use, and obesity may be variables associated with screening but the findings were less consistent.
Psychosocial factors	
Psychosocial factors	The most common reason for not being screened (either "ever" or "within the recommended time period") is that the respondent "never thought about it."[21,46]
Other findings	
Other findings	The 3 studies also reported findings that are not presented here because they were not found to be associated with CRC screening or were not reported across all 3 studies. One study reported the association between metropolitan statistical areas and screening rates and found no relationship.[151] The same study also reported screening rates by region of the country and found that those living in any areas other than the West were less likely to report current screening (AOR, range 0.79-0.82).[151]

Demographics. All three studies examined demographic characteristics, including age, sex, income, insurance status, race, ethnicity, acculturation, and other factors such as education and marital status. The adjusted screening rates reported for each study appear in Table 7. We then discuss the factors that one or more of the three studies reported as predictors of CRC screening rates. None of these studies adjusted for or reported findings for factors related to acculturation (i.e., English-language proficiency, foreign birth, years living in United States).

Age. For the three studies,[21,46,151] screening rates gradually increased for each age group from the age groups from 50 to 70 years. One study using 2000 NHIS data found that older patients were more likely to be screened than younger patients. Relative to the referent group (50-54 years), respondents 55-59 years of age were slightly more likely to report being screened (AOR,

Table 7. Adjusted CRC screening rates by key patient-level demographic characteristics, for three national studies

Demographic Characteristics	Ata et al., 2006[151] 2000 NHIS* % (95% CI)	Seeff et al., 2004[21] 2000 NHIS† % (95% CI)	Shapiro et al., 2008[46] 2005 NHIS‡ % (95% CI)
Overall screening rates			
Home FOBT within past year	15.1 (14.3-15.9)	17.1 (16.2-17.9)	12.0 (11.3–12.7)
Endoscopy within past 10 years	17.6 (16.8-18.4)	33.9 (32.9-35.0)	45.2 (44.0-46.4)
Either test within recommended time	25.8 (24.9-26.7)	42.5 (41.4-43.5)	50.0 (48.8-51.2)
Age			
50-54	19.7 (17.9-21.7)	35.3 (33.9-37.2)	40.4 (38.7-42.1)
55-59	25.6 (23.3-27.9)		
60-64	26.7 (24.4-29.1)	45.9 (43.8-48.0)	56.5 (54.3-58.6)
65-69	30.9 (28.5-33.5)		
70-74	30.5 (27.9-33.3)	52.3 (50.1-54.5)	60.2 (58.0-62.3)
75-79	26.5 (24.4-28.6)		
80+		40.7 (37.6-43.9)	50.3 (47.2-53.4)
Sex			
Female	23.9 (22.8-25.1)	41.0 (39.7-42.4)	48.7 (47.1-50.3)
Males	28.0 (26.6-29.5)	44.5 (42.9-46.1)	51.7 (49.9-53.4)
Married and living with partner	28.7 (27.4-30.0)	46.3 (44.9-47.7)	53.2 (51.6-54.7)
All others	20.9 (19.8-22.1)	36.6 (35.0-38.1)	44.4 (42.8-46.0)
Education			
< High school	17.8 (16.3-19.3)	31.4 (29.5-33.3)	37.0 (34.6-39.6)
High school	24.0 (22.4-25.6)	40.2 (38.3-42.0)	46.9 (44.8-49.0)
Some college	27.0 (24.8-29.4)	46.2 (44.1-48.3)	54.2 (52.3-56.2)
College graduate	32.6 (30.2-35.2)	54.0 (51.5-56.5)	60.7 (58.7-62.6)
Post-graduate	38.4 (35.2-41.7)	--	--
Race			
Non-Hispanic whites	27.3 (26.3-28.3)	43.6 (42.5-44.7)	51.1 (49.8-52.4)
Non-Hispanic blacks	22.7 (20.1-25.6)	37.8 (34.9-40.7)	43.5 (40.6-46.5)
Other	--	28.7 (24.5-33.0)	38.2 (27.7-49.8)
Ethnicity			
Hispanic	15.8 (13.5-18.5)	29.9 (26.4-33.3)	34.2 (30.6-37.9)
Asian	--	--	38.7 (32.8-44.9)
Annual household income			
<$20,000	19.6 (18.1-21.1)	35.2 (33.0-37.3)	37.4 (35.4-39.5)
$20,000- 34,999	25.6 (23.6-27.6)	41.1 (38.4-43.7)	47.5 (45.1-49.9)
$35,000- 44,999	25.1 (22.1-28.0)	--	--
$35,000- 54,999	--	44.1 (41.0-47.3)	50.1 (47.2-53.1)
$45,000- 65,000	27.5 (24.7-30.2)	--	--
$55,000- 74,999	--	46.6 (42.0-51.2)	54.4 (50.9-57.9)
≥$65,000	31.8 (29.7-33.9)	--	--
≥$75,000	--	56.6 (52.8-60.3)	58.5 (55.3-61.7)
Insurance status			
No (none)	10.1 (8.0-12.6)	18.1 (11.2-24.9)	24.1 (19.2-29.7)
Yes (coverage of some type)	27.0 (26.1-28.0)	--	--
Private only	--	44.4 (41.0-47.8)	48.7 (45.9-51.5)
Medicare only	--	40.0 (34.8-45.1)	44.6 (39.0-50.3)
Medicare + private/Medigap	--	50.1 (44.4-55.8)	58.1 (50.7-65.2)
Medicare + Medicaid	--	--	45.1 (38.7-51.6)
Medicaid only	--	--	27.6 (21.1-35.2)

Table 7. Adjusted CRC screening rates by key patient-level demographic characteristics, for three national studies (continued)

Demographic Characteristics	Ata et al., 2006[151] 2000 NHIS* % (95% CI)	Seeff et al., 2004[21] 2000 NHIS† % (95% CI)	Shapiro et al., 2008[46] 2005 NHIS‡ % (95% CI)
Military	--	--	68.2 (63.8-72.4)
Other/multiple carriers	--	37.8 (34.4-41.2)	49.7 (42.8-56.6)

CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; NHIS, National Health Interview Survey; '--', data not reported for corresponding range of responses.
* Multivariate adjustments were made for all independent variables in their analysis.
† Adjusted for all other variables in their analysis except for mammography and Pap test use.
‡ Adjusted using predictive margins for all other characteristics in their analysis.

1.51; 95% CI, 1.24-1.84),[151] as were those 60-64 years (AOR, 1.41; 95% CI, 1.41-2.05)[151] and even more so for those 65-69 (AOR, 2.14; 95% CI, 1.75-2.62) and 70-74 (AOR, 2.20; 95% CI, 1.80-2.70).[151] The other study using 2000 NHIS data reported the same trend (compared with subjects 50-59 years, AOR 1.45; 95% CI, 1.26-1.67 for those 60-69 years and AOR, 1.69; 95% CI, 1.41-2.03 for those 70-79[21]). The study using 2005 NHIS data showed a similar trend and presented findings as age-adjusted percentages; 42.6 percent of those 50-59 years of age (95% CI, 40.4-44.8 percent), 56.6 percent of those 60-69 years (95% CI, 54.4-58.7 percent); and 57.2 percent of those 70-79 years (95% CI, 54.5-59.9 percent) reported being screened for CRC.[46]

In all three studies, however, screening rates were lower for the oldest category of patients relative to the adjacent age group;[21,46,151] the two 2000 NHIS studies reported an AOR of 2.08 for those 75 years of age and older (95% CI, 1.70-2.53)[151] and AOR of 1.25 for those 80 years and older (95% CI, 1.01-1.56).[21] The study of 2005 NHIS data showed a similar trend: 49.9 percent of respondents 80 years or more years of age reported being current with CRC screening (95% CI, 46.1-53.8 percent).

Sex. For the two studies of 2000 NHIS data, the reported screening rate was slightly lower among females than male.[21,151] In one, males were more likely to report screening than females (AOR, 1.16; 95% CI, 1.03-1.31),[151] and in the other females were less likely to report being screened (AOR, 0.89; 95% CI, 0.80-0.99).[21] The study of 2005 NHIS data found no difference between screening rates of males (49.2 percent; 95% CI, 47.4-50.9) and females (50.4 percent; 95% CI, 48.7-52.2; $P = 0.29$).[46] For the two studies that presented screening rates for FOBT within the past year or endoscopy within the past 10 years, one reported no difference in FOBT or endoscopy screening rates among males and female,[46] and the other found similar screening rates for FOBT and only a slightly lower rate of endoscopy screening for females compared with males (AOR, 0.77; 95% CI, 0.69-0.86).[21]

Race. Comparisons are more challenging for the reports of CRC screening by race because the three studies reported the findings somewhat differently. All three studies reported findings for whites and blacks; all three reported adjusted rates that show no difference between blacks and whites.[21,46,151] In the two studies of 2000 NHIS data, blacks had a slightly nonstatistically higher odds ratio but not a statistically significant different rate of CRC screening than whites (as the referent group for both studies).[21,151] One study also reported CRC screening for the race category of "other," which could include Asians, American Indians, and others; it found that this group was less likely to report being screened than whites (AOR, 0.67; 95% CI, 0.50-0.92).[21] Another study also reported a current screening rate of 40.3 percent (95% CI, 27.7-54.4; $P = 0.07$) for subjects in the "other" race category.[46]

Ethnicity. All three studies provided CRC screening rates for Hispanics. One study reported that Hispanics were statistically less likely than whites to be screened for CRC (AOR, 0.73; 95%

CI, 0.58-0.92);[151] the other two studies showed that there was no statistically significant difference between Hispanics and "non-Hispanic" whites (AOR, 0.92; 95% CI, 0.75-1.12[21] for Hispanics with whites as the referent group; and adjusted percentage of 45.9% for Hispanics; 95% CI, 41.7-50.2%; compared with 50.2% for non-Hispanic whites; $P = 0.06$[46]).

We have included Asians in our discussion of ethnicity throughout this chapter; in places, we present study findings specific to subgroups of Asians (Chinese, Japanese, Korean, Vietnamese).[46] One study reported findings specific to Asians: the percentage reporting being screened was lower than the figure for whites (41.7 percent and 50.0 percent, respectively; $P = 0.07$).[46]

In terms of the combination of racial/ethnic differences, one study highlighted unadjusted and adjusted screening rates for Hispanics and blacks,[151] whites had the highest and Hispanics had the lowest proportions of adherence to timely screening. Compared with whites, Hispanics were 50 percent ($P < 0.001$) less likely to be adherent, and blacks approximately 23 percent ($P < 0.01$) less likely to be adherent. After multivariate adjustment (for all independent variables in their analysis), the difference between blacks and whites disappeared (AOR, 1.13; 95% CI, 0.95-1.35) but remained statistically significant for Hispanics (AOR, 0.73; 95% CI, 0.58-0.92).[151] The other two studies reported similar findings in the unadjusted and adjusted rates for the different racial and ethnic groups.[21,46] In one study, race was no longer a predictor of FOBT use when the rates were adjusted;[21] in another, adjustment for all the other factors in their analysis weakened the association between screening and Hispanic ethnicity (45.9 percent for Hispanics and 50.2 percent for non-Hispanics; $P = 0.06$).[46]

Annual household income. Two studies reported findings based on annual household income,[46,151] using slightly different income categories. Using the annual household income group of $20,000 or more as a referent, one study found that each higher income group was slightly more likely to report being screened; the group reporting an income of $65,000 or more was among those most likely to report being screened (AOR, 1.28; 95% CI, 1.04-1.58).[151] In another study, screening rates differed significantly between low-income and high-income groups: 45.5 percent screening rate for those < $20,000, and 53.2 percent screening rate for those ≥ $75,000 ($P = 0.006$).[46]

Insurance status. All three studies reported findings based on whether respondents had health insurance; and all demonstrated that those with no insurance were statistically significantly less likely to report being screened than those who had any type of insurance.[21,46,151] Using those without insurance as the referent group, both studies of 2000 NHIS data reported those with any insurance were more likely to report being screened than those without (AOR, 1.42; 95% CI, 1.05-1.93[151] and AOR, ranges 1.66-1.93, with statistically significant 95% CIs[21]). The study of 2005 NHIS data demonstrated a similar finding; 31.6 percent of those without insurance versus 43.0 percent to 67.9 percent of those in other insurance categories reported screening ($P < 0.0001$).

Two studies reported screening by type of insurance. For 2000 among those with any insurance, those with private insurance were the least likely to be screened (AOR, 1.66; 95% CI, 1.28-2.15) and those with a combination of private insurance and Medicare or Medigap were the most likely to be screened (AOR, 1.93; 95% CI, 1.44-2.59).[21] For 2005 among those with any insurance, those with Medicaid were the least likely with insurance to report being screened (43.0 percent; 95% CI, 35.7-50.6) and those from the military were the most likely to be screened (67.9 percent; 95% CI, 63.3-72.1).[46]

Other factors: Education level and marital status. Education level and marital status consistently reported as associated with CRC screening. All three studies reported that respondents with lower levels of education had lower levels of CRC screening than better

educated groups. For 2000, both studies reported that those who finished high school or had any education beyond that level were more likely than those who did not complete high school to report being screened (AOR, range 1.27-2.08 with "less than high school" as the referent group;[151] AOR, range 1.27-1.83 with "less than 12 years" as referent group[21]). For 2005, reported a similar trend; rates of CRC screening increased as education levels rose (ranging from 47.9 percent to 55.5 percent compared with 43.8 percent for those with less than 12 years of education; $P = 0.01$).[46]

With respect to marital status, all studies reported that being married was associated with CRC screening.[21,46,151]

Access to care. Access to care is a patient-level characteristic that many studies in our review examined. These three studies each reported two measures of access to care—whether an individual has a "usual (or, regular) source of care" and the frequency or recency of contact with the provider (i.e., number of visits in past year or time since the last visit).[21,46,151] Table 8 provides the adjusted rates for variables related to access to care.

Table 8. Adjusted CRC screening rates by patient-level variables of access to care for three national studies

Access to Care Variables at the Patient Level	Ata et al., 2006[151] 2000 NHIS*	Seeff et al., 2004[21] 2000 NHIS†	Shapiro et al., 2008[46] 2005 NHIS‡
	% (95% CI)	% (95% CI)	% (95% CI)
Access to care			
Usual source of care			
Yes	27.0 (26.1-28.0)	44.2 (43.2-45.3)	51.9 (50.7-53.1)
No	10.1 (8.0-12.6)	17.8 (14.9-20.8)	24.7 (20.8-29.0)
Number of physician visits in past years			
None	--	14.8 (12.6-17.0)	19.5 (16.8-22.5)
1	--	36.2 (33.3-39.1)	40.2 (37.3-43.2)
2-5	--	44.6 (43.0-46.3)	52.5 (50.7-54.3)
≥6	--	51.7 (49.9-53.5)	59.8 (58.0-61.6)
Time since last doctor visit			
≤ 6 months	28.9 (27.8-30.0)	--	--
> 6 months-1 year	22.9 (20.3-25.8)	--	--
>1-2 years	11.2 (8.4-14.7)	--	--
>2 years	3.7 (2.3-5.9)	--	--

CI, confidence interval; CRC, colorectal cancer; NHIS, National Health Interview Survey; '--', data not reported for corresponding range of responses

* Multivariate adjustments were made for all independent variables in their analysis.

† Adjusted for all other variables in their analysis except for mammography and Pap test use.

‡ Adjusted using predictive margins for all other characteristics in their analysis.

Usual source of care. All three studies found that those respondents who reported having a usual source of care were more likely to obtain CRC screening than those who did not have a usual source of care.[21,46,151] The two studies of 2000 NHIS data each reported significant differences in rates of CRC screening between those who had a usual source of care and those who did not (AOR, 1.61; 95% CI, 1.17-2.21[151] and AOR 1.65; 95% CI, 1.30-2.09).[21] For 2005, findings for adjusted rates were similar; 51.0 percent of those with a usual source of care (95% CI, 49.7-52.3%) and 30.5 percent of those without a usual source of care (95% CI, 26.5-34.8%; $P = 0.0001$) were screened.[46]

Frequency or recency of visits to physician. All three studies provided similar findings: those who had visited a physician more frequently in the past year or had seen a doctor more recently were more likely to report being screened for CRC.[21,46,151] In one study, those with no physician visits in the past year were significantly less likely to obtain screening than those who visited a physician at least once (AOR, range 2.40-4.68).[21] In another, those who had visited a physician within the past 1 to 2 years were less likely to have had a CRC screening test than those who had

visited within the past 6 months (AOR, range 2.76-7.59 with less than 2 years as the referent group).[151] The third study did not report adjusted rates for this variable; unadjusted rates appear in Table 8.[46]

Personal health factors and risk factors. Personal health factors are defined as characteristics from respondents' family history or personal health history (e.g., prior polyp removal, screening behavior with regard to other cancers, general health status, family CRC diagnosis) that would place them at increased risk for CRC or that may be related to healthy behaviors that could influence the extent to which they obtain regular CRC screenings. Risk factors for health problems that may be related to CRC screening include smoking, sedentary lifestyle, poor eating habits, obesity, and any factor that may place a person at increased risk for developing CRC. Table 9 presents the absolute rates of these variables as reported by the three national studies, followed by a discussion of findings for each.[21,46,151]

Table 9. Adjusted CRC screening rates by patient-level personal health or risk factors for three national studies

Health or Risk Factors	Ata et al., 2006[151] 2000 NHIS[†] % (95% CI)	Seeff et al., 2004[21] 2000 NHIS[‡] % (95% CI)	Shapiro et al., 2008[46] 2005 NHIS[§] % (95% CI)
Family history of CRC			
Yes	30.6 (29.3-32.0)*	59.7 (56.5-62.8)	68.3 (64.9-71.5)
No	23.8 (22.4-25.3)	41.4 (40.2-42.5)	48.8 (47.6-50.1)
Personal history of cancer			
Yes	32.3 (29.6-35.0)	55.1 (51.8-58.3)	63.9 (61.0-66.8)
No	24.9 (24.0-25.9)	40.6 (39.5-41.7)	47.8 (46.5-49.0)
General health status			
Excellent	30.1 (21.8-32.1)	--	--
Very good	27.7 (26.1-29.4)	--	--
Excellent/good	--	42.6 (41.4-43.8)	--
Excellent/very good/good		--	50.5 (49.1-51.9)
Good	24.6 (23.0-26.3)	--	--
Fair	21.1 (19.1-23.4)	--	--
Fair/poor	--	42.4 (40.1-44.7)	48.1 (45.7-50.4)
Poor	20.1 (17.2-23.3)	--	--
Body mass index (kg/m^2)			
Underweight	17.6 (13.3-22.8)		49.1 (47.1-51.0)
Normal (<25)	25.5 (24.0-27.0)	40.5 (38.7-42.2)	
Overweight (25-29)	27.6 (26.1-29.2)	43.6 (41.9-45.3)	51.2 (49.4-52.9)
Obese (≥30)	26.6 (24.7-28.5)	44.3 (42.1-46.5)	50.5 (48.4-52.7)

Table 9. Adjusted CRC screening rates by patient-level personal health or risk factors for three national studies (continued)

Health or Risk Factors	Ata et al., 2006[151] 2000 NHIS	Seeff et al., 2004[21] 2000 NHIS	Shapiro et al., 2008[46] 2005 NHIS
	% (95% CI)	% (95% CI)	% (95% CI)
Mammogram within 2 years			
No	--	19.1 (17.0-21.2)	24.0 (21.7-26.5)
Yes	--	49.2 (47.6-50.9)	60.6 (58.7-62.4)
Pap test within 3 years			
No	--	24.1 (21.6-26.7)	33.3 (31.0-35.8)
Yes	--	46.8 (45.2-48.3)	56.0 (54.0-57.9)
Physical activity			
None	20.5 (19.3-21.7)	35.3 (33.8-36.7)	41.9 (40.3-43.5)
Moderate/some/irregular	29.6 (27.6-31.6)	44.7 (42.3-47.1)	55.3 (52.9-57.6)
Regular or meet/exceed recommendations	33.3 (31.3-35.5)	51.2 (49.2-53.3)	57.6 (55.9-59.7)
Smoking status			
Never/nonsmokers	25.1 (23.8-26.5)	41.3 (39.8-42.9)	49.2 (47.6-50.7)
Former/quitters	30.9 (29.3-32.6)	48.2 (46.5-49.9)	56.0 (54.2-57.9)
Current/smokers	18.2 (16.3-20.3)	35.3 (32.6-38.0)	37.8 (34.9-40.8)
Alcohol use			
None	--	38.6 (37.2-40.0)	43.4 (41.7-45.0)
1-14 drinks/week	--	47.2 (45.8-48.7)	56.8 (55.2-58.4)
≥ 14 drinks/week	--	43.7 (39.0-48.5)	53.0 (48.7-57.2)

CI, confidence interval; CRC, colorectal cancer; NHIS, National Health Interview Survey; '--', data not reported for corresponding range of responses.
* For this study, findings reported were for "family cancer history" not specific to CRC.[151]
† Multivariate adjustments were made for all independent variables in their analysis.
‡ Adjusted for all other variables in their analysis except for mammography and Pap test use.
§ Adjusted using predictive margins for all other characteristics in their analysis.

Health factors. Family history of CRC or other cancer, personal history of other non-CRC cancers, and use of mammograms or Pap tests were all found to be consistently associated with CRC screening rates.[21,46,151] One study used "family cancer history" that was not specific to CRC; those who reported this as part of their history were significantly different from those who did not (AOR, 1.27; 95% CI, 1.13-1.43). Findings in another study were specific to a family history of CRC and reported a stronger association between screening rates; those with a family history were more than twice as likely to report being screened as those who had none (AOR, 2.04; 95% CI, 1.73-2.40).[21] The third study did not present the adjusted rates for this variable; unadjusted rates appear in Table 9.[46]

Three studies assessed the relationship between personal history of other (non-CRC) cancers and CRC screening. Two studies found this variable to be strongly associated with CRC screening (AOR, 1.08; 95% CI, 0.93-1.25;[151] AOR, 1.24; 95% CI, 1.12-1.37;[21] adjusted percentage of 59.8 percent screening rate for those with a personal history versus 48.3 percent for those without; $P < 0.0001$[46]).

Two studies reported use of mammograms and Pap tests.[21,46] In one study, analyses for use of mammograms were adjusted for all variables in their analysis except sex and Pap test use, and those for use of Pap tests were adjusted for all variables except sex and mammogram use and also for hysterectomy history.[21] For the association between mammography use and CRC screening, the AOR was 2.96 (95% CI, 2.50-3.50); for Pap tests the AOR was 2.41 (95% CI, 2.03-2.86). The second study did not provide adjusted rates for these variables.[46] Their unadjusted rates indicate that 60.6 percent of females who had obtained a mammogram in the

past 2 years versus 24.0 percent of females who had not and 56.0 percent of those who had obtained a Pap test in the past 3 years versus 33.3 percent of those who had not reported obtaining CRC screening within recommended time intervals.[46]

Findings specific to the association of general health status with CRC screening differed across studies. One study found little difference in CRC screening rates between respondents who considered themselves to be in excellent or good health and those in fair or poor health (AOR, 1.07; 95% CI, 0.94-1.22).[21] The other two studies reported that higher levels of perceived health seemed to be associated with higher CRC screening rates (AOR, range 0.73-0.90 with "excellent" as the referent group for one study[151] and 48.7 percent adjusted rates for those in "excellent/very good/good" health and 54.3 percent in "fair" or "poor" health; $P < 0.0001$[46]).

Risk factors. Risk factors reported by these studies included smoking status, obesity, physical activity, and alcohol use.[21,46,151] In two studies, current smokers were less likely than never or former smokers to be screened (AOR, 0.82; 95% CI, 0.70-0.95[21] and adjusted percentage of 41.5 percent screening rate for smokers compared with a 53.3 percent rate for former smokers and a 45.2 percent rate for those who never smoked; $P < 0.0001$[46]). One study reported no significant differences based on current or former smoking.[151]

None of the studies reported body mass index as a predictor of CRC screening. All three found that even some or moderate, as well as regular, respondents who reported some type of exercise had higher screening rates than those who reported no exercise.[21,46,151]

Alcohol use was reported in two studies.[21,46] One found that those who reported 1 to 14 drinks per week were more likely to report being screened than any other group (AOR, 1.14; 95% CI, 1.03-1.26).[21] The other study also reported significant differences specific to alcohol use; those who reported 1 or more drinks per week being more likely to be screened (adjusted percentages of 52.8 percent for those drinking 1 to 13 drinks/week (95% CI, 51.5-54.4%) and 51.9 percent (95% CI, 47.3-56.4%) for those drinking 14 or more drinks/week; compared with 46.5 percent (95% CI, 44.8-48.3%) for those reporting no alcohol use: $P < 0.0001$).[46]

Psychosocial factors. Two studies presented analyses based on reasons for never undergoing screening or undergoing screening beyond the recommended time intervals and include aspects of knowledge, attitudes, beliefs, or perceptions (i.e., psychosocial factors) that may be associated with CRC screening use.[21,46] One study using 2000 NHIS data examined reasons for not obtaining screening compared two age groups of respondents (those 50-64 years compared with those ≥ 65 years) and reported that lack of knowledge of either the FOBT or endoscopy as a test was a common barrier to undergoing either test (52.0 percent of those 50-64 years of age and 50.7 percent of those 65 or older reported this barrier for FOBT; 49.7 percent and 50.7 percent, respectively, reported this barrier for endoscopy).[21] Far fewer respondents reported any of the following reasons for not being screened, putting it off, or believing they did not need the test: expense or lack of insurance, the pain, unpleasantness, or embarrassment of having the test. Proportions ranged from 0.3 percent to 12.2 percent among those 50-64 and from 0.1 percent to 12.5 percent among those 65 or older.[21]

The study using 2005 NHIS data presented proportions of responses for the same items of the survey;[46] they compared individuals who never had had an FOBT or endoscopy with those who had had the test before but not in the recommended time interval. Results indicated that about half of the respondents reported "never thought about it" as a reason for not being screened ever (adjusted percentage of 53.9 percent (95% CI, 52.0-55.7%) for FOBT and 51.8 percent (95% CI, 49.9-53.6%) for endoscopy) or within the time interval (adjusted percentage of 51.7 percent (95% CI, 50.0-53.4%) for FOBT and 48.7 percent (95% CI, 47.0-50.4%) for endoscopy).[46] Far fewer respondents reported any of the psychosocial factors as reasons for not being screened ever or on time, such as their beliefs about testing ("did not need it", adjusted percentage ranges of

10.3 to 12.2 percent), or their perceptions that the tests were too painful/unpleasant/embarrassing (adjusted percent ranges of 0.8 to 2.0 percent).[46] Neither study commented on the extent to which any of these factors may relate to overall screening rates.

Patient Factors: Overview of Additional Studies

Here we present information from other studies that present findings from a national, regional, or local database, but that stratified their findings on one or more particular patient-level factor (e.g., age, sex, race, ethnicity). We highlight these studies in the sections specific to the variable of interest. To reduce the potential for redundancies, we only present the study characteristics and overview of results for each group of studies, and not a detailed description of all the studies included in this section.

In addition to the three overview studies, we included 53 studies[1-2,42,55-56,65,106-109,111-126,128-134,136-138,141,144-147,149-150,155-158,160-163,165-166] rated as good or fair quality. We present findings in summary tables for studies that had significant or particularly important or interesting results specific to that patient-level variable. Each table first presents studies rated as good quality listed in alphabetical order by first author's last name, followed by studies rated as fair quality that are also listed in alphabetical order by the first author's last name. Also, because we are reporting findings for a large number of studies, we have attempted to streamline the text such that detailed statistics (e.g., confidence intervals [CI]) are only presented in the summary tables and overall findings are presented in the text describing the studies. We also describe, just in text, other studies that provide supporting or contradicting results for each category of factors.

Although a large number of studies may have included the factors as presented in the following sections, we only present additional description in the text and include in the tables those studies that specifically aimed to explain whether the factor of interest for the section was related to CRC screening (rather than simply looked at a large number of factors). In some cases (for studies specific to both racial and ethnic differences), we include one study in more than one summary table. However, to minimize the discussion as much as possible, we generally present one study only once in a table and a few studies are not presented in summary tables at all because their findings support others presented. At the summary of each factor, we then briefly reference all of the other studies that included the factor in their final multivariate analyses and whether and how they found the factor to be associated with CRC screening.

Age. *Study characteristics.* All studies discussed in this section included age in their analysis of factors associated with CRC screening of their sample. Two studies, both rated fair quality, focused on the association between age and CRC screening (Table 10); both presenting results for patients 65 years or older.[55,150] One study presented self-reported findings from a national database of responses to the 2003 Health Information National Trends Survey (HINTS);[55] we include it here (instead of as an overview study) because the authors explored screening specifically among older people (ages 65-89 years). The second study analyzed 2002-2003 Medicare physician/supplier billings claims data from three states (Florida, Illinois, and New York).[150] The HINTS study focused on the outcome of screening as defined by national guidelines (i.e., FOBT in the past year or FS/colonoscopy in the past 10 years), whereas the Medicare claims study defined CRC screening as any test (i.e., colonoscopy, FS, double-contrast barium enema, or FOBT) obtained during the study period (2002-2003).[150] In terms of the "age" variable, one study focused on comparing those who were ages 65-74 years with those who were 75-89 years of age[55] the other categorized the age variable into four groups (ages 65-69; 70-74; 75-79; and 80 or more years).[150]

Table 10. Studies of the association of age with CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Considered	Variables Associated with CRC Screening*	Results (95% CI)
Berkowitz et al., 2008[55] Cross-sectional, retrospective, national HINTS (2003) respondents 65-89 years old N = 1,148 (583 not up-to-date with screening) Fair	Assess beliefs and perceptions of risk about CRC and gaps in knowledge about screening in adults aged 65-89 years	FOBT (within past year) or FS or colonoscopy in past 10 years (self-report)	Age (65-74 vs. 75-89 years)	Gender, race, income, education, marital status, family history of CRC, health status, regular source of care, annual MD visits, knowledge about CRC and testing, beliefs about CRC, perceived risk	↑ Older patients (75-89 years)	Older patients were more likely than younger patients to be up to date with CRC screening (AOR, 1.92; 95% CI, 1.32-2.79; *P* < 0.001)
Ananthakrishnan et al., 2007[150] Cross-sectional, retrospective, 3 states Medicare physician/ supplier billing claims in Florida, Illinois, and New York, 2002-2003, 65+ years N = 596,470 Fair	Identify effects of some demographic characteristics on screening behavior	Any test (colonoscopy, FS, double-contrast barium enema, or FOBT) (claims)	Age (65-69; 70-74; 75-79; 80+)	Race, sex, per-capita income, education	↓ Oldest patients	Patients 80+ years were less likely to have received any CRC test than other age groups, regardless of income (RR range, 0.84-0.90).

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HINTS, Health Information National Trends Survey; MD, Medical Doctor; P, probability; RR, relative risk.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

Overview of results. Age was a predictor of screening in the HINTS study such that older patients (ages 75-89) were more likely than younger patients (65-74) to be up-to-date with CRC screening (AOR, 1.92; $P < 0.001$).[55] Age was also associated with CRC screening in the Medicare claims study, until the age of 80 year or older; these older patients were less likely to have received any CRC test than any other age groups, regardless of income (RR range, 0.84-0.90).[150]

These findings agree somewhat with the overview studies presented previously.[21,46,151] The Medicare claims study supports those findings in that screening rates decline slightly among patients over age 80 years.[150] The HINTS study found an overall increase in screening rates from the younger age range of respondents (65-74) to the older age group (75-89).[55] If these investigators had defined more but shorter age ranges in their analysis, they might have found rates with respect to age similar to those in the other four studies.[21,46,150-151]

Of all the studies that included age as a variable in their adjusted logistic regression models, 20 reported that older patients (i.e., ages 60-75) were more likely than younger patients (i.e., 50-60 years) to be current with CRC screening and that rates among the very old age groups (i.e., 76 years or older) were lower than those for younger age groups.[1-2,42,56,107-108,111,114,116,120,122,126,132-133,138,146,156-158,163] Four studies reported no differences in screening for age groups included in their analyses.[106,109,130,166]

Sex. *Study characteristics.* As with the age variable, all studies included this patient variable in their analyses of factors associated with CRC screening. Two, both rated as good quality, focused specifically on this demographic factor (Table 11).[42,133] Both presented national-level findings of self-reported data with all results stratified by gender; one presented findings from the 2002-2003 HINTS[133] and the second presented findings from the 2000 NHIS.[42] Both studies presented findings for respondents 50 year of age or older.[42,133] Both also used the same indicators to assess the outcome of screening (i.e., FOBT in the past year or endoscopy in the past 10 years).[42,133]

Table 11. Studies of the association of sex with CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Considered	Variables Associated with CRC Screening*	Results (95% CI)
McQueen et al., 2006[133] Cross-sectional, national HINTS, 2002-2003, 50+ years N = 2,686 Good	Examine correlates of test use by gender	Any test (endoscopy in the last 10 years or FOBT in the last year) (self-report)	Gender	Age, gender, race, education, number of physician visits in past year, family history of CRC	↑ of FOBT among female No differences by gender for other tests	Females reported slightly higher lifetime (ever) and recent use of FOBT than males (17.1% lifetime and 9.3% recent for female; and 12.1% lifetime and 5.2% recent for male)
Peterson et al., 2007[42] Cross-sectional, national NHIS, 2000, 50+ years N = 11,487 Good	Explore gender differences in use of CRC screening tests and gender-specific correlates of CRC testing	Any test (FS or colonoscopy in the last 10 years or FOBT in the last year)	Gender	Age, gender, ethnicity/ race, education, annual income, insurance type	No gender differences in current CRC screening rates	Females were not less likely than males to be current in testing for CRC (AOR 0.98; 95% CI, 0.88-1.08)

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HINTS, Health Information National Trends Survey; NHIS, National Health Interview Survey.
*Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

Overview of results. Much like the three national studies,[21,46,151] gender was not consistently associated with CRC screening. One study showed that females and males were similar in their current screening rates for any test (37.0 percent and 37.1 percent, respectively),[42] and the other presented findings showing the same patterns of use (66.4 percent for females and 61.8 percent for males).[133] However, these studies did find differences among males and females for specific tests.[42,133] In one study, females were more likely than males to report having completed an

FOBT in the past year (9.3 percent compared to 5.2 percent, respectively); the groups did not differ in endoscopy screening in the past 10 years.[133] The other study found no gender differences in current CRC screening rates.[42]

Of the studies in the patient characteristics section of this review that included this variable in their adjusted logistic regression models, 14 reported an association between gender and CRC screening. Males had higher rates of screening for all tests than females in seven studies;[1,113,126,137,158,163,166] females had higher rates overall than males in three studies;[56,157,169] females were more likely than males to report a recent FOBT than males in two studies;[2,133,138] and males were more likely than females to have had an endoscopy (either colonoscopy or FS) in two studies.[2,114,138] An additional 12 studies with sex as a variable in their final analyses found no differences in CRC screening.[42,55,106-109,111,116,122,132,134,160]

Race. *Study characteristics.* We consider six studies here because they focused specifically on the association between race and CRC screening (Table 12); we rated two as good quality[1,158] and four as fair quality.[114,122,129,150,165] In terms of race, we present only those findings specific to Blacks[1,114,129,150,158,165] or American Indians and Alaska Natives.[122] Studies specific to Asians appear below in ethnicity because we cite findings specific to subgroups of Asians.

Of the six studies considered here, four provided findings for non-Hispanic whites compared with non-Hispanic blacks;[1,114,129,158] one presented findings for whites and all nonwhites;[165] and one compared American Indians living in the Southwest United States with Alaska Natives.[122] Two presented findings from a national sample of respondents;[1,129] two presented findings from several states;[122,150,165] and two presented locally based findings.[114,158] Three studies reported self-reported findings from survey data;[114,122,129] two others presented findings from medical (or Medicare) claims data;[150,158,165] and the sixth presented findings from a combination of 2001-2005 Medical Expenditure Panel Survey (MEPS) and the 2000-2004 NHIS.[1] Those included in the samples were 50 years of age or older,[1,114,122] 50-75 years of age,[158] 65 years of age or older,[129,150] or 70-79 years.[165]

In terms of the screening outcome, there were several different variations of how this was operationalized:

- Three studies defined up-to-date screening as those who reported FOBT in the past year, FS in the past 5 years, or colonoscopy (double-contrast barium enema for one of these) in the past 10 years.[114,129,158]
- One study defined screening as FOBT in the past 2 years or endoscopy at any time;[1]
- One study defined CRC screening as FOBT in the past year, and FS or colonoscopy in the past 5 years, [165]; and
- Another study only included colonoscopy or FS in the past 5 years (excluding FOBT).[122]

Overview of results. All but two of these studies[122,165] gave both unadjusted (AOR age-adjusted only) rates for CRC test usage by various racial groups and rates from multivariable analysis that included factors that are known or thought to be associated with CRC screening. The four studies that compared CRC screening for non-Hispanic whites and either non-Hispanic blacks/Blacks[1,114,129,158] reported inconsistent findings. The two studies based on nationally

Table 12. Studies examining the association between race and CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Jerant et al., 2008[1] Cross-sectional, retrospective, national MEPS, 2001-2005, combined with NHIS, 2000-2004, ≥ 50 years N = 22,973 Good	Examine correlates of screening among all 4 major US racial/ethnic categories (non-Hispanic white, Asian, black, and Hispanic individuals)	FOBT in past 2 years; endoscopy at any time (combined data)	Race (non-Hispanic whites and blacks)	Age, gender, metropolitan statistical area, region, year	No differences based on race	Absolute rates for screening among blacks were 25.5% for FOBT; 38.3% for endoscopy; and 48.2% for the combined tests; among non-Hispanic whites, rates were 25.8%, 49.0, and 57.2%, respectively. Initial analysis (adjusted for demographics) showed blacks to be significantly less likely than non-Hispanic whites to have CRC tests (unadjusted OR 0.72; 95% CI, 0.65-0.80). Further adjustment to the model (i.e., when foreign birth, language spoken at home are taken into account) eliminated these differences.
Christman, et al. 2004[158] Cross-sectional, retrospective, local Community health center, 2002, Florida, 50-75 years N = 1,176 Good	Determine the rate of CRC screening in patients attending a sample of community health centers	Any test (FOBT in past year, FS in past 5 years, colonoscopy or double-contrast barium enema in the previous 10 years) (claims)	Race (Black, white, Hispanic)	Age, gender, marital status, insurance status, access to care Charlson Comorbidity Index, health status, screening behavior	↑ Blacks	Unadjusted rates for CRC screening: 40.1% whites; 51.3% Blacks Blacks were more likely to have been screened for CRC than whites (AOR, 1.38; 95% CI, 1.04-1.84; *P* = 0.03)

Table 12. Studies examining the association between race and CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Fenton et al., 2009[165] Cross-sectional, retrospective, regional Medicare claims data in 9 states, mid-1995 through 2003, 70-79 years N = 60,450 Fair	Assess changes in screening rates among which compared to nonwhite Medicare enrollees	FOBT in past year or FS/colonoscopy in past 5 years	Race (whites, blacks)	Age, sex, rural/urban, income, comorbidity, geographic region	↓ Blacks for colonoscopy No differences based on race for FOBT or FS	Up-to-date screening in whites ranged from 39.4% to 47.3%, while those in blacks ranged from 29.0% to 38.1%. (CI provided in graphic form in manuscript; all statistically significant)
O'Malley, et al., 2005[129] Cross-sectional, retrospective, national MCBS linked to Medicare claims and ARF, 2000, Medicare beneficiaries, 65 years or older N = 9985 Fair	Quantify the size of any racial differences in the receipt of CRC screening among beneficiaries	FOBT in past year, FS in past 5 years, colonoscopy in past 10 years (self-report from MCBS)	Race (white, black)	Age, sex; SES (education, income)	No differences based on race	Unadjusted rates: Whites - 48.2% (95% CI, 46.4-50.0%) Blacks - 39.1% (95% CI, 35.7-42.6%) Racial differences were eliminated after adjustment for SES (i.e., education, income)
Schumacher, et al. 2008[122] Cohort study, several states (Alaska, Southwest United States) Baseline survey, 2004-2007, American Indian/Alaska Natives, 50+ years N = 2,779 Fair	Investigate predictive factors associated with receiving each of the cancer screening tests	Colonoscopy or FS in past 5 years (self-report)	Race (American Indian and Alaska Native)	Age, location, gender, education, family history of cancer, family history of CRC, smoke cigarettes in past 5 years, history of chronic medical condition, language, residency, income, other screening tests	↓ Southwest American Indian compared to Alaska Natives	Overall screening rate was 22% Alaska Natives were more likely to have obtained CRC screening than Southwest American Indians (AOR, 3.86; 95% CI, 2.92-5.10)

Table 12. Studies examining the association between race and CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Thorpe, et al., 2005[114] Cross-sectional/ retrospective, local Community Health Survey, 2003, New York City residents ≥ 50 years N = 3,606 Fair	Examine characteristics of people undergoing screening within guidelines	Any test per guidelines (FOBT within past year, FS in past 5 years, or colonoscopy in past 10 years) or colonoscopy within past 10 years (self-report)	Non-Hispanic whites and Non-Hispanic blacks	Age, race, family and neighborhood income, ethnicity, gender, personal risk factors (i.e., current smoking, physical inactivity), access to care, insurance, regular source of care	↓ non-Hispanic blacks for colonoscopy in past 10 years; no differences for other timely tests	Respondents who were non-Hispanic blacks were less likely than non-Hispanic whites (unadjusted rates) to be up-to-date with CRC screening (52.3%; 95% CI, 48.2-56.4 compared with 60.3; 95% CI, 57.8-62.8, respectively) Adjusted rates showed no differences between non-Hispanic whites and non-Hispanic blacks in screening by any timely screening test (AOR, 0.92; 95% CI, 0.74-1.13) but did show that non-Hispanic blacks were less likely to have received a colonoscopy in the past 10 years when compared with non-Hispanic whites (AOR, 0.72; 95% CI, 0.58-0.91)

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; MEPS, Medical Expenditure Panel Survey; NHIS, National Health Interview Survey; P, probability; MCBS, Medicare Current Beneficiary Survey; ARF, Area Resource File; SES, socioeconomic status.

* Unadjusted rates by race were not provided.

† Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

representative samples found no difference in adjusted screening rates and race;[1,129] one study reported that non-Hispanic blacks were less likely to be screened than non-Hispanic whites[114] and one study reported that Blacks were statistically significantly more likely to be screened for CRC than whites ($P = 0.03$).[158] The study of Medicare claims data in 9 states among 70-79 year olds compared changes in screening over time for whites and blacks. In 1995, 39.4 percent of White enrollees were up-to-date with CRC screening compared with 29 percent of Blacks. In 2003, overall percentages of enrollees up-to-date increased, but disparities between racial groups persisted, with 47.3 percent of Whites up-to-date compared with 38.1 percent of Blacks. The differences were statistically significant between all groups in both 1995 and in 2003.[165]

Additional studies not highlighted here used race as a variable in their final multivariate analysis. One reported that non-Hispanic blacks were more likely than non-Hispanic whites to report being screened;[107] six noted that non-Hispanic whites were more likely than non-Hispanic blacks (or non-whites) to report being current with screening[106,120,128,138,142] or ever screened;[125] and nine reported no differences by race.[42,55,111,119,132,134,147,156-157] Finally, the study giving

findings specific to Southwest American Indians and Alaska Natives found that Alaska Natives were more likely than those in the Southwest United States to report being screened (AOR, 3.86).[122]

Ethnicity - Hispanics. *Study characteristics.* Six studies (7 articles) had the specific aim of examining the relationship between Hispanic ethnicity and CRC screening (Table 13), Of these, we rated two as good quality;[1,141,147] they used self-reported findings from a nationally representative sample collected either through the NHIS in 1998[147] or a combination of the 2000-2004 NHIS and 2001-2005 MEPS.[1,141] The four studies we rated as fair quality included one of 2000 NHIS findings,[111] another of changes from 2000 NHIS compared to 2003 data,[119] one of a trend analysis of 2000 NHIS data compared with 2005 data,[113] and one of respondents living in a local county in 1998-1999 that was reported in two separate articles.[116-117]

Table 13. Studies of the association of Hispanic origin with CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening*	Results (95% CI)†
Goel et al., 2003[147] Cross-sectional, retrospective, national NHIS, 1998, ≥ 50 years N = 32,440 (15% foreign-born) Good	Determine whether foreign birthplace‡ explains some racial/ethnic disparities in cancer screening	FOBT in past year or proctoscopy (as a proxy for FS) in past 5 years (self-report)	Hispanic vs. non-Hispanic white	Age, marital status, geographic region, education, income, health status, comorbidities, body mass index, hospitalizations in prior year, access to care (i.e., insurance status, visits in past year, usual source of care)	↓ Hispanics	Unadjusted screening rates: non-Hispanic whites: 28% FOBT, 30% FS; Hispanics: 18% FOBT, 20% FS; *P*<0.005 Hispanics were less likely than non-Hispanic whites to have been screened for FOBT (AOR, 0.75; 95% CI, 0.59-0.94) or FS (AOR, 0.77; 95% CI, 0.62-0.96) Adjusted for above plus language spoken at home, nativity: AOR, 1.0; 95% CI, 0.85-1.18
Jerant et al., 2008[141] Cross-sectional, retrospective, national MEPS, 2001-2005, combined with NHIS, 2000-2004, ≥ 50 years	Identify independent contributions of basic demo-graphics, socio-economic factors, access barriers, and language-based barriers to	FOBT in past 2 years or endoscopy ever (self-report)	Ethnicity (Mexican, Cuban, Puerto Rican, Dominican) vs. non-Hispanic white	Age, gender, region, year, income, education, insurance, usual source of care, race, ethnicity ethnicity/race, country of origin	↓ Mexican or Dominican After adjustments made for language spoken at home, there were no differences in screening rates.	Total unadjusted screening rates: Non-Hispanic whites: 55.9% Mexican: 35.2% Cuban: 51.0% Puerto Rican: 45.7% Dominican: 28.5% Adjusted for age, gender, region, and year: Mexican: (AOR, 0.46; 95% CI, 0.40-0.53) Puerto Rican: (AOR, 0.65; 95% CI, 0.47-0.91)

Table 13. Studies of the association of Hispanic origin with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening*	Results (95% CI)†
Jerant et al., 2008[141] (continued) N = 22,419 Good	disparities in CRC screening					Dominican: (AOR, 0.30; 95% CI, 0.19-0.45) Adjusted for above plus income and education: Mexican: (AOR, 0.70; 95% CI, 0.60-0.81) Dominican: (AOR, 0.44; 95% CI, 0.28-0.69) Adjusted for above plus insurance, usual source of care, health status: Mexican: (AOR, 0.79; 95% CI, 0.69-0.91) Dominican: (AOR, 0.54; 95% CI, 0.32-0.91)
Shih et al., 2006[119] Cross-sectional, retrospective, national NHIS, 2000 and 2003 CCS, Medicare beneficiaries, 65 years or older N = 6,180 (in 2000); 5,759 (in 2003) Fair	Explore whether changes in Medicare reimbursement for colonoscopy addressed ethnic disparities	Ever received endoscopy	Race/ ethnicity (non-Hispanic whites, Hispanics)	SES variables and access barriers	↓ Hispanics	Unadjusted screening rates were approximately 30% among Hispanics in 2000, with only a slight increase by 2003. Screening among non-Hispanic whites was approximately 45% in 2000, increasing to 50% in 2003 *(findings presented only in a bar chart)*. Odds of screening declined for Hispanics between 2000 and 2003 and the differences between Hispanics and non-Hispanic whites became significant in 2003 (AOR; 0.77; 95% CI, 0.59-0.99; *P* = 0.048).
Thompson et al., 2005[116] Thompson et al., 2006[117] Cross-sectional, retrospective, local Survey in 20 communities Lower Yakima Valley,	Compare CRC screening prevalence and the association between reported barriers and screening participation between Hispanics and non-Hispanic whites	FOBT in past 2 years or endoscopy in past 5 years (self-report)	Hispanics vs. non-Hispanic whites	Age, gender, income, access to health insurance, smoking, residential community	↓ Hispanic for endoscopy in past 5 years No differences for other tests	Unadjusted screening rates: FOBT ever: non-Hispanic whites 55.7%; Hispanics 40.6%; *P* = 0.003 No difference for FOBT in past 2 years Endoscopy ever: non-Hispanic whites 44.4%; Hispanics 26.9%; *P* <0.001 Endoscopy in past 5 years: non-Hispanic whites 33.7%; Hispanics 24.1%; *P* <0.05 Adjusted rates were only significant for endoscopy in

Table 13. Studies of the association of Hispanic origin with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening*	Results (95% CI)†
Thompson et al., 2005[116] Thompson et al., 2006[117] (continued) Washington, 1998-1999, ≥ 50 years n = 1,795 Fair						past 5 years (AOR, 0.52; 95% CI, 0.28–0.98)
Trivers, et al., 2008[113] Cross-sectional, retrospective, national NHIS, 2000 compared with 2005, 50-64 years N = 6,020 in 2000; 6,706 in 2005 Fair	Determine whether progress was made between 2000 and 2005 in reducing CRC screening disparities by race, ethnicity, income, and insurance status	Any test (FOBT within past year, FS or colonoscopy in past 10 years) (self-report)	Hispanic and non-Hispanic	Age, gender, race, ethnicity, poverty ratio, insurance, education, region, years in United States	↓ Hispanic females vs. non-Hispanic female	Unadjusted screening rates: In 2000 among male: 23.6% Hispanics compared with 39.3% for non-Hispanic whites Among female: 28.9% Hispanics compared with 37.7% non-Hispanic whites In 2005 among male: 31.3% Hispanics compared with 45.1% non-Hispanic whites Among female: 27.1% Hispanics compared with 46.3% non-Hispanic whites
Wee, et al., 2004[111] Cross-sectional, retrospective, national NHIS, 2000, 50-75 years N = 11,427 Fair	Examine whether disparities in CRC screening persist in year 2000.	FOBT in past year; FS in past 5 years; or colonoscopy in past 10 years (self-report)	Race/ ethnicity (white, black, Hispanic, other)	Age, race or ethnicity, educational level, region of the country, body weight as classified into standard body mass index categories, family history of CRC, healthcare access, smoking status, illness burden	↓Hispanic	Unadjusted screening rates: Whites FOBT 25%, endoscopy 31%; Hispanics FOBT 15%, endoscopy 19%; *P* <0.001 No difference in screening by endoscopy Adjusted rates with non-Hispanic whites as referent: FOBT: (AOR, 0.7; 95% CI, 0.5-0.9) endoscopy: (AOR, 0.8; 95% CI, 0.6-1.0) either: (AOR, 0.7; 95% CI, 0.6-0.9; all *P* < 0.05)

AOR, adjusted odds ratio; BRFSS, Behavioral Risk Factor Surveillance System; CCS, Cancer Control Supplement; CI, confidence intervals; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; MEPS, Medical Expenditure Panel Survey; NHIS, National Health Interview Survey; P, probability.

* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

† Only adjusted rates that are statistically significant are presented.

‡ Results for acculturation, language, and foreign birth are presented separately below (see acculturation, language, foreign birth).

Studies in this section used either non-Hispanic whites or non-Hispanics (any race) as the comparison group. Three studies used all respondents 50 years of age or older in their sample;[1,116,141,147] one focused on those 50-64 years,[113] another included those 50-75 years,[111] while one study focused on Medicare beneficiaries aged 65 or older.[119]

The definition of the outcomes of being up-to-date with screening varied across the studies and included the following:

- One study defined CRC screening as FOBT in the past year or endoscopy in the past 10 years;[113]
- One study (of the same sample) defined being screened as FOBT in the past 2 years or endoscopy in the past 5 years;[116-117]
- One study defined being screened as FOBT in the past year, FS in the past 5 years, or colonoscopy in past 10 years;[111]
- One study defined being screened as FOBT in the past year and proctoscopy in the past 5 years;[147]
- One study was focused on only screening by endoscopy (ever received);[119]
- One study defined being screened as having an FOBT in the past 2 years and ever having had an endoscopy.[1,141]

We present both unadjusted (or age-adjusted only) rates for CRC test usage by persons of Hispanic ethnicity compared with rates for some other group, as well as rates adjusted by potential confounding variables.

Overview of results. Comparisons of absolute screening rates consistently show that Hispanic ethnicity is associated with lower CRC screening test usage. Overall, adjustment for socioeconomic and health care access factors significantly attenuates, but generally does not eliminate, this disparity. Studies are mixed regarding the relative effect sizes of socioeconomic status and health care access in attenuating these differences. One study that explored the impact of changes in Medicare reimbursement on endoscopy use by different racial and ethnic groups found that, while there were increases in rates among non-Hispanic whites and blacks between 2000 and 2003 (per NHIS data), the difference between non-Hispanic whites and Hispanics in obtaining this test widened during this time period, to a statistically significant gap ($P = 0.048$).[119] One national-level study of both MEPS (2001-2005) and NHIS (2000-2004) data included in this section stratified their analysis by Hispanic subgroup and showed that disparities for persons of Mexican and Dominican origin were greater than for persons of Cuban or Puerto Rican origin.[141] Their findings indicate that respondents of Mexican or Dominican origin are less likely than non-Hispanic whites to be up-to-date with CRC screening (in a model adjusted for demographics and access to care, Mexicans had AOR, 0.70 and Dominicans had AOR, 0.44). However, no differences were found across the Hispanic subgroups once language was incorporated into the model.[141]

Additional studies not examined in detail here presented related findings. Four studies demonstrated that the adjusted rates for screening were lower among Hispanics than non-Hispanic whites;[115,120,126,163] evidence from six other studies suggested that screening rates did not differ among Hispanics.[42,55,107,112,157-158]

Ethnicity - Asians. *Study characteristics*. Because several studies provide findings for different groups of Asians, we present these findings here (Table 14).[1-2,109,118,130] We included five studies, all based on self-reported data that examine screening rates among Asians: two had data for Asians overall,[1-2] and three give data for specific groups of Asians.[109,118,130]

Of the two studies of Asians overall, one rated as good quality reported findings from a combined national dataset of 2001-2005 MEPS and 2000-2004 NHIS'[1] the other, rated as fair

Table 14. Studies of the association of Asian American origin with CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Jerant et al., 2008[1] Cross-sectional, retrospective, national MEPS, 2001-2005, combined with NHIS, 2000-2004, ≥ 50 years N = 22,973 Good	Examine correlates of screening among all 4 major US racial/ethnic categories (non-Hispanic white, Asian, black, and Hispanic individuals)	FOBT in past 2 years; endoscopy at any time	Asians vs. non-Hispanic whites	Age, gender, metropolitan statistical area, region, year	↓ Asians	Unadjusted screening rates: Asians: 14.8% FOBT; 27.5% endoscopy; 33.8% combined FOBT and endoscopy Non-Hispanic whites: 25.8% FOBT; 49.0% endoscopy; 57.2% combined FOBT and endoscopy Adjusted for age, gender, region: AOR, 0.41; 95% CI, 0.33-0.50 Adjusted for above plus income and education: AOR, 0.42; 95% CI, 0.34-0.52 Adjusted for above plus insurance, usual source of care, health status: AOR, 0.44; 95% CI, 0.35-0.55 Adjusted for above plus language spoken at home, nativity: AOR, 0.63; 95% CI, 0.49-0.81
Wong et al., 2005[2] Cross-sectional, retrospective, state California Health Interview Survey, 2001, ≥ 50 years	Factors related to screening rates among Asian Americans compared with non-Latino whites	FOBT in past year or endoscopy in past 10 years, or both (self-report)	Asian Americans (Koreans, Filipinos, Chinese, South Asian, Japanese, and Vietnamese)	Ethnic group, age, gender, education, marital status, household size and income, years in US, comorbidities, English language proficiency,	↓ Filipino for ever having had or being current for endoscopy ↓ Korean for ever having FOBT	Unadjusted screening rates: Ever screened: Any test: 75% non-Hispanic whites compared with a low of 49% for Koreans and a high range of 72% for Japanese Up-to-date screened: Any test: 62% non-Hispanic whites compared with low

Table 14. Studies of the association of Asian American origin with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Wong et al., 2005[2] (continued) N = 1,771 Asian Americans Fair				family history of CRC	↑ Vietnamese for ever having any test and for being up to date with any test but FOBT	range of 41% for Koreans and a high range of 58% among Japanese Adjusted rates showed Koreans were less likely to have ever had an FOBT (AOR, 0.40; 95% CI, 0.25-0.62; *P* < 0.001); and Filipinos were less likely to have ever received an endoscopy (AOR, 0.62; 95% CI, 0.44-0.88) or to be up-to-date for that test (AOR, 0.68; 95% CI, 0.48-0.97; *P* < 0.05) Vietnamese were more likely to have ever had or be up-to-date with any of the tests
Studies for Specific Asian Groups						
Nguyen, 2008[130] Cross, sectional, retrospective, counties in 2 states Vietnamese, 2004, residents of counties in California or Texas, 50-74 years N = 867 Fair	Identify determinants of CRC screening among Vietnamese Americans	FOBT alone, FS alone in past 5 years, FOBT + FS in past 5 years, or colonoscopy in past 10 years (self-report)	Vietnamese Americans	Demographics (age, gender, marital status, years in US, education, employment, insurance, English-language proficiency, income, residence), access (health status, usual source of care, MD ethnicity), knowledge of or attitudes about CRC and screening	No comparison group	Overall, 62% had received any CRC test; 25% were up-to-date on FOBT, 16% were up-to-date on FS, and 23% were up-to-date on colonoscopy

Table 14. Studies of the association of Asian American origin with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Sun et al., 2004[118] Cross-sectional, retrospective, local Chinese Americans, 1999-2000, 3 senior centers in New York City, ≥ 50 years N = 192 Fair	Investigate factors associated with CRC screening among senior Chinese Americans	FOBT only in past year, FOBT + FS in past 5 years, or no test	Chinese Americans	Age, gender, marital status, home owner, citizenship, years at residence, education, income, insurance, employment, family history of CRC, worries or fears, perceived susceptibility, self-efficacy, social influence, intention, efficacy of screening	No comparison group	Overall, 27.9% reported FOBT within past year; 22.2% reported FS
Yip, et al., 2006[109] Cross-sectional, retrospective, local Chinese Americans, 2003-2004, community health center in Seattle, ≥50 years N = 383 Fair	Identify factors associated with CRC screening among Chinese Americans	FOBT in past year, FS in past 5 years and/or colonoscopy in past 10 years (claims)	Chinese Americans	Age, gender, insurance, language spoken	No comparison group	Overall, 39.7% were assessed as being screened for CRC according to guidelines. Of these, 18.9% had completed FOBT in past year, 2.9% completed FS in past 5 years, and 21.3% completed colonoscopy in past 10 years

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; MEPS, Medical Expenditure Panel Survey; N, number; NHIS, National Health Interview Survey.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

quality, presented findings from the 2001 California Health Interview Survey (CHIS).[2] The three studies that present findings for specific subpopulations, all rated as fair quality for this specific variable, do not provide screening rates for the population in question compared with rates for other groups; they collected primarily convenience samples of patients from either communities in two states (California and Texas) with large samples of Vietnamese Americans,[130] senior centers in New York City with relatively large groups of Chinese Americans,[118] and one

community health center in Seattle with a large Chinese American patient population.[109] We include these only in this section because of limits in their samples. All but one of the studies defined their population as those 50 years or older; one focused on those 50-74 years.[130]

The outcome of screening was assessed differently across the studies as follows:

- One study defined being screened as having FOBT in the past year or endoscopy in the past 10 years[2]
- One study defined CRC screening as FOBT in the past 2 years and ever having had an endoscopy[1]
- One study defined being screened as FOBT in the past year, FS in the past 5 years, FOBT with FS in the past 5 years, or colonoscopy in the past 10 years[130]
- One study defined being screened as FOBT in the past year, FOBT with FS in the past 5 years, or no testing[118]
- One study defined CRC screening as FOBT in the past year, FS in the past 5 years, or colonoscopy in the past 10 years.[109]

Overview of results. Comparisons of absolute screening rates consistently show that being of Asian descent is associated with lower CRC screening test usage. Overall, adjustment for socioeconomic and health care access factors significantly attenuates, but generally does not eliminate, this disparity. For the large national study of MEPS and NHIS data, Asians were shown to be less likely than non-Hispanic whites to be current with screening, even when all adjustments were made for demographics, socioeconomic status, access to care, and language.[1] In the other large study that compared different Asian subgroups on screening rates, the findings were mixed, showing that the unadjusted rates of all the Asian groups were consistently lower than those for non-Hispanic whites,[2] Adjustments to the multivariate analysis eliminated these differences for all groups except for endoscopy in Filipinos (AOR, 0.62 for ever use and AOR, 0.68 for up-to-date use) and ever use of FOBT in Koreans (AOR, 0.40).[2] Vietnamese were consistently more likely than non-Hispanic whites to have ever been screened and to be up-to-date with all but FOBT (AOR, range 1.24-1.54; $P < 0.05$); for FOBT, Vietnamese were less likely than non-Hispanic whites to have ever received FOBT (AOR, 0.90; $P < 0.05$), but there were no differences for up-to-date screening by FOBT.[2]

We also found four studies with some related information that demonstrates the inconsistency in findings across studies of Asian use of CRC screening. One reported that Asians were less likely than non-Hispanic whites overall to have been screened;[114] another reported that Asian Americans and Pacific Islanders were less likely than non-Hispanic whites to have received an FOBT,[147] a third reported no difference in screening rates between Asians and non-Hispanic whites,[163] and the fourth found that Vietnamese were just as likely as whites to have had a FOBT in the past year or colonoscopy in past 10 years but were significantly less likely to have received a FS in the past 5 years ($P < 0.05$).[112]

In the three studies that presented findings specific to a subgroup of Asians, one study found that 25 percent of Vietnamese were up-to-date with screening;[130] another study reported that 27.9 percent of Chinese American respondents reported FOBT within the past year and 22.2 percent reported FS;[118] and the third study reported that 39.7 percent of their sample of Chinese Americans were current for CRC screening.[109]

Acculturation. *Study characteristics.* We assessed nine studies in terms of the extent to which acculturation was a factor in predicting CDC screening (Table 15).[1-2,118,120-122,141,147,149,161] By acculturation, we mean three possible indicators: place of birth (i.e., foreign- or US-born), years living in United States, English-language proficiency, or a combination of these. Although

Table 15. Studies of the association between acculturation and CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Afable-Munsuz et al., 2009[149] Cross-sectional, retrospective, national NHIS, 2000, 2003, 2005, Latinos 50 years or older N = 38,347 (2304 Mexicans; 503 Puerto-Ricans; 484 Cubans) Good	Examine the relationship between acculturation and CRC screening among older Mexican, Puerto-Rican, and Cuban adults	FOBT in past year; FS in past 5 years; colonoscopy in past 10 years (self-report)	Acculturation (i.e., US or foreign born; and language preference of interview)	Age, sex, income status, education, insurance, usual source of care, number of chronic diseases	↑ English language proficiency for FOBT ↑ US born for endoscopy among Mexicans ↓ US born for FOBT among Puerto Ricans	English language interview was positively associated with FOBT in past year (AOR, 2.5; 95% CI, 1.1, 5.4) US born among Mexicans was positively associated with endoscopy (AOR, 1.5; 95% 1.1, 2.2) and negatively associated with FOBT among Puerto Ricans (AOR, 0.3; 95% CI, 0.2, 0.7)
Diaz et al., 2008[161] Cross-sectional, retrospective, national BRFSS, 2006, ≥ 50 years N = 99,895 Good	Examine relationship between language and CRC screening among Latinos and non-Latinos	FOBT in past year; endoscopy in past 10 years (self-report)	English-language proficiency (non-Latinos responding to survey in English; Latinos responding in English; Latinos responding in Spanish)	Age, gender, marital status, insurance, geographic region	↑ English-language proficiency	Latinos responding in Spanish were 43% less likely to have obtained CRC screening than non-Latinos (AOR, 0.57; 95% CI, 0.44-0.74) and 36% less likely to have been screened when compared with Latinos responding in English (AOR, 0.64; 95% CI, 0.48-0.84)

Table 15. Studies of the association between acculturation and CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Goel, et al., 2003[147] Cross-sectional, retrospective, national NHIS, 1998, ≥50 years N = 32,440 (15% foreign-born) Good	Determine whether foreign birthplace explains some racial/ethnic disparities in cancer screening	FOBT in past year or proctoscopy (as a proxy for FS) in past 5 years	Foreign-born (born outside US)	Age, marital status, geographic region, education, income, health status, comorbidities, body mass index, hospitalizations in prior year, access to care (insurance status, visits in past year, usual source of care)	No differences for foreign-born respondents once analysis adjusted for access to care	Foreign-born Hispanics and Asian Americans and Pacific Islanders were just as likely as US-both Hispanics and Asian Americans and Pacific Islanders to have been screened by FOBT (AOR, 1.05; 95% CI, 0.68-1.64 for Hispanics; AOR, 0.62; 95% CI, 0.29-1.33 for Asian Americans and Pacific Islanders) or for proctoscopy (AOR, 0.89; 95% CI, 0.59-1.37 for Hispanics; AOR, 0.96; 95% CI, 0.44-2.09 for Asian Americans and Pacific Islanders)
Jerant, et al., 2008[1] Cross-sectional, retrospective, national MEPS, 2001-2005, combined with NHIS, 2000-2004, ≥ 50 years N = 22,973 Good	Examine correlates of screening among all 4 major US racial/ethnic categories (non-Hispanic white, Asian, black, and Hispanic individuals)	FOBT in past 2 years or endoscopy ever	Language spoken at home; foreign- or US-born	Age, sex, metropolitan statistical area (rurality), region of US, income, education, insurance, usual source of care, self-rated health	↑ English-language proficiency ↑ US-born	Respondents who reported speaking English at home were more likely to report being screened than those who did not (AOR, 1.84; 95% CI, 1.52-1.33 for combined screening with FOBT or endoscopy) Those born in the US were also more likely to be screened than those who were not (AOR, 1.16; 95% CI, 1.01-1.33)

Table 15. Studies of the association between acculturation and CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Jerant, et al., 2008[141] (continued) N = 22,419 Good						There were no differences in screening rates among other groups of Hispanics in terms of their reported screening
Shah, 2006[121] National cross sectional survey; NHIS, 2000 Hispanics age 50-80 N = 1,163 Fair	Examine whether low acculturation is a risk factor for underutilization of CRC screening examinations in the Hispanic population	Not having had FOBT (at home) in past year and not having had lower endoscopy in past 5 years	Acculturation (i.e., English language usage) in tertiles: low, moderate, high	Marital status, age, education, income	No difference in screening rates based on language usage	Adjusted rates for not being screened with low English language usage as the referent: Moderate: AOR, 0.92; 95% CI, 0.60-1.42 High: AOR, 0.75; 95% CI, 0.45-1.25
Shih et al., 2008[120] Cross-sectional, retrospective, national NHIS, 2000, ≥ 50 years N = 12,179 Good	Examine factors associated with CRC screening of US- and foreign-born groups	Ever been screened by FOBT or endoscopy (self-report)	Foreign-born by years in US (short = < 10 years; moderate = 10-14 years; long duration = ≥ 15 years)	Age, gender, race/ethnicity, geographic region, urban vs. rural	↓ Foreign-born and living in US ≤ 10 years or ≥ 15 years	Foreign-born respondents living in US ≤10 years were less likely than US-born non-Hispanic whites to be screened for CRC (AOR 0.46; 95% CI, 0.29-0.71), as were foreign-born respondents living in US for 15 years or more (AOR 0.58; 95% CI, 0.51-0.67; $P \leq 0.001$)
Schumacher et al., 2008[122] Cohort study, several states (Alaska, Southwest United States)	Investigate predictive factors associated with receiving each of the cancer screening tests	Colonoscopy or FS in past 5 years (self-report)	English-language proficiency (language spoken at home)	Age, location, gender, education, family history of cancer, family history of CRC, smoke cigarettes in past 5 years, history of chronic	↓ American Indians using native languages at home	Respondents speaking only native languages at home were less likely to have obtained CRC screening than those speaking English at home (AOR, 0.50; 95% CI, 0.33-0.76)

Table 15. Studies of the association between acculturation and CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Schumacher et al., 2008[122] (continued) Baseline survey, 2004-2007, American Indian/Alaska Natives, 50+ years N = 2,779 Fair				medical condition, language, residency, income, other screening tests		Those speaking English and native languages at home were also less likely to have received CRC screening (AOR, 0.65; 95% CI, 0.50-0.85)
Sun et al., 2004[118] Cross-sectional, retrospective, Local Chinese Americans, 1999-2000, 3 senior centers in New York City, ≥ 50 years N = 203 Fair	Investigate factors associated with CRC screening among senior Chinese Americans	FOBT only in past year, FOBT + FS in past 5 years, or no test (claims)	Years of US residency (< 10 years; 10-19 years; ≥ 20 years)	Age, gender, marital status, home owner, ethnicity, years at residence, education, income, insurance, employment, family history of CRC, worries or fears, perceived susceptibility, self-efficacy, social influence, intention, efficacy of screening	↑ Years in US	Years living in US was a predictor of FOBT only (AOR, 0.64; 95% CI, 0.41-0.99; $P < 0.05$); or for either FOBT only or FOBT + FS (AOR, 0.54; 95% CI, 0.64-0.94)
Wong et al., 2005[2] Cross-sectional, retrospective, State California Health Interview Survey, 2001, ≥ 50 years	Factors related to screening rates among Asian Americans compared with non-Latino whites	FOBT in past year or endoscopy in past 10 years, or both (self-report)	Foreign-born and years living in US (< 15 years in the US or ≥ 15 years in US)	Ethnic group, age, gender, education, marital status, household size and income, years in US, comorbidities, English language proficiency, family history of CRC	↓ Living in US for < 15 years	Foreign-born respondents living in US for < 15 years were less likely to have ever received CRC screening (AOR, 0.48; 95% CI, 0.32-0.71) or to be up-to-date with screening (AOR, 0.58; 95% CI, 0.40-0.82)

Table 15. Studies of the association between acculturation and CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Wong et al., 2005[2] (continued) N = 1,771 Asian Americans Fair						

AOR, adjusted odds ratio; BRFSS, Behavioral Risk Factor Surveillance Survey; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; MEPS, Medical Expenditure Panel Survey; NHIS, National Health Interview Survey; US, United States.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

these factors may be important for any race or ethnicity, the studies we consider here examined them specific to non-white Hispanics,[1,121,141,149,161] Asians,[118] or both Hispanics and Asians;[2,147] one study included all racial/ethnic groups by whether or not they were born in the United States;[120] and one focused on American Indians and Alaska Natives.[122] Six of the nine studies are based on nationally representative samples of respondents collected through self-reported survey data.[1,120-121,141,147,149,161] One study was based on self-reported data from across several states,[122] one on data from a state-based survey,[2] and one on locally based claims data from three senior centers in New York City.[118] All but one[121] of the nine studies included those 50 years of age or older in their sample.

The operationalization of CRC screening differed across the nine studies as follows:

- Two studies included those who had FOBT in the past year or endoscopy in the past 10 years among those currently screened;[2,161]
- Two studies defined screening as FOBT in the past year and either FS or protoscopy in the past 5 years;[118,147]
- One study (with varied results described in two articles) defined screening as having FOBT in the past 2 years or ever having had an endoscopy;[1,141]
- One study defined screening as those who had ever had FOBT or endoscopy;[120]
- One study defined screening as having had either colonoscopy or FS in the past 5 years;[122]
- One study defined screening as a FOBT in past year, FS in past 5 years, or colonoscopy in past 10 years; [149] and,
- One study used a lack of screening as their outcome such that those who had no FOBT in the past year or no endoscopy in the past 5 years were considered to be not screened for CRC.[121]

Overview of results. Of the nine studies (reported in 10 articles), four reported findings specific to whether respondents were foreign- or US-born;[2,118,120,147] three examined the

relationship between English-language proficiency and screening;[122,141,161] and three examined both place of birth and English-language proficiency.[1,121,149]

With respect to being foreign-born or years living in the United States, we considered three studies with findings specific to place of birth, three with findings specific to the number of years living in the United States,[2,118,120] and four with information as to whether the respondent reported being born in the United States.[1,120,147,149] For place of birth, two studies found that those born in the US were more likely to have been screened than those who were foreign born[134] (or foreign born were less likely to be screened if living in US 10 years or less[119]), whereas another found no differences in screening based on place of birth once other factors were controlled. [114] Four studies also reported a negative association between number of years living in the United States and being up-to-date with CRC screening.[1-2,118,120,147,149]

Two studies presented findings specific to Asian Americans. In one analysis of a convenience sample of Chinese Americans, as a person's years in the United States increased so did their odds of being screened (AOR, 0.64; $P < 0.05$).[118] Another study based on data collected through the 2001 CHIS reported that Asian Americans living in the United States less than 15 years were less likely to be up-to-date with screening than those living here longer than 15 years (AOR, 0.58).[2]

Two additional studies not included here (because exploring acculturation was not a specific aim of their work) reported that the years of living in the United States made no difference in terms of CRC screening.[114,163]

With respect to English-language proficiency, we considered four studies.[1,121-122,141,161] All but one[150] found an association between this factor and CRC screening. The fourth study used a scale for acculturation that was based on English language usage (e.g., language most often spoken or read, everyday usage via TV, radio); it found no difference in screening rates once findings were adjusted for socioeconomic status and access to care variables.[121] One of these four studies presented findings from American Indian and Alaska Natives across several states that demonstrated an association between CRC screening and either speaking only native languages at home (AOR, 0.50) or speaking a combination of native language and English at home (AOR, 0.65; 95% CI, 0.50-0.85).[122] A similar relationship was found for any respondents of the national study of 2001-2005 MEPS and 2000-2004 NHIS data; speaking English at home was significantly associated with increased CRC screening (AOR, 1.84; 95% CI, 1.52-1.33).[1] Overall, Latinos who were interviewed in Spanish were less likely to report screening than non-Hispanic whites (AOR, 0.57, or more likely to not be screened with AOR of 2.5).[149,161]

Income. *Study characteristics.* Most studies included household income as a potential confounding variable; we highlight two studies, both rated fair quality, here because a primary study aim was to examine the association between income and screening rates (Table 16).[114,123] One study relied on national data from the 2002 BRFSS constructed for metropolitan or micropolitan statistical areas (MMSA) to examine the predictive value of area poverty rates on CRC screening.[123] The other study presented local data collected through a Community Health Survey of New York City residents.[114] Both studies relied on self-reported data from respondents 50 years of age or older.[114,123] One study assessed the outcome of CRC screening by respondent reports of whether they had obtained an FOBT in the past year or a endoscopy in the past 5 years.[123] The other study defined CRC screening as having received FOBT in the past year, FS in the past 5 years, or colonoscopy in the past 10 years.[114]

Overview of results. Similar to the three national overview studies,[21,46,151] both of these studies found an association between income and screening rates; persons with lower incomes were less likely to receive any CRC test, and those with higher incomes were more likely to be screened.[114,123]

Table 16. Studies of the association of income with CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders/ Considered	Variables Associated with CRC Screening*	Results (95% CI)
Shootman et al., 2006[123] Cross-sectional, retrospective, national BRFSS (2002), for 98 MMSA, ≥ 50 years N = 118,000 Fair	Analyze contextual effect of area poverty rate on never having been screened	Any test (FOBT with past year, either FS or colonoscopy in past 5 years (self-report)	MMSA; household income	Gender, age, race/ethnicity	↓ residing in high poverty areas	People residing in low income area were less likely than those in higher income areas to have never received FS/colonoscopy (AOR, 1.10; 95% CI, 1.01-1.19) or FOBT (AOR, 1.19; 95% CI, 1.12-1.27)
Thorpe et al., 2005[114] Cross-sectional/ retrospective, local Community Health Survey, New York City residents ≥ 50 years N = 3,606 Fair	Examine characteristics of people undergoing screening within guidelines	Any test per guidelines (FOBT within past year, FS in past 5 years, or colonoscopy in past 10 years) (self-report)	Personal household income; neighbor-hood income level (% of families ≤ 200% federal poverty level, if 45% or more met this definition, neighbor-hood was identified as low income)	Age, race, ethnicity, gender, personal risk factors (current smoking, physical inactivity), access to care, insurance, regular source of care	↓ Household income < $25,000[c] for any test and for colonoscopy ↓ Neighbor-hood income (medium) for any test	Groups with lowest likelihood of screening were poor (AOR, 0.68 for any test: 95% CI, 0.54-0.85) Living in a medium-income (vs. poor- or high-income) neighborhood made respondents less likely to receive any test (AOR, 0.76; 95% CI, 0.61-0.93)

AOR, adjusted odds ratio; BRFSS, Behavioral Risk Factor Surveillance System; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; MMSA, metropolitan and micropolitan statistical area.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

These studies also add findings at both the neighborhood and MMSA levels by suggesting that even living in lower-income areas predicts CRC screening rates. People residing in low MMSAs were less likely than those in high-income MMSA to receive an endoscopy (AOR 1.10) or FOBT (AOR 1.19);[123] respondents living in a medium-income neighborhood (versus a poor or a high-income neighborhood) were less likely to receive any test (AOR, 0.76).[114]

Of the other studies that included income level as a variable in their final multivariate analysis, 10 found either that persons with low income were less likely than those with high income to receive screening,[1-2,42,107,120,122,126,130,150,156] or that higher-income respondents were more likely than lower-income ones to have obtained screening.[120,150] One study that focused on

exploring racial differences in screening found that controlling for SES (i.e., education, income) in a nationally representative sample of Medicare beneficiaries eliminated any differences in rates. [129] An additional six studies reported no difference in screening rates by income level.[55,108,156-157,160,163]

Insurance status. *Study characteristics.* We include seven studies, one rated as good quality[56] and the rest rated as fair quality, in the highlighted results specific to insurance status[107,113-114,124,138,160] (Table 17). Of these, four are based on national samples of respondents or patients;[56,113,124,138] two are based on state-level samples;[107,160] and one was based on a local sample of New York City residents.[114] All but one study relied on self-reported data; the exception relied on a national sample of Medicare beneficiaries for their analysis.[138] The populations of interest for three studies was those 50 years or age of older;[107,114,160] two studies focused on those ages 50-64 years;[56,113] and two relied on samples of people 65 years or older.[124,138]

In terms of the outcome of screening, definitions varied

- Three studies defined CRC screening as FOBT in the past year, FS in the past 5 years, or colonoscopy in the past 10 years;[107,114,160]
- One defined being screened as having an FOBT in the past year or an endoscopy in the past 10 years;[113]
- One defined the outcome as having had an FOBT in the past 2 years or an endoscopy in the past 5 years;[124]
- One defined being screened as any CRC test in the past year;[138] and
- One defined being screened as having had an FOBT in the past year.[56]

Overview of results. Four of the seven studies compared screening rates according to whether respondents reported having any insurance or no insurance.[56,113-114,160] All four studies reported results similar to those from the three overview studies;[21,46,151] those without insurance were far less likely to report being screened than those with any type of insurance.[56,113-114,160] This relationship remained when data from of national samples of survey respondents in 2000 were compared with those in 2005; females showed no change from 2000 to 2005 in screening rates (AOR, -1.3), and males showed only a slight increase in screening over time (AOR, 3.0).[113]

Other studies also reported similar findings. Generally, for any tests, the uninsured were less likely to be up-to-date with screening than those with some insurance.[2,116,128]
Of the three studies that focused on the association between different types of insurance coverage and CRC screening, one focused on two groups, one comprising "dual" recipients of both Medicare and Medicaid and the other nondual Medicare recipients.[138] Another explored how those with managed care coverage compared with those having other insurance coverage among a Medicare-enrolled population (i.e., 65 years or older),[124] and a third examined these relationships in those 50 years or older.[107] Another study (not in summary table) compared type of insurance among a sample of low-income women residing in Washington, DC and reported (based on self-reports) that those participating in Health Maintenance Organizations (HMO) were more likely than others to be current with screening (AOR, 6.39; 95% CI, 2.05, 19.9 for private HMO; $P < 0.01$).[128]

These studies reported two main results. Persons who are dual recipients were less likely than others to receive any of the CRC tests (i.e., FOBT, FS, colonoscopy);[138] those in a managed care Medicare plan were more likely to be screened per guidelines than those with any other types of insurance (Medicare or otherwise).[107,124]

Table 17. Studies of insurance status as a predictor of CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Cairns et al., 2006[56] Cross-sectional, national HINTS, 2002-2003, 50-64 years N = 1,253 Good	Examine the role of communi-cation factors and insurance on CRC screening.	FOBT within the past year (self-report)	Insurance coverage vs. no coverage	Age, insurance, whether there is a usual provider, gender, race/ethnicity, annual household income, employment, rural vs. urban county, education	↓ uninsured	Uninsured were 64% less likely to be screened than the insured (AOR, 0.36; 95% CI, 0.241–0.536; $P < 0.001$)
de Bosset, et al., 2008[160] Cross-sectional, state BRFSS, 2005, Virginia residents 50 years or older N = 2,887 Fair	Examine whether self-reported insurance coverage was associated with CRC screening	FOBT within past year and/or lower endoscopy within past 5 years (self-report)	Insurance coverage vs. no coverage	Gender, age, education, income, employment, having seen physician in previous year	↓ uninsured males	Insured males were more likely to report CRC screening than uninsured males (AOR, 2.02; 95% CI, 0.96-4.23) For females, there was no effect of insurance coverage (AOR, 0.86; 95% CI; 0.34-1.93)
Koroukin et al., 2006[138] Cross-sectional, national Medicare Denominator File, 1999, ≥ 65 years N = 23 million (2.5 million duals, 20.2 million nonduals) Fair	Assess disparities in CRC screening between elderly dual Medicare-Medicaid enrollees (duals) and non-duals.	Any test code (colonoscopy, FS, FOBT) within the past year (claims)	Insurance status: Medicare dual eligible vs. non dual-eligible	Dual beneficiary status, age, race, sex	↓ dual-eligibles	Use of CRC screening services decrease if dual enrollment in Medicare-Medicaid: FOBT (AOR, 0.48; 95% CI, 0.45-0.51), FS (AOR, 0.55; 95% CI, 0.49-0.61), FS or colonoscopy (AOR, 0.60; 95% CI, 0.54-0.67), colonoscopy (AOR, 0.85; 95% CI, 0.80-0.89)

Table 17. Studies of insurance status as a predictor of CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Schneider et al., 2008[124] Cross-sectional, retrospective, national Medicare Current Beneficiary Survey, 2000, ≥ 65 years N = 10,173 Fair	Assessed whether benefi-ciaries in MMC plans were more likely than those in traditional FFS insurance to receive CRC screening and whether type of insurance was associated with use of specific screening strategies	Any test (2 years for FOBT or 5 years for colonoscopy or FS) (self-report)	Insurance status categories: MMC; FFS SUPP; FFS NO SUPP	Age, gender, race, Hispanic origin, education, marital status, annual income, metro area residency	↑ MMC	MMC (52.9%) was more likely than supplemental insurance groups (FFS SUP) (50.7%, *P* = 0.15) to receive CRC screening, but time-interval appropriateness was similar between groups (no confidence intervals provided) Beneficiaries in MMC were more likely than those in the FFS SUPP group to receive interval-appropriate FOBT (36.3% vs. 32.1%; *P* = 0.013), but less likely to receive an interval-appropriate invasive screening procedure (35.9% vs. 40.8%; *P* < 0.001)
Trivers, et al., 2008[113] Cross-sectional, retrospective, national NHIS, 2000 compared with 2005, 50-64 years N = 6,020 in 2000; 6,706 in 2005 Fair	Determine whether progress was made between 2000 and 2005 in reducing CRC screening disparities by race, ethnicity, income, and insurance status.	Any test (FOBT within past year, FS or colonoscopy in past 10 years) (self-report)	Insurance status categories; public, private, or none	Age, gender, race, ethnicity, poverty ratio, insurance, education, region, years in US	↑ private health insurance	For both males and females with private insurance, there was a significant increase in screening from 2000 to 2005 (change over time for male: OR, 6.7; 95% CI, 3.4-9.9 and for female: OR, 10.0; 95% CI, 7.0-13.0) For females with no insurance, there was no change from 2000 to 2005 in screening rates (AOR, -1.3; 95% CI, -7.1-4.6) and for male, there was only a slight increase in screening over time (AOR, 3.0; 95% CI, -3.9 to 9.8)

Table 17. Studies of insurance status as a predictor of CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Thorpe, et al., 2005[114] Cross-sectional, retrospective, local Community Health Survey, 2003, New York City residents, ≥ 50 years N = 3,606 Fair	Analysis of individual- and neighbor-hood-level factors associated with colon cancer screening practices	Any test (colonoscopy in past 10 years, FOBT in past year, and FS in past 5 years) (self-report)	Insurance status	Age, race, birthplace, gender, education, household income, neighborhood income	↓ uninsured	Any timely CRC screening test: Medicaid or Medicare (AOR 1.02; 95% CI, 0.81-1.28); uninsured (AOR 0.31; 95% CI, 0.20-0.48) Colonoscopy in past 10 years: Medicaid or Medicare (AOR 0.89; 95% CI, 0.71-1.13); uninsured (AOR 0.39; 95% CI, 0.23-0.65)
Zapka et al., 2002[107] Cross-sectional, state Community Health Survey, 1998, Massachusetts residents, ≥ 50 years N = 1,002 Fair	Assess the role of insurance status, type of plan, frequency of preventive health visits, and provider recom-mendation on utilization of CRC screening tests	Any test (colonoscopy or barium enema within 10 years, FS within 5 years, and FOBT in the past year) (self-report)	Insurance status categories: for those 50-64 years-- private (non-HMO); HMO; public, uninsured; For those 65+- non-HMO Medicare; Medicare HMO; duals	Gender, race, education, employment status, income, marital status, family history of CRC, perceived health status	↑Medicare non-HMO participants	Medicare HMO participants were somewhat more likely to be currently tested than Medicare non-HMO participants (AOR, 1.83; 95% CI, 0.91-3.71) There was an interaction between insurance status and respondents who believed their insurance did, or did not pay for CRC tests

AOR, adjusted odds ratio; BRFSS, Behavioral Risk Factor Surveillance System; CI, confidence interval; CRC, colorectal cancer; FFS, fee-for-service; FFS + NO SUPP, fee-for-service Medicare + no supplemental insurance; FFS + SUPP, fee-for-service Medicare + supplemental insurance; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HINTS, Health Information National Trends Survey; HMO, health maintenance organization; MMC, Medicare managed care; N, number; RR, relative risk.
*Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

Overall, 13 additional studies with insurance status as a variable in their final adjusted logistic regressions reported that those who were uninsured were less likely than those insured to report current CRC screening.[1-2,42,111,116,120,126,130,134,146,156-157,163] Three other studies that included insurance status in such analyses found no difference in CRC screening by this variable.[109,132,137]

Access to care. *Study characteristics.* Access to care is defined in most studies as having a usual (or regular) source of care and visiting that provider at least once within the past year. Most studies included these variables as control or potential confounding variables; here we present

more detailed information on four studies that specifically highlighted the relationship between access-to-care variables and CRC screening (Table 18).[108,133-134,163]

One study, rated as good quality, based results on the 2002-2003 HINTS;[133] the others, all rated as fair quality, presented either regional[134,170] or state-level findings.[163] All four studies

Table 18. Studies of the association of access to care with CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Considered	Variables Associated with CRC Screening*	Results (95% CI)
McQueen et al., 2006[133] Cross-sectional, national HINTS, 2002-2003, 50+ years N = 2,686 Good	Examine correlates of test use by gender	Any test (endoscopy in the last 10 years or FOBT in the last year) (self-report)	Number of physician visits in past year; having a usual source of care	Demographics, access, health status, health behaviors	↑ Visit physician regularly ↓ No usual source of care	Those who had visited a physician 1 or more times in the previous year were more likely to be screened by endoscopy than those with no visits in the prior year (AOR 5.12; 95% CI, 2.54-10.29 for males and OR 4.89; 95% CI, 1.79-13.37 for females; $P < 0.05$) "Not having a doctor" was associated with not being screened for CRC in both males (AOR, 0.1; 95% CI, 0.0-0.5 for FOBT and OR, 0.5; 95% CI, 0.1-1.9 for endoscopy) and females (AOR, 0.2; 95% CI, 0.1-0.8 for FOBT and OR, 0.5; 95% CI, 0.2-1.4 for endoscopy)

Table 18. Studies of the association of access to care with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Considered	Variables Associated with CRC Screening*	Results (95% CI)
Etzioni et al., 2004[163] Cross-sectional, state CHIS, 2001, 50+ years N = 22,343 Fair	Examine individual-level variables associated with screening	Any test (FOBT within past year, FS or colonoscopy in past 5 years) (self-report)	Access to care combined as a composite of insurance status with whether respondent reported a usual source of care. Insurance categories included: < 65 years: employer-based, private/self-purchased, public, uninsured 65+ years: Medicare + supplement, Duals, Medicare only, uninsured; Number of physician visits in past year	Age, gender, race, marital status, income, education, self-reported health status, number of visits to physician in last 12 months, percent of life lived in the US, English proficiency	↓ Uninsured individuals with and without a usual source of care ↑ Number of physician visits	Uninsured respondents with usual source of care were less likely to receive CRC testing than those in any of the other insurance categories with usual source of care (RR, 0.61; 95% CI, 0.53-0.69 for 50-64 years; RR, 0.62; 95% CI, 0.37-0.92 for 65+) Uninsured with no usual source of care were less likely to be screened than any of the other groups of individuals (RR, 0.32; 95% CI, 0.23-0.43 for 50-64; RR, 0.08; 95% CI, 0.00-1.21 for 65+) Respondents who reported visiting a physician 1 or more times in past year were more likely to report being current with screening (RR range 1.41-1.77)

Table 18. Studies of the association of access to care with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Considered	Variables Associated with CRC Screening*	Results (95% CI)
Matthews et al., 2007[134] Cross-sectional, regional Survey administered to 5-county region in Midwest, 2005, 50-79 years N = 1,033 Fair	Identify indicators of up-to-date CRC screening	FOBT within past year, FS in past 5 years, or colonoscopy in past 10 years (self-report)	Regular physician visits	Gender, age, race, education	↑ Visit physician regularly	Respondents who reported visiting a physician regularly were more likely to report being current with screening (AOR 2.02; 95% CI, 1.49-2.74)
Young et al., 2007[108] Cross-sectional, regional RDD survey, residents in eastern Colorado, 2005, 50 years or older N = 1,005 (weighted sample) Fair	Identify variables Associated with screening	Any CRC test (FOBT in past year, FS or double-contrast barium enema in past 5 years, colonoscopy in past 10 years)	Saw a doctor or other health care provider in past year; geographic proximity to a facility that offers testing	Age, gender, race/ethnicity, marital status, education, employment, income, patient request for screening, perceived risk, family history	↑ Visit with provider in past year No difference based on proximity to health facility	Respondents who reported visiting a doctor or other health provider in past year were more likely to be up-to-date on CRC screening than others (AOR, 1.29; 95% CI, 1.21-1.38) Up-to-date screening for those living in an area with a health care facility were no different than those without a health facility (range of *P* values = 0.38-0.78)

CHIS, California Health Interview Survey; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; HINTS, Health Information National Trends Survey; OR, odds ratio; RDD, random digital dialing; RR, relative risk.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

relied on self-reported data for their analysis.[108,133-134,163] The two regional studies relied on survey data collected in 2005 from a five-county region in the Midwest[134] or data collected in 2005 across a region in the state of Colorado.[108] The state-based study used CHIS data.[163] One study included respondents ages 50-79 years;[134] the other three included those 50 years or older.[108,133,163]

To assess the CRC screening outcome, two studies used FOBT in the past year or endoscopy in the past 10 years,[108,133] one study defined CRC screening as having obtained FOBT within the past year or endoscopy in the past 5 years,[163] and the fourth defined the outcome as FOBT in the past year, FS in the past 5 years, or colonoscopy in the past 10 years.[134]

Overview of results. As with the three overview studies,[21,46,151] usual source of care predicted CRC screening for both a study of multiple factors influencing screening in a national sample[133] and a state-based study of the relationship between screening and having a usual source of care combined with insurance status.[163] The national study found that not having a usual source of care was associated with not being screened among both males and females (AOR range, 0.1-0.5).[133] In the state-based study, uninsured respondents with no usual source of care were less likely to be screened than any of the other groups of individuals in their sample (RR, 0.32 for 50-64; RR, 0.08 for 65+).[163]

Several other studies found similar results: usual source of care was consistently associated with higher rates of CRC screening.[1-2,42,56,107-108,111,120,128,130,157] A recently published study of the 2004 BRFSS also reported a strong association between screening and having at least 1 personal health care provider (AOR, 3.95; 95% CI, 2.58-4.41).[155] Another study reported no difference in CRC screening and having a regular provider.[124]

Similar to the three overview studies,[21,46,151] other included studies consistently reported a strong association between the frequency of visits to a physician and CRC screening. Authors of the national study reported that one or more physician visits in the prior year was associated with endoscopic screening (5.12; 2.54-10.29 for males and 4.89; 1.79-13.37 for females; $P < 0.05$).[133] The three other studies also found that the number of physician visits was strongly associated with CRC screening. Seven other studies in this review reported the same association.[2,55,107,126,132,137,158,166]

Personal health and risk factors. *Study characteristics.* A total of nine studies, all of which we rated as fair quality, are included in the summary table (Table 19) for personal health or risk factors associated with CRC screening.[55,108,114,126,132,137,145,157,166] Personal health factors are characteristics from the person's family history or personal health history (e.g., family CRC diagnosis, personal prior polyp removal, screening behavior with regard to other cancers, general health status) that would place them at increased risk for CRC and/or may be related to healthy behaviors that could influence the extent to which they obtain regular CRC screenings. Risk factors for health problems possibly related to CRC screening include smoking, sedentary lifestyle, poor eating habits, obesity, and any factor that may place a person at increased risk for developing CRC.

For this set of variables, we have included one study that specifically evaluated the association between CRC screening and family history of CRC,[108] two studies that included other cancer screenings,[137,157] one study specific to general health status,[55] and five studies specific to risk factors (i.e., obesity/overweight, smoking, or physical inactivity).[114,126,132,145,166] Eight studies relied on cross-sectional, retrospective data collected through a survey, including four of which were based on national samples;[55,126,145,157] two were based on state samples;[132,137] one reported on a regional sample;[108] and one focused on a city-based or local sample.[114] The remaining study presented findings from medical chart reviews of 22 primary care provider (PCP) practices in the states of New Jersey and Pennsylvania.[166]

Table 19. Studies of the association of personal health/risk factors with CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders Considered	Variables Associated with CRC Screening*	Results (95% CI)
Family History of CRC						
Young et al., 2007[108] Cross-sectional, regional RDD survey, residents in eastern Colorado, 2005, ≥ 50 years N = 1,005 (weighted sample) Fair	Identify variables associated with screening	Any CRC test (FOBT in past year, FS or double-contrast barium enema in past 5 years, colonoscopy in past 10 years)	Family history of CRC	Age, gender, race/ethnicity, marital status, education, employment, income, last MD visit, patient request for screening, perceived risk, residence by zip code	↑ Family history of CRC	Respondents with a family history of CRC were more likely than others to have received colonoscopy (AOR, 2.61; 95% CI, 1.86-3.68) and be up to date on any CRC test (AOR, 1.74; 95% CI, 1.20-2.53)
Other Cancer Screenings						
Carlos et al., 2005[157] Cross-sectional, national BRFSS, 2001, females ≥ 50 years N = 52,478 Fair	Understand screening behaviors among female	FOBT within past year, FS or colonoscopy in past 5 years (self-report)	Mammogram (within past year) and Pap smear (within past year)	Age, race, educational level, employment status, income, self-reported general health, smoking, health insurance, personal doctor	↑ regular Pap smear and mammogram ↓ Preceived 'good' health status	Increased screening rates with females who reported adherence to mammograms (AOR, 2.42; $P < 0.01$) and Pap smears (AOR, 1.70; $P < 0.01$) Females who perceived their health as good were less likely to adhere to CRC screening than other females (AOR, 0.79; 95% CI, 0.66-0.93; $P < 0.01$)

Table 19. Studies of the association of personal health/risk factors with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders Considered	Variables Associated with CRC Screening*	Results (95% CI)
Lemon et al., 2001[137] Cross-sectional, retrospec-tive, state level State-based telephone survey of residents 1998, ≥ 50 years N = 954 Fair	Examine relationship of personal characteristics, health and lifestyle behaviors, and cancer screening practices to current CRC screening	FOBT in past year, FS in past 5 years, colonoscopy in past 10 years, or double-contrast barium enema in past 10 years (self-report)	Mammogram (within past year) for female; PSA (within past year) for male; smoking (never, former, or current); use of any type of vitamin supplements, family history of CRC	Gender, education, insurance status, checkup at least every year	↑ Other cancer screening behavior for males and female	Males and females who were currently screened for PSA or mammography, respectively, were more likely to report being up-to-date with CRC screening (AOR, 4.40; 95% CI, 2.94-6.58; *P* < 0.001)
General Health Status						
Berkowitz et al., 2008[55] Cross-sectional, retrospective, national HINTS (2003) respondents 65-89 years old N = 1,148 Fair	Assess beliefs and perceptions of risk about CRC and gaps in knowledge about screening in adults ages 65-89 years	FOBT (within past year) or, FS or colonoscopy in past 10 years (self-report)	General health status (excellent, very good, good, fair, poor)	Gender, race, income, education, marital status, family history of CRC, health status, regular source of care, annual MD visits, knowledge about CRC and testing, beliefs about CRC, perceived risk	No statistically significant difference based on perceived health status	People who perceived their health to be excellent or very good were no more or less likely to be up-to-date with CRC screening than those who are in fair or poor health (*P* = 0.11)

Table 19. Studies of the association of personal health/risk factors with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders Considered	Variables Associated with CRC Screening*	Results (95% CI)
Risk Factors (Obesity, smoking, physical inactivity)						
Heo et al., 2004[145] Cross-sectional/ retrospec-tive, national BRFSS, 2001, ≥ 50 years N = 84,284 Fair	Estimate the association between body mass index and CRC screening	FOBT in past year or FS in past 5 years (self-report)	5 body mass index-defined categories: Normal weight = 18.5- < 25 Overweight = 25- < 30 Obesity Class I = 30 - < 35 Obesity Class II = 35 - < 40 Obesity Class III = ≥ 40	Age, education, race, income, general health status, smoking, employment, health insurance	↑ Obesity for FS screening No differences by obesity for FOBT	Body mass index was not associated with obtaining an FOBT (AORs ranged from 0.90-0.98) Compared with normal weight adults, those who were overweight (AOR, 1.15; 95% CI, 1.02-1.31); in the obesity class I (1.21, 95% CI, 1.09-1.35), II (1.17; 95% CI, 1.04-1.44); and III (1.27; 95% CI, 1.05-1.58) were more likely to have obtained a screening FS within the past 5 years ($P < 0.05$)
Rosen and Schneider, 2004[126] Cross-sectional, retrospec-tive, national BRFSS, 1999, 51-80 years N = 52,886 Fair	Evaluate whether association exists between body mass index and CRC screening	FOBT in past year or endoscopy in past 10 years (self-report)	Normal weight (body mass index = 18.5-24.9); Overweight (25.0-29.9); Obese (30.0-34.9); Morbidly obese (≥ 35)	Age, gender, ethnicity, education, marital status, income, census region, self-reported health status, smoking status, time since last checkup, insurance status	↓ Morbidly obese females for FOBT or endoscopy	Morbidly obese females were less likely than females with a normal body mass index to receive CRC screening (AOR, -5.6; 95% CI, -2.6 to -8.5). There were no obesity-related disparities in screening rates for males

Table 19. Studies of the association of personal health/risk factors with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders Considered	Variables Associated with CRC Screening*	Results (95% CI)
Ferrante et al., 2006[166] Cross-sections, retrospec-tive, 22 PCP practices Chart reviews in 22 PCP practices in New Jersey and Pennsylvania, 2003-2004, ≥ 50 N = 1,297 Fair	Examine whether obesity is associated with lower rates of CRC screening	FOBT within past year, FS or double-contrast barium enema in past 5 years, colonoscopy in past 10 years (claims)	Obesity (body mass index ≥ 30 kg/m^2) compared with non-obese	Age, gender, number of comorbidities, number of visits in past 2 years, number of years attending practice	↓ Obese for any CRC test	Obese patients had 25% decreased odds of being screened for CRC compared with nonobese patients (AOR, 0.75; 95% CI, 0.62-0.91; *P* = 0.004)
Maleis et al., 2006[132] Cross-sectional/ retrospective, state Maryland Cancer Survey, 2002, ≥ 50 years N = 3,436 Fair	Determine whether overweight or obese adults ages 50 years or older are up-to-date with CRC screening	FOBT within past year, FS in past 5 years or colonoscopy in past 10 years (self-report)	Normal or under-weight (body mass index < 25); overweight (body mass index 25-29.9); obese (body mass index ≥ 30)	Age, race, gender, marital status, education, employment, geographic area, health insurance status, having had a physical examination in past 2 years, CRC screening recommend-dations	No statistically significant difference based on weight	Overweight people had similar odds of being up-to-date with CRC screening as normal or underweight people (AOR, 1.05; 95% CI, 0.83-1.33) Obese people had slightly lower, though statistically insignificant, odds of screening (AOR, 0.84; 95% CI, 0.65-1.09)

Table 19. Studies of the association of personal health/risk factors with CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review	Predictors Examined	Potential Confounders Considered	Variables Associated with CRC Screening*	Results (95% CI)
Thorpe et al., 2005[114] Cross-sectional/ retrospec-tive, local Community Health Survey, New York City residents, 2003, ≥ 50 years N = 3,606 Fair	Examine characteristics of people undergoing screening within guidelines	FOBT within past year, FS in past 5 years, or colonoscopy in past 10 years (self-report)	Current smoking (nonsmoker or current); physical activity (some activity or none)	Age, race, family and neighborhood income, ethnicity, gender, personal risk factors (current smoking, physical inactivity), access to care, insurance, regular source of care	↓ Current smoker ↓ physically inactive	Current smokers (AOR, 0.62; 95% CI, 0.49-0.78) and residents who reported being physically inactive (AOR, 0.74; 95% CI, 0.63-0.88) were less likely to be current on CRC screening (*P* NR)

AOR, adjusted odds ratio; BRFSS, Behavioral Risk Factor Surveillance System; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HINTS, Health Information National Trends Survey; N, number; P, probability; PCP, primary care physician; PSA, prostate-specific antigen; RDD, random digital dialing.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

All but two studies included respondents 50 years of age or older in their samples; persons 65-89 years were in one study,[55] and persons 51-80 years in the other.[126]

Studies defined outcomes of CRC screening differently, as follows:

- Two studies considered a respondent to be screened if they reported an FOBT in the past year or endoscopy (i.e., FS or colonoscopy) in the past 5 years;[145,157]
- Two studies defined the outcome of interest as FOBT in the past year or endoscopy in the past 10 years;[55,126]
- Four studies defined screening as FOBT in past year, FS or double-contrast barium enema in past 5 years, or colonoscopy in past 10 years;[108,114,132,166]
- One study defined it as FOBT in past year, FS or double-contrast barium enema in the past 5 years, or colonoscopy in the past 10 years.[137]

Overview of results. We have divided our overview of results into two groups. Presented first are health factors such as having a family history of CRC, participating in other healthy practices like being screened for other cancers, and general health status in relation to screening. This is followed by information on risk factors such as obesity, smoking, and sedentary lifestyle. With respect to family history of CRC, findings are generally consistent with those from the three overview studies:[21,46,151] having a family history of CRC was associated with a higher likelihood of obtaining CRC screening. One study using regional, self-reported findings yielded

data showing that that those with a family history of CRC were more likely than others to be up-to-date with CRC screening in general (AOR, 1.74) and for colonoscopy (AOR, 2.61).[108]

Several other studies reported similar findings supporting a strong association between family history and screening for CRC.[2,55,122,134,137,142,158] Only one study reported that subjects with a family history of CRC were not more likely to be screened for CRC (AOR, 0.85; $P = 0.43$).[55] Five additional studies reported an association between family CRC history and screening rates in their final multivariate analysis.[2,42,107,122,134,158]

Two studies showed that, among both males and females, obtaining regular screening for other cancers was associated with CRC screening; this is consistent with the three overview studies.[21,46,151] The 1998 study that examined screening among males and females found that other cancer screening, including mammogram or prostate specific antigen (PSA) testing, was significantly associated with CRC screening (AOR, 4.40; $P < 0.001$).[137] Another, which used 2001 BRFSS data, reported that subjects up to date for mammograms and Pap smears were more likely than those no up to date to be screened for CRC (AOR 2.42 for mammograms and AOR 1.70 for Pap smears; $P < 0.01$ for both).[157] Other studies included in this report support the positive association of other cancer screening behavior with CRC screening.[42,108,122-123,133-134,156,158]

With respect to other healthy behaviors, one study that reported an association between vitamin supplement use and CRC screening (AOR, 1.87).[137]

For general health status, a few studies examined the association between perceived health status and CRC screening, as did the three overview studies,[21,46,151] but overall findings are inconsistent. The study based on the 2003 HINTS national survey showed no association between perceived general health and CRC screening ($P = 0.11$).[55] Another study reported that females who perceived their health as good were less likely to adhere to CRC screening than those perceiving their health to be fair or poor (AOR, 0.79; $P < 0.01$).[157] Another study presented related factors, including a number of chronic illnesses and Charlson scores (i.e., a weighted index of 19 selected categories of disease found to be associated with mortality and other important health outcomes, in which a higher scores equates with worse health) obtained through medical record review. This group reported that patients with more illnesses were more likely to be screened (AOR, 1.12; $P < 0.0001$) but that those with higher Charlson scores were less likely to be screened (AOR, 0.84; $P = 0.0001$).[158]

Six other studies not presented in this section but that included perceived health in their final multivariate analysis also found that those with more positive perceptions of their health (i.e., excellent, very good, good) were less likely to report current CRC screening than those with lower or less positive perceived health,[1,107,111,120,134,157] another study reported the opposite results such that those with perceived good health were more likely to be screened.[163] Another study found no association between perceived health and screening behavior.[2]

In terms of obesity, four studies reflected inconsistencies about the association of weight with CRC screening.[126,132,145,166] One study using data from 84,284 subjects from the 2001 BRFSS classified patients into five body mass index categories and found that no association between body mass index and FOBT completion.[145] For this study, the authors did find that overweight or obese males were more likely to have obtained FS within the past year compared to females ($P < 0.05$).[145] Another study based on 1999 BRFSS data found only an association between CRC screening for morbidly obese females and no differences for any other body mass index category in comparisons with respondents of normal weight (AOR, -5.6).[126] Another study used data from the Maryland Cancer Survey and found that overweight and obese people had odds of being up-to-date with CRC screening similar to those for people of normal weight (AOR, 1.05 and AOR, 0.84, respectively).[132] In the fourth study, obese patients in primary care provider practices were

less likely than normal-weight patients to be screened for CRC (AOR, 0.75; $P = 0.004$).[166] Another study (not included in summary table) explored the relationship between BMI and CRC screening in American Indian and Alaskan Native men and found no association between these two variables in a nationally representative survey conducted in 2004-2005.[131] Yet another study found that persons who were categorized as overweight were slightly more likely to have received an endoscopy and/or FOBT (RR, 1.2 and 1.1, respectively, $P < 0.05$).[111]

With respect to smoking and sedentary lifestyle (i.e., physical inactivity), one study reported findings from a community survey of New York city residents;[114] current smokers (AOR, 0.62) and residents who reported being physically inactive (AOR, 0.74) were less likely (than various comparison groups) to be current on CRC screening.[114] Similarly, another study reported that current smokers were less likely to be screened by endoscopy (AOR, 0.13; $P = 0.009$).[106] Both studies support the findings from the three overview studies, which found that current smokers were less likely to be screened for CRC than those who had never or were former smokers.[21,46,151]

Four other studies (omitted in Table 19 because their analysis focused on other patient characteristics and CRC screening) supported the three overview studies in reporting that current smokers were less likely than former or never smokers to report being screened.[115,122,126,157] One study reported no difference in smoking status and CRC screening.[116]

Psychosocial factors. *Study characteristics.* Another topic addressed by several studies is the extent to which psychosocial factors (i.e., knowledge, attitudes, beliefs, or perceptions about cancer and/or screening) may predict CRC screening behavior. As previously noted, two of the overview studies[21,46] presented findings related to some psychosocial factors; both found that knowledge of screening tests were predictors for screening.

Table 20 presents summary information for the five studies involving the association between these factors and CRC screening; all involved self-reported responses from survey data influencing screening.[55,106,133-134,144] Two national studies were based on HINTS data collected from the fall 2002 through spring 2003.[55,133] Another study collected data from a sample residing in a five-county region of the Midwest;[134] another study collected data locally from patients using three neighborhood clinics;[106] while the remaining study collected data from Japanese Americans residing in the Greater New York region.[144]The ages of respondents in the five studies differed: two studies collected data from those 50 years or older,[133,144] another study used data from those 51 years or older;[106] a third presented findings on those 65 to 80 years of age;[55] and the remaining study presented findings specific to those ages 50-79 years.[134]

Three different definitions of screening were used to determine whether respondents were up-to-date: two studies used the definition that an FOBT had been obtained within the past year and FS or colonoscopy within the past 10 years;[55,133] two studies defined being screened as reporting an FOBT in the past year, FS in the past 5 years, or colonoscopy in the past 10 years;[134,144] and one focused on endoscopy screening (i.e., FS in the past 5 years or colonoscopy in the past 10 years).[106]

Overview of results. Various authors have tended to define psychosocial factors somewhat differently; we divide the discussion of these factors into the four categories of knowledge, attitudes, perceptions, and beliefs. Table 21 summarizes the items included in each survey analysis of the studies in this section. In terms of knowledge or awareness of CRC or the available tests, two studies presented findings about whether respondents reported: (1) understanding the appropriate intervals of testing,[133] (2) being aware of the types or numbers of tests available,[55] and (3) knowing the expense of each test.[133]

Table 20. Studies of the association between psychosocial factors and CRC screening

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
McQueen et al., 2006[133] Cross-sectional, retrospective, national HINTS, 2002-2003, ≥ 50 years N = 2,686 Good	Examine correlates of test use by gender	Any test (endoscopy in the last 10 years or FOBT in the last year) (self-report)	Perceived risk to CRC; beliefs about testing (i.e., fear of finding cancer; getting tests is too expensive) or knowledge of testing (i.e., time intervals of tests)	Demographics, access, health status, health behaviors	↑ Understood appropriate time intervals for tests ↑ Fear of finding cancer with test; perceived risk to CRC for females ↓ Did not know if tests are too expensive for endoscopy ↓ Did not know costs or believed too expensive for FOBT	Males and females were more likely to be screened if they understood the appropriate time intervals for FOBT (AOR, 5.42; 95% CI, 2.52-11.66 for males and AOR, 5.25; 95% CI, 3.23-8.52 for female) and endoscopy (AOR, 4.69; 95% CI, 2.55-8.65 and AOR, 3.18; 95% CI, 2.26-4.47, respectively) Females were more likely to be screened if they believed they were more likely than others to be diagnosed with CRC (AOR, 2.53; 95% CI, 1.43-4.46 for endoscopy); if they believed CRC testing leads to early detection (AOR, 3.03; 95% CI, 1.03-8.93 for FOBT); or if they had a fear of finding cancer (AOR, 1.78; 95% CI, 1.18-2.68)

Table 20. Studies of the association between psychosocial factors and CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
McQueen et al., 2006[133] (continued)						Males and females were less likely to be screened if they didn't know if the tests were too expensive (0.43; 95% CI, 0.24-0.78 and 0.46; 95% CI, 0.30-0.71 for endoscopy, respectively) Females were also less likely to be screened with FOBT if they believed it was too expensive (AOR, 0.55; 95% CI, 0.32-0.93) or didn't know the costs (AOR, 0.46; 95% CI, 0.27-0.79) All *P* values < 0.05
Berkowitz et al., 2008[55] Cross-sectional, retrospective, national HINTS, 2003, 65-89 years N = 1,148 Fair	Assess beliefs and perceptions of risk about CRC and gaps in knowledge about screening in adults ages 65-89 years	FOBT (within past year) or, FS or colonoscopy in past 10 years (self-report)	Beliefs about testing (i.e., arranging to be checked is easy; fear of finding cancer; getting checked increased odds of getting cancer; getting tests is too expensive) or knowledge of testing (i.e., age of likely onset; number of available tests)	Gender, race, income, education, marital status, family history of CRC, health status, regular source of care, annual MD visits, knowledge about CRC and testing, beliefs about CRC, perceived risk	↓ Beliefs of lack of ease of testing and tests being too expensive; lack of knowledge of available tests	Respondents who believed that it is not easy to arrange to be tested (AOR, 0.47; 95% CI, 0.25-0.91) or that the tests are too expensive (AOR, of disagreeing with test being too expensive = 1.25; 95% CI, 0.80-1.97); or had a lack of knowledge about the number of available tests (AOR, 0.28; 95% CI, 0.19-0.42) were less likely to report being screened *P* values at 0.03 or better

Table 20. Studies of the association between psychosocial factors and CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Honda and Singer, 2006[144] Cross-sectional, retrospective, regional Survey administered by phone in the Greater NY region (NY, NJ, CT), Japanese Americans 50 years or older N = 341 Fair	To develop and test a model to explain factors related to CRC screening adherence among Japanese Americans	FOBT in past year; FS in past 5 years; or colonoscopy in past 10 years (self-report)	Emotional family and friend support (family's and friends' concern for and understanding of you, reliance on family/friends)	Age, income, education, acculturation, marital status, and insurance	↑ Emotional family support indirectly related to adherence ↑ Emotional friend support directly related to adherence	Emotional friend support had direct impacts on adherence (γ = 0.15); emotional family support was indirectly related to adherence via increased subjective norms among family and friends (γ = 0.12).
Matthews et al., 2007[134] Cross-sectional, retrospective, regional Survey administered to 5-county region in Midwest, 2005, 50-79 years N = 1,033 Fair	Identify indicators of up-to-date CRC screening	FOBT within past year, FS in past 5 years, or colonoscopy in past 10 years (self-report)	Perceived beliefs (i.e., CRC tests are safe; if healthy, no need to test; irresponsible not to test); or attitudes (i.e., anxiety about tests; positive attitude toward screening in general)	Gender, age, race, education	↑ Belief that tests are safe; irresponsible not to test; positive attitude about cancer screening ↓ Anxiety about tests; and belief that if healthy, no need to test	Respondents were more likely to be screened if they believed the tests are safe (AOR, 1.39; 95% CI, 1.09-1.78); that it's irresponsible not to get tested (AOR, 2.16; 95% CI, 1.67-2.78); or had a positive attitude about screening in general (AOR, 2.35; 95% CI, 1.76-3.13) Respondents were less likely to be screened if they had anxiety about the tests (AOR, 0.50; 95% CI, 0.49-0.64) or believed that if they are healthy, they don't need to be tested (AOR,

Table 20. Studies of the association between psychosocial factors and CRC screening (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Modifiers Reported	Variables Associated with CRC Screening	Results (95% CI)
Matthews et al., 2007[134] (continued)						0.58; 95% CI, 0.42-0.79) *P* values are all 0.05 or better
Zimmerman et al., 2006[106] Cross-sectional, retrospective, local Survey administered in 3 clinics, 2003, > 50 years N = 325 Fair	Identify determinants of patient-reported receipt of CRC screening	FS in past 5 years, colonoscopy in past 10 years, or both (FOBT not included) (self-report)	Barriers to endoscopy (perceived inconvenience or trouble; unpleasantness of test)	Age, race	↓ Perceived barriers for endoscopy	People who reported barriers to endoscopy were less likely than those who did not to be screened by endoscopy (AOR, 0.33; 95% CI, 0.18-0.60; *P* < 0.0001) Perceived social support for CRC screening was not associated with screening

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; HINTS, Health Information National Trends Survey; MD, medical doctor; γ, gamma.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

Table 21. Types of factors and descriptions of variables used in selected studies to examine the influence of psychosocial factors on CRC screening

Types of Psychosocial Factors Used in Selected Studies	Knowledge	Attitudes	Perceptions	Beliefs
Description of Variables Used	• Understood time intervals for taking test[133] • Does not know if test is expensive or what the cost is[133] • Knows tests that are available[55]	• Positive attitude toward cancer screening[134] • Has anxiety about test[134] • Fearful of finding cancer[133]	• Perceived barriers to screening[106] • Perceived social support to get testing[106,144] • Perceived risk/susceptibility to CRC[133,144]	• Believes: • Tests are safe[134] • Irresponsible not to test[134] • If healthy, no need to be tested[134] • Tests lead to early detection[133] • Not easy to arrange to be tested[55]

CRC, colorectal cancer.

One national study using the 2002-2003 HINTS reported that both males and females were statistically more likely to be screened if they understood the appropriate time intervals of both the FOBT and endoscopy (AOR, range 4.69-5.42 for males and 3.18 and 5.25 for females; all *P* values < 0.05).[133] The same study found that males and females who did not know whether tests were "too expensive" (for them) were less likely than those who did know to receive an

endoscopy (AOR, 0.43 and 0.46, respectively; $P < 0.05$); this same finding was also reported for females and FOBT testing (AOR, 0.55; $P < 0.05$).[133] In another study, respondents 65 years of age or older who lacked knowledge about the number of tests that were recommended for their age group were less likely to be screened that knew about the recommended guidelines for testing frequency (AOR, 0.28).[55]

With regard to attitudes about testing or CRC, one study reported findings about overall attitudes toward screening and anxieties about tests from a regional survey of residents in the Midwest.[134] If respondents had a positive attitude toward screening in general, they were more likely to report being screened (AOR, 2.35); if they had anxiety about tests in general, they were less likely to be screened (AOR, 0.58).[134] Being fearful of finding cancer was positively associated with CRC screening among women in one study (AOR, 1.78).[133]

Three studies reported findings specific to perceived barriers to screening and perceived social support for screening, as well as perceived risk to being diagnosed with cancer.[106,133,144] Perceived barriers to screening by endoscopy (e.g., inconvenience and unpleasant aspects of screening are perceived to be a problem) were associated with not being screened for CRC (AOR, 0.33; $P < 0.0001$) in one study. Another study highlighted in another section of this chapter also reported findings that support a relationship between perceived barriers to screening and adherence.[142] Perceived social support to be screened was not associated with screening in one study,[106] but was both indirectly (through perceived emotional support from family) and directly (through perceived emotional support from friends) related to adherence to screening in the one included study that tested a structural equation model to examine factors influencing screening.[144] Perceived risk to being diagnosed with cancer was positively associated with being screened for females (AOR, 2.53).[133] Two other studies not presented in this section found that perceived risk to being diagnosed with CRC was associated with screening.[108,130]

Three studies included analyses of beliefs that may be associated with CRC screening. Positive associations with CRC screening were found with the following beliefs: that the tests are safe (AOR, 1.39);[134] that it is irresponsible not to be tested (AOR, 2.16);[134] and, for females, that tests lead to early detection (AOR, 3.03).[133] Those who believed that, if they are healthy, they do not need to be tested were less likely to report being screened (AOR, 0.58)[134] as were those who thought that arranging for testing would not be easy (AOR, 0.47).[55]

Another study not presented in this section (because psychosocial factors were not a specific aim of their research) reported no association between belief that testing detects cancer early and screening rates.[108]

Patient Factors: Followup after Positive FOBT

Study characteristics. We identified two studies, both rated as fair quality, that assessed factors that may be related to followup after an abnormal FOBT result (Table 22).[88,168] Both studies were conducted using claims data from one Veterans Administration (VA) Hospital; one focused on patients 70 years of age or older[168] and the other on patients 50 or older.[88] The outcome measure of interest to both was whether a patient completed a colonoscopy or double-contrast barium enema[168] or a full colon evaluation (defined as colonoscopy or double-contrast barium enema with FS)[88] within 12 months of receiving the FOBT results.

Table 22. Studies of factors associated with followup after abnormal CRC screening results are received

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Primary Outcome of Interest for Review (i.e., screening or followup after abnormal FOBT; completion rates or discussions)	Predictors Examined	Potential Confounders/ Considered	Variables Associated with CRC Screening[a]	Results (95% CI)
Garman et al., 2006[168] Cross-sectional/ retrospective, local 1 VA hospital, patients 70 years or older N = 266 Fair	Examine comorbid disease and performance of complete full colon evaluation after positive FOBT	Completion of colonoscopy, or double-contrast barium enema after positive FOBT (claims)	Comorbidity (measured by Charlson Comorbidity Score)	Age	No association with Charlson score	Patients receiving followup who had higher Charlson scores did not differ significantly from those who had lower scores (*P* = 0.38)
Fisher et al., 2006[88] Cross-sectional, retrospective, local 1 VA hospital, 50 years or older N = 538 Fair	Explore factors associated with undergoing a full colon evaluation after a positive FOBT	Completion of a full colon evaluation (with a colonoscopy or double-contrast barium enema plus FS) within 12 months of receiving positive FOBT (claims)	Race (white, Black, missing)	Race, age, marital status, primary care clinic where FOBT obtained	No association with race	Blacks were as likely to receive full colon examination as whites (AOR, 1.14; 95% CI, 0.57-1.75)

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; N, number; OR, odds ratio; VA, Veterans Administration.

Overview of results. Each study examined different predictors for receipt of a follow-up test. One explored the association of comorbidity (measured through Charlson scores)[168] and the investigated the differences in followup for white and Blacks.[88] The study focusing on comorbidities found that patients who had higher Charlson scores (i.e., more comorbidities) were no more likely than those with low scores to receive followup after a positive FOBT.[168] Follow-up rates after a positive FOBT were not associated with race; Blacks were as likely to receive a full colon evaluation as whites (AOR, 1.14).[88]

Physician Factors Associated with CRC Screening

This part of KQ 2 focuses on physician factors associated with CRC screening, CRC screening discussions, or the quality of CRC screening. Although we found many studies that examined the association of patient characteristics and CRC screening, we found only one study

that examined physician characteristics,[127] one study that examined "patient-physician connectedness,"[152] and 12 studies that examined physician recommendation of CRC screening. Of these 12 studies, 7 were national studies from two databases (NHIS and HINTS)[21,46,55-57,111,159] and 5 were regional studies from four different states or areas.[107,142,148,153]

Physician characteristics. *Study characteristics.* This cross-sectional study, which we rated fair quality, used data from the 2000-2001 Community Tracking Study (CTS) Physician Survey (response rate 59 percent), a nationally representative telephone survey of nonfederal physicians in 60 randomly selected metropolitan statistical areas (Table 23).[127] Among other items, the CTS asked physicians about their age, years in practice, specialty, board certification, and site of medical school graduation (US/Canada versus other). The investigators assessed information on CRC screening and patient care visits for Medicare beneficiaries ages 65 years and older from Medicare claims data. The investigators linked the databases by physician ID numbers, allowing them to identify 3,660 primary care physicians who cared for 24,581 Medicare beneficiaries in the database. They could then generate 1-year (2001) CRC screening rates for physicians with similar characteristics.

Table 23. Studies of the association between physician characteristics and CRC screening

Author, Year, Study Design, Population, Setting, Sample size, Quality	Primary Outcomes of Interest for Review	Predictors Examined	Potential Confounders Considered	Variables Associated with CRC Screening*	Results (95% CI)
Pham et al., 2005[127] Cross-sectional study, retrospective, National 2000-2001 Nationally representative physician survey and Medicare claims data, 2000-2001 N = 3,660 physicians 24,581 patients (≥ 50 years) Fair	1-year rates of colonoscopy or FS, excluded FOBT (self-report and claims)	Physician and practice characteristics, including use of computerized physician reminders, size and type of the practice.	Patient co-morbidity, individual income and other demographic and education factors; doctor-patient interaction factors; managed care practice factors; system factors.	↑ Family physicians ↑ Board certified ↑ US Medical school graduate No other associations identified	Association between CRC screening and physician specialty (patients cared for by family physicians 9.9% vs. patients cared for by general internists 7.8%, $P < 0.001$); board certification (board certified 9.5% vs. not board certified 6.5%, $P < 0.05$); and site of medical school graduation (US or Canada 9.3% vs. non-US or Canada 7.7%, $P < 0.05$).

CI, confidence intervals; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; N, number; P, probability; US, United States

* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

Overview of results. CRC screening rates did not differ between patients with male versus female physicians; neither did they differ among physicians who had been in practice for 0-10 years versus 11-20 years versus > 20 years. Patients cared for by family physicians had somewhat higher 1-year screening rates than those cared for by general internists (9.5 percent versus 7.8 percent, $P < 0.001$); patients cared for by board certified physicians had higher screening rates than those cared for by non-board certified physicians (9.5 percent versus 6.5 percent, $P < 0.05$). Patients cared for by physicians who graduated from US or Canadian medical schools had higher screening rates than those cared for by physicians who graduated from other medical schools (9.3 percent versus 7.7 percent, $P < 0.05$). Another study (highlighted under patient level factors) explored the relationship between race and screening among a nationally representative sample of Medicare beneficiaries and found that, controlling for other factors,

patients whose usual care physician was a primary care generalist rather than another type of specialist had significantly higher odds of CRC screening (AOR, 1.31; 95% CI, 1.12-1.53).[129]

Physician-Patient connectedness. *Study characteristics.* A retrospective cohort study, which we rated good quality, examined the association between CRC screening and patient-physician connectedness (Table 24).[152] Although this variable could be seen as either a system variable or a patient-physician interaction variable, we have elected to review it under physician characteristics because the study was conducted in a single large academic practice network with large variation among physicians (e.g., specialty, number of years in practice, etc.), indicating that the variable at least partially indicated physician practice style. It was conducted in the Massachusetts General Hospital adult primary care network (181 primary care physicians working in four community health centers and nine hospital-affiliated practices). Using electronic billing records, the investigators identified all patients with at least one visit to one of these practices between 2003 and 2005. Using a validated algorithm, the investigators further divided these patients into three groups: practice-connected (i.e., patient was considered a regular user of the practice but had seen a variety of physicians within the practice), physician-connected (i.e., a patient of the practice as well as seen by the same physician for most visits), or unconnected (i.e., patient could not be assigned to either a practice or a physician). Using electronic billing and laboratory data, the investigators calculated, among other indicators, CRC screening rates (colonoscopy within 10 years, FS within 5 years, or FOBT within one year) for physician-connected patients (n = 31,215) versus practice-connected patients (n = 6,453), excluding unconnected patients (who were often either just entering or leaving the practice).

Table 24. Studies of the association between physician or practice connectedness with CRC screening

Author, Year, Study Design, Population, Setting, Sample size, Quality	Primary Outcomes	Independent Variables of Primary Interest	Potential Confounders	Predictors of CRC screening Identified	Results
Atlas et al., 2009[152] Retrospective cohort study, data collected, practice based Medical records review, 2003-2005, patients ≥ 50 N = 181 primary care physicians, n = 31,215 physician connected patients and 6,453 practice connected patients Good	FOBT within past year, FS within past 5 years, colonoscopy within past 10 years (claims)	Physician vs. practice connectedness, determined by a validated algorithm	Patient and physician characteristics, characteristics of the patient-physician interaction, financial (insurance) characteristics, all controlled for in analysis.	↑ Physician connectedness ↑ Practice connectedness	Adjusted CRC screening rates: Physician connected patients: 72.1% (95% CI, 70.5-73.7) Practice connected patients: 58.0% (95% CI, 56.7-59.4) *P* < 0.001

CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; N, number; P, probability.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

Overview of results. Physician-connected patients had higher CRC screening rates (adjusted percentage 77.1) than practice connected patients (adjusted percentage 69.5; $P < 0.001$).

Physician recommendation. We found 12 studies that examined the association between CRC screening and physician recommendation of CRC screening. Seven are analyses from two large national databases: NHIS and Health Information National Trends Survey (HINTS).[21,46,55-57,111,159] The other five studies are regional studies.[107,136,142,148,153] We discuss the seven national papers and then assess what additional insights come from the regional studies. Agreement of results among all these studies is high.

Study characteristics of national studies. As shown in Table 25, four of the seven national studies used the NHIS 2000 cancer control module;[21,57,111,159] one used the NHIS 2005 cancer control module.[46] Two studies analyzed the 2002-2003 HINTS database.[55-56] We rated three studies as good quality[21,46,56] and the remainder as fair.

Table 25. National studies of association between physician recommendations and CRC screening

Author, Year, Study Design, Population, Setting, Sample size, Quality	Primary Outcome of Interest for review	Independent Variables of Primary Interest	Potential Confounders	Predictors of CRC screening Identified	Results
Cairns et al., 2006[56] Cross-sectional, national HINTS, 2002-2003, 50-64 years N = 1,253 Good	FOBT within the past year (self-report)	Reasons for not being screened	Age, insurance, whether there is a usual provider, gender, race/ethnicity, annual household income, employment, rural vs. urban county, education	↓ No physician recommendation	Among uninsured, 91% who received recommendation had received a test; those without a recommendation were 98.5% less likely (95% CI, 0.003-0.083) to receive tests ($P < 0.001$).
Seeff et al., 2004[21] Cross-sectional, retrospective, national NHIS, 2000, ≥ 50 N = 14,874 Good	FOBT in past year; endoscopy in past 10 years (self-report)	Physician recommendation in past year as a reason for not having had a CRC test	Age, gender, race, ethnicity, education, marital status, insurance status, income, usual source of care, MD visits/year, personal/risk factors	↓ No physician recommendation	Of those 50-64 years, 94.1% (95% CI, 93.3-94.9%) who were not current with testing had not been recommended by physician to get a FOBT; 92.8% (95% CI, 91.9-93.7%) had not been recommended to get an endoscopy Of those ≥ 65, 95.9% (95% CI, 95.1-96.6%) had not received a physician recommendation for FOBT and had not been tested; 95.2% (95% CI, 94.4-96.1%) had not received a recommendation for an endoscopy

Table 25. National studies of association between physician recommendations and CRC screening (continued)

Author, Year, Study Design, Population, Setting, Sample size, Quality	Primary Outcome of Interest for review	Independent Variables of Primary Interest	Potential Confounders	Predictors of CRC screening Identified	Results
Shapiro et al., 2008[46] Cross-sectional, retrospective, national NHIS, 2005, ≥ 50 N = 13,269 Good	FOBT in past year; endoscopy in past 10 years (self-report)	Reasons for not having a FOBT or endoscopy, by colorectal cancer testing history, NHIS 2005	Age, gender, race, ethnicity, education, marital status, insurance status, income, usual source of care, MD visits/year, personal/risk factors	↓ No physician recommendation	Of those who never had tests, lack of physician recommendation given as reason for not having a FOBT: 96.3% of those who never had either test (95% CI, 95.6-96.9%); 95.4% (95% CI, 94.7-96.0) for those who had test but not in recommended time. As a reason for no endoscopy; 89.7% of those who never had either test (95% CI, 88.5-90.7%); 87.9% (95% CI, 88.5-90.7%) of those who had test but not in recommended time
Berkowitz et al., 2008[55] Cross-sectional, retrospective, national HINTS, 2002-2003; 65-89 years N = 1,148 (583 not up-to-date with screening) Fair	FOBT (within past year) or, FS or colonoscopy in past 10 years (self-report)	Physician recommendation reported	Gender, race, income, education, marital status, family history of CRC, health status, regular source of care, annual MD visits, knowledge about CRC and testing, beliefs about CRC, perceived risk	↓ No physician recommendation	Reasons for not being screened: No recommendation received for 65-74 year olds: FOBT: 87.5% (95% CI, 76.7–93.7%) FS/colonoscopy: 79.1% (95% CI, 69.3-86.4%) For those 75-89 years: FOBT: 84.4% (95% CI, 70.6-92.3%); FS/colonoscopy: 75.9% (95% CI, 64.1-86.2%)
Coughlin et al., 2005[159] Cross-sectional, retrospective, national NHIS, 2000, ≥ 50 N = 11,480 Fair	Persons with no recent CRC test	Physician recommendation as a reason for not being tested	Age, gender, race, ethnicity, marital status, education, years in US, family history of CRC, general health status, income, insurance status	↓ No physician recommendation	Reasons for not being screened: Physician didn't recommend FOBT: 94.6% (95% CI, 94.0-95.2); endoscopy: 93.5% (95% CI, 92.8-94.2)

Table 25. National studies of association between physician recommendations and CRC screening (continued)

Author, Year, Study Design, Population, Setting, Sample size, Quality	Primary Outcome of Interest for review	Independent Variables of Primary Interest	Potential Confounders	Predictors of CRC screening Identified	Results
Klabunde et al., 2005[57] Cross-sectional, retrospective, national Surveys of doctors (PCPs) and patients (from NHIS), data collected 1999-2000, for patients ≥ 50 N = 1,235 PCPs N = 6,497 adults Fair	No FOBT in past year nor endoscopy in past 10 years (self-report)	Physician recommendation	Age, gender, race, ethnicity, marital status, education, income, insurance, MD visit in past year, years in US, urban/rural	↓ No physician recommendation	Among respondents who had not been tested for: FOBT: 21.6% (95% CI, 20.2–23.0) or endoscopy: 22.2% (95% CI, 20.9–23.6) had not received a MD recommendation.
Wee et al., 2005[111] Cross-sectional, retrospective, National NHIS, 2000, 50-75 years N = 11,427 Fair	FOBT in past year; FS in past 5 years; or colonoscopy in past 10 years (self-report)	Physician not recommending screening	Age, race or ethnicity, educational level, region of the country, and body weight as classified into standard BMI categories, family history of CRC, healthcare access, smoking status, and illness burden.	↓ No physician recommendation	Reasons that respondents did not have a FOBT (of 9017), 22% reported their physician did not recommend; for FS/colonoscopy, 21% reported their physician did not recommend.

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HINTS, Health Information National Trends Survey; MD, medical doctor; NHIS, National Health Interview Survey; P, probability; PCP, primary care physician; US, United States.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

The NHIS cancer control module for CRC did not change between 2000 and 2005; results from the analyses of these two surveys were similar. All five of the NHIS studies assessed the percentage of people who had not had a screening test within the recommended interval and who reported that they had not had a physician recommendation to be tested within the past year. One study also examined data on 1,235 primary care physicians from the Survey of Colorectal Cancer Screening Practices, a 1999-2000 nationally representative survey of primary care and specialty physicians and health plan medical directors.[57]

The 2002-2003 HINTS survey was a nationally representative random-digit dialing telephone survey of 6,369 noninstitutionalized civilians ages 18 and older, with over-sampling of blacks and Hispanics. Respondents who had not been screened within the recommended time interval (1 year for FOBT, 5 years for FS, and 10 years for colonoscopy) were asked an open-ended question about reasons for not being screened. The reasons were later aggregated into 12 predefined categories for analysis. Among the categories was lack of physician recommendation.[55-56] One HINTS study[56] primarily examined CRC screening in the uninsured

(ages 50 to 64 years); the other assessed CRC screening in older respondents (ages 65 to 89 years).[55]

Overview of results of national studies. For people who had not had a screening test in the recommended interval but who had a physician whom they had visited within the past 12 months, three studies agreed that from 92 percent to 94.6 percent had not received a physician recommendation for screening in that year.[21,111,159] The fourth NHIS 2000 study compared reasons for low screening rates given by NHIS participants and those given by primary care physicians from the 1999-2000 Survey of Colorectal Cancer Screening Practices.[57] Thirty-seven percent of physicians and 20 percent of NHIS participants cited failure of physician recommendation as a primary reason for low screening rates. As in the three other studies from the NHIS 2000, this study also found that among those respondents who had not been screened and who had seen a physician within the past year, about 90 percent had not received a recommendation for screening over that year.[57] The NHIS 2005 study found results almost identical to the NHIS 2000 studies.[46]

One HINTS study found that 75 percent to 85 percent had not been advised to be screened over this year.[55] The other HINTS analysis examined barriers to CRC screening among the uninsured and found that about 91 percent of uninsured people who had received a physician recommendation for screening had in fact been screened; only 13 percent of uninsured respondents who had not received a recommendation had been screened ($P < 0.001$).

Study characteristics of regional studies. Of the five regional studies, all rated as fair quality (Table 26),[107,136,142,148,153] four were telephone surveys of people in three different areas: two studies from Massachusetts;[107,153] one from Maryland; [148] one from Iowa; [136] and one from Genessee County, Michigan.[142] These studies included one that called respondents who had responded to the 1999 BRFSS,[153] and findings from either a state-based[107,148] or county-based health survey.[142] One other study was a project that combined patient surveys and medical record reviews from family practices in rural Iowa.[136] The study from Iowa matched a 2004 mailed survey of 511 patients (53 percent response rate) with a medical record review.[136]

Table 26. Regional studies of the association of physician recommendation with CRC screening

Author, Year, Study Design, Population, Setting, Sample size, Quality	Primary Outcomes of Interest for Review	Predictors Examined	Potential Confounders Considered	Variables Associated with CRC Screening	Results (95% CI)
Brawarsky et al., 2004[153] Cohort, state Massachusetts BRFSS and a CRC call-back study, 1999, ≥ 50 N = 779 Fair	FOBT in past year, FS in past 5 years, colonoscopy in past 10 years (self-report)	Physician recommendation	Age, education, gender	No comparison group	75% had received a physician recommendation; 81% who had a recommendation adhered to testing

Table 26. Regional studies of the association of physician recommendation with CRC screening (continued)

Author, Year, Study Design, Population, Setting, Sample size, Quality	Primary Outcomes	Independent Variables of Primary Interest	Potential Confounders	Predictors of CRC screening Identified	Results
Gilbert et al., 2005[148] Cross-sectional, retrospective, state Maryland Cancer Survey, 2002, 50-64 years N = 2,994 Fair	FOBT in past year; FS in past 5 years; or colonoscopy in past 10 years (self-report)	Ever had recommendation for FOBT, FS, or colonoscopy	Age, gender, race, ethnicity, SES, marital status, health status, personal and family risk factors	↑ Physician recommendation	Those who ever had physician recommendation were more likely to have completed the FOBT (AOR, 70.72; 95% CI, 66.56-77.45); FS (AOR 17.41; 95% CI, 14.9-20.25); or colonoscopy (AOR 57.32; 95% CI, 53.82- 60.75).
Janz, et al., 2003[142] Cross-sectional, retrospective, county residents in Michigan, 50-79 years N = 355 Fair	FOBT in past year and FS in past 5 years; OR colonoscopy in past 10 years (self-report)	Physician recommendation	Relevant sociodemographic and related factors (unspecified)	↑ Physician recommendation	Between 54 and 65% of respondents indicated that their physician had recommended FOBT, and over 92% of those subjects reported having had the test (no *P* values or odds ratios provided).
Levy et al., 2006[136] Cross-sectional, retrospective, practice based Iowa family physicians (n = 16), 2004, 55-80 years N = 511 Fair	Five FOBT within past 5.5 years; FS or DCBE within past 5.5 years; colonoscopy in past 10.5 years (claims)	Physician recommendation	Personal or family CRC history, recommendation, sociodemographic information (not specified)	↑ Physician recommendation	Patients who recalled physician recommendation for testing were more likely than others to have been screened (AOR, 6.4; 95% CI, 4.2-9.6).
Zapka et al., 2002[107] Cross-sectional, State CHS, 1998, Residents of Massachusetts, ≥ 50 years N = 1,002 Fair	Any test (colonoscopy or barium enema within 10 years, FS within 5 years, and FOBT in the past year) (self-report)	MD ever recommended FS	Gender, race, education, employment status, income, marital status, family history of CRC, perceived health status	↑ Physician recommendation	Persons 50-64 and ≥65 were more likely to have received a FS if MD had ever been recommended (AOR, 13.44; 95% CI, 7.22-25.02 and AOR 12.39; 95% CI, 5.68-27.06, respectively, *P* < 0.0001).

AOR, adjusted odds ratio; BRFSS, Behavioral Risk Factor Surveillance System; CHS, Community Health Survey; CI, confidence interval; CRC, colorectal cancer; DCBE, double contrast barium enema; FOBT, fecal occult blood test; FQHC, federally qualified health center; FS, flexible sigmoidoscopy; MD, medical doctor; N, number; SES, socioeconomic status.
*Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

Overview of results of regional studies. All five studies found a strong association between physician recommendation and receipt of CRC screening, much like those at the national level.

Patient-Provider Communication

Study characteristics. We found five cross-sectional studies, which we rated fair quality, pertaining to the association between patient-provider communication and CRC screening (Table 27).[56,135,140,154,167] Two used HINTS data to examine the association between communication and screening among the uninsured.[56,135] Both used measures from the Consumer Assessment of Healthcare Providers and Systems (CAHPS®) to assess patient-provider communication; these address how well patients feel the provider listens to them, explains options, respects them, spends adequate time with them, and involves them in medical decision making. Another study used data from 8,488 survey respondents from the MEPS to examine the relationship between patient-provider communication and socioeconomic variables on the receipt of CRC screening;[154] patient-provider communication was assessed by measures derived from CAHPS. Another study surveyed 397 Black church members in North Carolina;[140] it assessed this factor with a "communication score" based on five patient-reported items. The final study surveyed female patients of primary care physicians in Los Angeles on their perceptions of how enthusiastically their provider recommended or discussed CRC screening with them.[167]

Table 27. Studies of the association of patient-provider communication and CRC screening

Author Year Study design Population Setting Sample size Quality	Study Aims	Primary Outcomes of Interest	Predictors Examined	Potential Confounders and Modifiers Considered	Variables Associated with CRC Screening†	Results (95% CI)
Cairns et al., 2006[56] Cross-sectional, national sample, HINTS Ages 50-64 1,253 Fair	Examine the role of communication factors and insurance, with a specific focus on the uninsured, to examine disparities in CRC screening	Ever screened for FOBT, FS, or colonoscopy (self-report)	Patient-provider interaction based on five CAHPS measures*	None. A analyses of patient-provider communication were bivariate and did not adjust for potential confounders	No differences on interaction variables	No communication measures were significantly related to CRC screening status.

Table 27. Studies of the association of patient-provider communication and CRC screening (continued)

Author Year Study design Population Setting Sample size Quality	Study Aims	Primary Outcome	Measurement of Independent Variable of Primary Interest	Potential Confounders and Modifiers	Variables Associated with CRC Screening†	Results (95% CI)
Carcaise-Edinboro et al., 2008[154] Cross-sectional, national sample Medical Expenditures Panel Survey (MEPS) Age 50 years or older 8,488 Fair	Examine the relationship between patient-provider communication and socioeconomic variables on the receipt of CRC screening)	Ever screened for CRC by FOBT, colonoscopy, or FS in lifetime (self-report)	Patient-provider communication assessed by measures derived from CAHPS	Age, sex, race, education, geography, metropolitan statistical area, insurance status, family income, usual source of care, self-reported health,	↑ Enough time with provider for any test ↑ MD adequately explains information for FOBT	Those who reported that they sometimes, usually, or always have enough time with the provider were more likely to be screened by any test (AOR range, 2.61-2.99). Those who reported that their provider sometimes, usually, or always adequately explains information about FOBT were more likely to report being screened (AOR range, 3.67 to 6.42).
Fox et al., 2009[167] Cross-sectional, retrospective, local Survey of women patients of 63 PCP in Los Angeles, 50 years or older N = 904 Fair	Examine the separate contributions of patients and physicians to their communication regarding cancer screening	FOBT within past year	Level of enthusiasm provider showed in discussion about FOBT	Race, ethnicity, income, education, insurance,	↑ Low level of enthusiasm from MD for FOBT (vs. no discussion)	Patients who perceived a low level of enthusiasm from provider were more likely to complete FOBT than those who reported no discussion (AOR, 6.426; $P < 0.0001$). For those who perceived high enthusiasm, the relationship to screening was not significant.

Table 27. Studies of the association of patient-provider communication and CRC screening (continued)

Author Year Study design Population Setting Sample size Quality	Study Aims	Primary Outcome	Measurement of Independent Variable of Primary Interest	Potential Confounders and Modifiers	Variables Associated with CRC Screening†	Results (95% CI)
Katz et al., 2004[140] Cross-sectional, church-based, 1 state (North Carolina) Age 50 years or older 397 Fair	Determine the relationship between the general quality of patient-rated patient-provider communication and the completion of CRC screening	Undergoing FOBT, colonoscopy, FS within the recommended time period (self report)	Communication score used to categorize quality of communication as good, fair, or poor; based on five items (abbreviated versions here): (1) receive understandable information from doctor (2) feel rushed during visits (3) feel your doctor allows you to become involved (4) feel uncomfortable asking doctor about tests (5) feel that your doctor understands your health needs	Sex, source of health care, knowledge of CRC risk	↑ Quality of communication	Quality of communication (good vs. poor/fair communication scores) were significantly associated with improved completion of CRC screening: OR 1.95 (95% CI, 1.29-2.94).
Ling et al., 2006[135] Cross-sectional, national sample, HINTS Age 51 years or older 2,670 Fair	Assess the association between provider-patient interaction and CRC screening utilization	CRC screening up to date or not (self-report); considered up to date if FOBT in past year or FS or colonoscopy in past 10 years	Respondents were asked five CAHPS* measures.	Age, sex, race, highest education level, tobacco use, household income	No differences based on provider-patient interaction ↑ Trust in cancer information provided	The up-to-date and not up-to-date groups did not differ significantly on any patient-provider interaction item. Having trust in cancer information from the doctor was associated with being up-to-date with CRC screening: AOR 2.08 (95% CI, 1.49-2.94).

AOR, adjusted odds ratio; CAHPS, Consumer Assessment of Healthcare Providers and Systems; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HINTS, Health Information National Trends Survey; MD, medical doctor.

*CAHPS measures: During the past 12 months, how often did doctors or other health care providers: listen carefully to you, explain things in a way you could understand, show respect for what you had to say, spend enough time with you, involve you in decisions about your health care as much as you wanted]? Would you say always, usually, sometimes, or never?
†Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

All five studies measured patient-provider communication as perceived by patients. In addition, all five used patient-reported CRC screening status as their primary outcome. One study also assessed subject's trust in cancer information from the doctor.[135]

Overview of results. The two national studies that used HINTS data reported no significant association between patient-provider communication measures (from CAHPS) and CRC screening status.[56,135] However, the MEPS-based study demonstrated that patients who reported that their provider spent enough time with them and adequately explained information were 2.6 to 6.4 times more likely to have undergone CRC screening.[154] The North Carolina study reported that better quality of patient-provider communication was significantly associated with completion of CRC screening.[140] The fifth study of women of PCP physicians in Los Angeles found that even a discussion with the provider with perceived 'low enthusiasm' for testing was significantly more likely to result in testing than no discussion about testing (AOR, 6.246; $P < 0.0001$).[167] One other study (presented in the patient level factors section) also supported a positive relationship between patient-provider communication and any CRC screening.[144]

One of the HINTS studies reported that subjects having trust in cancer information from the doctor were more likely to be up-to-date with CRC screening (OR = 2.08, 95% CI, 1.49-2.94).[135] Another study, highlighted in the patient level factors section on insurance status also reported a positive relationship between adherence to FOBT and patient's report that their provider demonstrates compassion.[128]

Periodic Health Examinations

Study characteristics. We found one study, which we rated as fair quality, that focused on the association between receipt of a periodic health examination (PHE) and CRC screening rates (Table 28).[164] It was a retrospective cohort study of 64,288 consecutive enrollees in a Washington state health plan who had attended one or more primary care visits in 2002-2003 and had been eligible for one or more cancer screening tests (for CRC, breast cancer, or prostate cancer).[164] It defined a PHE as any outpatient encounter (in 2002-2003) having either (1) an evaluation and management code indicating "initial evaluation" (codes 99386-7) or "reevaluation and management of a healthy individual" (codes 99396-7) or (2) an International Classification of Diseases, Ninth Revision, Clinical Modification, code signifying either a general medical examination (code V700 or V708-9) or a gynecologic examination (code V723). The study reported results for a combined outcome of either FOBT or invasive CRC testing (FS, colonoscopy, or barium enema).

Overview of results. A greater proportion of subjects who had had a PHE received CRC screening than subjects who had not had a PHE (unadjusted: 57.2 percent versus 17.2 percent, respectively).[164] The incidence of CRC testing was more than three times higher in patients who received PHEs than in those who did not (adjusted relative incidence, 3.47; 95% CI, 3.34-3.59; $P < 0.001$).[164]

Results from several other studies in this review supported the finding that subjects having periodic health examinations, annual physicals,[134] physicals,[171] health maintenance examinations,[136] or annual checkups[108,153,172] are more likely to have had CRC screening than people not receiving such services. We do not describe these studies in further detail or include

them in the table because they were not designed to focus on this factor (PHEs); rather, they primarily examined another factor or examined multiple factors simultaneously.

Table 28. Studies of association between periodic health examination (PHE) and CRC screening

Author Year Study design Population Setting Sample size Quality	Study Aims	Primary outcome	Measurement of Independent Variable of Primary Interest	Potential Confounders and Modifiers	Association of Variables to CRC Screening*	Results
Fenton et al., 2007[164] Retrospective cohort, 1 state Enrollees in a Washington State health plan N = 64,288 Fair	Determine the association between receipt of a PHE and completion of cancer screening	Completion of either FOBT (based on automated laboratory data) or invasive testing (FS, colonoscopy, or barium enema; based on CPT codes from outpatient and inpatient encounters) in 2002-2003	PHE, from evaluation and management codes or ICD9 codes	Adjusted for age, sex, comorbidity (Charleson comorbidity index), number of outpatient visits, baseline PHE receipt, baseline number of target organ cancer tests, and significant interactions between PHE receipt and the listed covariates	↑ PHE	Of those who received a PHE, 57.2% received CRC testing vs. 17.2% of those who did not receive a PHE (AOR, 3.47; 95% CI, 3.34-3.59; *P* < 0.001)

AOR, adjusted odds ratio; CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; CPT, current procedural terminology; ICD-9, International Classification of Diseases, Ninth revision; N, number; P, probability; PHE, periodic health examination.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

System Level Factors Associated With CRC Screening

This part of KQ 2 focuses on health care system characteristics associated with CRC screening, CRC screening discussions, or the quality of CRC screening. The issue we addressed is whether the organization of health care services influences CRC screening. Thus, we searched for studies of any research design that examined the association between system characteristics and any of our three primary outcomes (measured in a valid and reliable manner): CRC screening rates, the frequency or quality of CRC discussions, or the quality of CRC screening.

By health care system characteristics, we are referring to such variables as involvement of nonclinician staff in screening, the practice's being part of a managed care organization, use of reminder or recall systems, having an organized endoscopy referral system, the size and/or type of the medical practice, and the degree of local autonomy over the structure of care delivery. We distinguish between these system characteristics and other factors, such as patient access to health care (including having health insurance or having a regular source of health care), characteristics of the patient-clinician interaction (including trust or having health maintenance visits), or receiving a clinician recommendation for screening.

Study characteristics. We found six fair-quality studies that provided some information about this question.[66,110,127,139,143,173] Three studies used large datasets (one including 155 VA primary care clinics),[110] another used Medicare claims data,[139] another used Medicare claims

data plus a national physician survey,[127] while the sixth used survey data to compare patients who receive their regular care from county health centers versus those going to a private physician office in the New York City area.[66] Two studies collected data from medical practices.[143,173] One of the latter studies focused on 22 suburban primary care practices in New Jersey and Pennsylvania,[143] and another examined a single primary care practice within a low-income urban New York City setting.[173] Five studies were cross-sectional,[66,110,127,139,143] and the sixth was a cohort study.[173]

The six studies examined a variety of system variables, including involvement of nonclinician staff in screening, reminder systems, endoscopy referral systems, local autonomy of the internal structure of care delivery, size or type of the practice, group versus solo practice, and degree of managed care activity in the area. All used the outcome of CRC screening (according to national screening guidelines), assessed either through administrative databases,[127,139,173] through direct medical record review,[110,143] or self-report via telephone surveys.[66]

Overview of results. Five of the six studies reported a positive association between some system characteristic and CRC screening (Table 29). The most positive associations were use of nonphysician staff (for either general counseling[143] or assistance with the screening process[173]). In one study, a practice's use of nonphysician staff for general lifestyle counseling was associated with a near-doubling of CRC screening (from 27.2 to 54.1 percent points);[143] in another, nonphysician "patient navigators" (along with several other administrative changes) increased the number of patients receiving colonoscopy each month from 75.7 to 119.0.[173]

Table 29. Studies of the association between system level factors and CRC screening

Author, Year, Study Design, Population, Setting, Sample Size, Quality	Primary Outcomes	Independent Variables of Primary Interest	Potential Confounders	Association of Variables to CRC Screening*	Results
Yano et al., 2007[110] Cross-sectional, retrospective, VA based Data collected 1998 and 2001 Primary care directors survey, 155 VA primary care clinics across country, 1999-2000 and 38,818 patient claims data (2001) Fair	Abstracted data on colonoscopy, FOBT, FS; overall screening rate (claims)	Centralization (authority over operations, staffing, etc.), resources (sufficiency of nonclinician staffing, space, clinical support), and complexity (facility size, academic status, managed care) of organization	Patient and clinician characteristics, health care use	↑ Centralization (i.e., autonomy), resources (i.e., clinical support), and complexity (i.e., facility size)	Autonomy over internal structure ($P < 0.04$), clinical support ($P < 0.03$), and smaller size ($P < 0.001$) were statistically significantly associated with more CRC screening.

Table 29. Studies of the association between system level factors and CRC screening (continued)

Author, Year, Study Design, Population, Setting, Sample Size, Quality	Primary Outcomes	Independent Variables of Primary Interest	Potential Confounders	Association of Variables to CRC Screening*	Results
Hudson et al., 2007[143] Cross-sectional study, retrospective, practice based 22 family practices, NJ and PN, 2003-2004 N = 795 Fair	Colonoscopy, FOBT, and FS; overall screening rate	Use of nursing or health educator staff to counsel patients about diet, exercise, or tobacco use Use of patient reminder systems of any type (not specifically for CRC screening)	Physician, patient, interaction, and other practice characteristics; variation in types of reminders used	↑ Counseling from non-clinician staff, use of reminder systems	CRC screening rates: Use of nonclinician staff for counseling: • Yes: 54.1% • No: 27.2% [AOR, 2.96 (95% CI, 2.21-3.96)] Reminder systems: • Yes: 39.9% • No: 19.6% [AOR, 2.57 (95% CI, 1.77-3.74)]
Koroukian et al., 2005[139] Cross-sectional study, retrospective, national Association of county-level assessment of managed care (MCA) with Medicare FFS patients, 1998-1999, ≥ 65 N = 23 million Fair	Colonoscopy, FOBT, FS (claims)	County-level assessment of MCA, based on % Medicare patients on managed care in each US county: High: > 30% Moderate: 10-29.9% Low: < 10%	Patient, physician, and interaction characteristics; practice organizational characteristics; only have county-level data on patient and physician characteristics	↑ Managed care among Medicare FFS patients	Greater level of MCA associated with CRC screening: High vs. low MCA: • FOBT: AOR, 1.10 (95% CI, 1.04-1.16) • Colonoscopy: AOR, 1.07 (95% CI, 1.03-1.10) • FS: AOR, 0.98 (95% CI, 0.93-1.03) No absolute screening rates given.
Messina, et al., 2009[66] Cross-sectional, retrospective, local Telephone survey of random samples of patients of CHC compared to those of PPO offices in the New York City area, 52- 75 years of age	FOBT within past year, FS in past 5 years, colonoscopy in past 10 years (self-report)	Type of provider (CHC or PPO)	Gender, race/ ethnicity, education, income, insurance, health status	↓ CHC patients compared to PPO patients for endoscopy screening ↑ CHC patients compared to PPO patients for FOBT	FOBT was more frequent among CHC patients; FS and colonoscopy were more frequent among PPO patients ($P < 0.001$) CHC patients less frequently cited no physician recommendation as a barrier to FOBT, but more frequently cited no

Table 29. Studies of the association between system level factors and CRC screening (continued)

Author, Year, Study Design, Population, Setting, Sample Size, Quality	Primary Outcomes	Independent Variables of Primary Interest	Potential Confounders	Association of Variables to CRC Screening*	Results
Messina, et al., 2009[66] (continued N = 1070 Fair					recommendation as a barrier to FS and colonoscopy, compared with PPO patients (p<0.02).
Nash et al., 2006[173] Retrospective cohort analysis, before and after an organizational intervention (no control group), data collected 2003-2004 Single medical center in New York City Fair	Monthly rate of screening colonoscopy, broken-appointment (appt) rate for colonoscopy (claims)	Intervention included (1) two "patient navigators" to assist patients in obtaining a colonoscopy, providing continuity between departments as patients navigated the system; (2) new DERS to allow PCP to refer patients directly for colonoscopy; and (3) GI suite enhancements to improve operational efficiency (e.g., more colonoscopies, efficient colonoscope cleaning, more nurses in procedure rooms)	Societal, independent increase in colonoscopy happening at same time; other cointerven-tions (e.g., public information at same time) also possible	↑ Patient navigation (due to reduced broken appoint-ments)	Broken colonoscopy appt rate decreased from 67.2% before intervention to 5.3% after intervention. The broken appointment rate started immediately after patient navigators hired and before DERS was in place.
Pham et al., 2005[127] Cross-sectional, retrospective, national Physician survey and Medicare claims data, 2000-2001 N = 3,660 physicians and 24,581 patients Fair	One-year rates of colonoscopy or FS, excluded FOBT because claims data not reliable	Patient characteristics (e.g., age) from Medicare file, some patient variables (e.g., income) from zip code data Physician and practice characteristics from CTS physician survey, focus on primary care physicians Practice characteristics	Patient comorbidity, individual income and other demographic and education factors; doctor-patient interaction factors; managed care practice factors	No associations found	No statistically significant association between CRC screening among patients cared for by physicians in different practice types (e.g., medium/large group vs. solo/two-person group: AOR, 1.12 [95% CI, 0.90-1.38]). Patients cared for by physicians with access to reminders were not more likely

Table 29. Studies of the association between system level factors and CRC screening (continued)

Author, Year, Study Design, Population, Setting, Sample Size, Quality	Primary Outcomes	Independent Variables of Primary Interest	Potential Confounders	Association of Variables to CRC Screening*	Results
Pham et al., 2005[127] (continued)		including use of computerized physician reminders, size and type of the practice			to have been screened: 5.8% with reminders vs. 5.9% without reminders (adjusted AOR, 0.96 [95% CI, 0.84-1.09]).

CI, confidence interval; CRC, colorectal cancer; CTS, Community Tracking Study; DERS, Direct Endoscopic Referral System; FFS, fee-for-service; FOBT, fecal occult blood test; GI, gastrointestinal; MCA, managed care activity; N (n), number; AOR, adjusted odds ratio; PCP, primary care physician; SES, socioeconomic status; US, United States; VA, Veterans Administration; vs., versus; MCA, managed care; CHC, county health center; PPO, private physician offices.
* Arrow symbols (↓or ↑) are provided as a quick reference point of overall findings and represent the association reported between each variable and CRC screening.

Two other studies found what appears to be moderate increases in CRC screening associated either with higher levels of managed care activity in the area[139] or with a higher level of autonomy over the internal structure of the practice.[110] Although both findings were statistically significant, determining the exact strength of the association in these studies is difficult because they did not provide absolute screening rates.

Use of patient reminders was associated with a higher level of CRC screening in one study (39.9 percent versus 19.6 percent).[143] However, the availability (rather than the use) of computerized physician reminders was not associated with a higher screening rate after adjustment for practice size and patient covariates.[127]

In addition, one study found that smaller practices (within a group of large practices) were associated with higher screening rates (although absolute rates were not given).[110] After adjusting for other patient and physician covariates, investigators on another study found no association between practice size among smaller practices (solo/two-person group practice versus larger group practice) and CRC screening (5.9 percent versus 5.8 percent 1-year screening rates).[127] The final study found higher endoscopy screening rates among patients of private physician offices compared to those receiving care in the same geographic region through county health centers ($P < 0.001$).[66] This study also found that patients of county health centers were more likely to cite no physician recommendation as a barrier to endoscopy when compared to patients of private physician offices ($P = 0.02$).[66]

Summary

We categorized studies examining factors associated with the use of CRC screening tests into five domains: 1) patient factors, 2) physician factors (including physician characteristics, physician-patient connectedness, and physician recommendations about screening), 3) patient-physician communication factors, 4) the periodic health examination, and 5) system level factors. We further categorized the patient factors into four groups: patient demographics, access to care, personal health or risk factors, and psychosocial factors.

All included studies focused on factors associated with underuse of CRC screening. None focused on factors associated with underuse of CRC discussions or on factors associated with overuse or misuse of CRC screening.

Several factors are consistently and significantly associated with reduced CRC screening (i.e., $P < 0.05$ or confidence intervals that do not overlap or include 1.0). They include:

- Low household income
- No health insurance
- Being Hispanic or Asian
- Not being acculturated into the United States
- Limited access to care (i.e., lack of a regular source of primary care and no visits in previous year to provider), and
- No physician recommendation to be screened.

Factors positively associated with CRC screening include having private insurance, being non-Hispanic white, higher education level, participating in regular screenings for other cancers, having a family history of CRC or personal history of another cancer, having regular access to care, having effective provider-patient communication, or physician recommendation. We found one study each that examined the association between screening and specific physician characteristics, physician-patient connectedness, and use of periodic health examinations. Thus, insufficient evidence exists to draw conclusions about these relationships. Studies on system level factors that might influence CRC screening did not consistently measure the same variables but seem to support counseling by nonclinicians, reminder systems, and assisting patients to keep appointments.

KQ 3: Which Strategies Are Effective In Increasing The Appropriate Use Of Colorectal Cancer Screening And Followup?

KQ 3 focuses on the evidence on effectiveness of strategies that have attempted to increase appropriate CRC screening and followup. Therefore, all included studies measured the outcome of CRC screening and/or followup rates; one also included the outcome of a discussion with a provider about screening.

We classified strategies into those that targeted the patient, the provider, the health system, and/or the community. We identified and included 15 studies that targeted the patient,[85,174-187] 2 that targeted the provider,[186,188] and 5 (six manuscripts) that targeted the health care system.[162,189-193] (Some studies had more than one focus.) We found no RCTs of either fair or good quality that tested interventions implemented within a community. Of these 21 studies in all, one focused on appropriate followup after an abnormal screening;[188] the others focused only on increasing screening rates.

We present only those studies that we rated as fair or good quality. Common reasons that we rated studies as poor quality included a combination of issues. For example, the randomization process was not explained, was difficult to determine, or was not blinded to the provider; the response rate was low (< 60 percent); the investigators used nonstandard instruments or outcome measures to assess screening or followup rates; and/or the comparison samples were dissimilar on key characteristics at baseline.

Our overall summary and strength of evidence tables for studies addressing this KQ are presented at the beginning of this section. The remainder of this section provides, first, an overview of studies of patient-level interventions. We then consider the two studies of a provider-level intervention[186,188] and the five studies of a system-level intervention.[162,189-193]

KQ 3 Overall Summary and Strength of Evidence

In the tables that follow, our overall grades of the strength of evidence appear in the far right column; grades for key domains to determine the strength of evidence are in the intermediate columns. Table 2 (Chapter 2) defined terms used to describe the strength of evidence; these definitions can also be found in the glossary for this report.

We included 21 RCTs, rated good or fair quality, of interventions designed to increase CRC screening. These included 15 studies that targeted the patient,[85,174-187] 2 that targeted the provider,[186,188] and 5 (including two manuscripts of the same study) that targeted the health care system.[162,189-193]

Following categories similar to those recently used to develop recommendations by the Task Force on Community Preventive Services (TFCPS) on CRC screening,[194] we divided the types of studies of interventions targeting patients into five categories: (1) patient reminders;[175,182-183,186] (2) small media (with[177-178,181] and without[174-176,185] decision aids); (3) group education;[184-185] (4) one-on-one interaction;[85,179-180] and (5) reducing structural barriers.[85,175,179,183,186-187] Much like recommendations for the Guide to Community Preventive Services,[194] these studies include five that have more than one type of intervention.[85,175,179,183,185] For each of these, we categorized them into more than one type of intervention in determining the strength of evidence and presenting the overall findings in the following sections. When possible, we attempted to evaluate the incremental contribution of each component separately. However, for most studies, the effect of all the components was evaluated collectively, such that findings were not presented by authors in a way that allowed us to assess the incremental impact of adding each component. Across these 15 RCTs focused on patient-level interventions, the range of increases in screening was 0 percent to more than 40 percentage points.[85,174-187]

As shown in Table 30, we found high strength of evidence that interventions that provide patient reminders lead to small to moderate increases in screening (percent increases ranged from 5.0- 15 percentage points).[175,182-183,186] We also found high strength of evidence that of small media, such as delivery of education videos or brochures to patients before being seen by a physician or in the mail through a church registry list, have little to no impact on screening rates.[174-176,185] Use of decision aids, delivered via small media, was less conclusive. Although we recognize that not all decision aids are equal, with some designed to be more interactive with patients than others, we found the evidence to be mixed in terms of how effective they are in increasing screening (rate change in percentage points from 3 percent [$P = 1.0$[181]] to 14.2 percent[177] and 23 percent[178]). For this mixed evidence, with two of three studies showing benefit, we concluded that the strength of evidence is low (because of the inconsistent results) that some types of decision aids are effective for increasing screening. We identified two studies examining the impact on CRC screening rates of group education delivered either by Native Hawaiians among Native Hawaiians[184] or by African Americans for their fellow church members on the need for testing.[185] These studies demonstrated mixed effects; one showed a negative finding on the impact of the intervention on screening[184] and another finding a borderline positive effect ($P = 0.08$),[185] we concluded that the strength of evidence is low for this intervention type. The two remaining categories of patient level interventions (one-on-one interventions and eliminating barriers) both provided high strength of evidence that they yield an increase in screening rates. The interventions designed to provide one-on-one interactions, through either a nurse, or health educator,[85,179] or on the phone,[180] hold promise in their ability to increase CRC screening, with

Table 30. Effect of patient-level interventions on CRC screening rates

Number of Studies; # of Subjects	Risk of Bias Design/ Quality	Consistency	Directness	Precision	Results	Overall Strength of Evidence
Patient Reminders						
Denberg et al., 2006[182] Myers et al., 2007[175] Church et al., 2004[183] Sequist, et al., 2009[186] 4: 25,442	Low 4 RCTs/ 1 Good, 3 Fair	Consistent	Direct	Precise	Patient reminders are effective vs. no intervention (5.0 - 15 percentage point increase in screening rates).	High
Small Media (only)						
Zapka et al., 2004[174] Myers et al., 2007[175] Costanza et al., 2007[176] Campbell, et al., 2004[185] 4: 5,245	Low 4 RCTs/ 1 Good, 3 Fair	Consistent	Direct	Precise	Small media (i.e., providing education to patients without specific decision aids) do not seem to be effective.	High
Small Media/Decision Aids						
Ruffin et al., 2007[178] Dolan and Frisina, 2002[181] Pignone et al., 2000[177] 3: 518	Low 3 RCTs/ 1 Good, 2 Fair	Inconsistency present	Direct	Imprecise	Mixed results such that 2 of 3 studies found decision aids to be beneficial versus no or limited interventions (14 - 23 percentage point increase in screening rates reported in the two positive studies).	Low
Group Education Interventions						
Braun, et al., 2005[184] Campbell, et al., 2004[185] 2: 409	Low 2 RCTs/ 2 Fair	Consistent	Direct	Imprecise	Group education interventions were not more effective than comparisons for increasing screening rates.	Low
One-on-one Interventions						
Basch et al., 2006[180] Stokamer et al., 2005[85] Tu et al., 2006[179] 3: 1,545	Low 3 RCTs/ 1 Good, 2 Fair	Consistent	Direct	Precise	One-on-one interactions were effective in increasing CRC screening rates (14.6 - 41.9 percentage point increase).	High
Eliminating Barriers						
Tu et al., 2006[179] Stokamer et al., 2005[85] Myers et al., 2007[175] Church et al., 2004[183] Potter, et al., 2009[187] 5: 4304	Low 5 RCTs/ 2 Good, 3 Fair	Consistent	Direct	Precise	Eliminating barriers for increasing CRC screening was effective vs. no intervention (14.6 - 41.9 percentage point increase in any CRC test use).	High

CRC, colorectal cancer; RCT, randomized controlled trial.

percentage point increases ranging from 14.6 percent in FOBT completion,[85] 20.9 percent of any CRC test through repeated telephone counseling, and 41.9 percent in FOBT completion through an intervention provided by a bi-lingual health educator.[179] Those designed to eliminate barriers by providing FOBT tests to use at home or providing access to individuals who can help to address barriers were also shown to be effective in increasing screening rates (rate change from 14.6- 41.9 percentage points).[85,175,179,183,187]

We also address discussions with providers as an outcome for KQ 3 and found one study that presented findings specific to increases in this outcome (Table 31).[177] These investigators reported 25.1 percent increase in discussions (Table 31), but with only one study we concluded that there is low overall strength of evidence for patient-level interventions to increase discussions with providers.

Table 31. Effect of patient-level intervention on discussions with providers

Number of Studies; # of Subjects	Risk of Bias Design/Quality	Consistency	Directness	Precision	Results	Overall Strength of Evidence
Pignone et al., 2000[177] 1: 651	Low 1 RCT/ 1 Fair	Consistency Unknown (single study)	Direct	Imprecise	One study favored use of small media with or without decision aids vs. no intervention in increasing discussions with providers (25.1 percentage point difference).	Low

RCT, randomized controlled trial.

In addition to the 15 studies of patient level interventions, we included 2 studies on provider level interventions (Table 32).[186,188] One study on provider-level interventions sent reminders to physicians who had patients in need of surveillance colonoscopies;[188] the other study used electronic reminders during patient office visits to increase ordering of the tests.[186] The first study favored providing reminders to physicians to increase surveillance colonoscopies, but the other found no difference between CRC screening rates of patients whose providers received reminders or not ($P = 0.47$).[186] We rated the strength of evidence as low because the included studies tended to indicate no benefit in provider reminders in increasing screening.

Table 32. Effect of provider-level interventions on CRC screening rates

Number of Studies; # of Subjects	Risk of Bias Design/Quality	Consistency	Directness	Precision	Results	Overall Strength of Evidence
Ayanian, et al., 2008[188] Sequist, et al., 2009[186] 2: 251 physicians: 22,630 patients	Low 2 RCTs/ 2 Good	Inconsistent	Direct	Imprecise	Mixed results such that 1 study found a slight increase in surveillance colonoscopy and another study found no difference in CRC screening among patients whose provider received reminders.	Low

RCT, randomized controlled trial; CRC, colorectal cancer.

The five studies (six articles) on system-level interventions[162,189-193] implemented changes to improve referral of patients for screening[190-192] or identified a person such as a patient navigator[189] or someone in a similar role (i.e., Prevention Care Manager or PCM)[162,193] to help patients navigate the health care system (Table 33). Their findings indicated that this intervention may provide promising effects on increasing CRC screening.

The 21 studies identified as eligible for this KQ represented a small fraction of all studies reporting on interventions designed to improve CRC screening. These other (ineligible) studies were not conducted as a RCT design, provided a limited description of the intervention, or used untested or unvalidated measures in assessing outcomes.

Table 33. Effect of system-level interventions on CRC screening rates

Number of Studies; # of Subjects	Risk of Bias Design/ Quality	Consistency	Directness	Precision	Results	Overall Strength of Evidence
Jandorf et al., 2005[189] Dietrich, et al., 2007[162] Roetzheim, et al., 2004[190] Roetzheim, et al., 2005[191] Ling, et al.., 2009[192] Dietrich, et al., 2006[193] 5: 9445	Low 5 RCTs/ 5 Fair	Consistent	Direct	Precise	System- level interventions are effective in increasing CRC screening vs. no intervention (7%-28.2% difference in screening rates).	High

RCT, randomized controlled trial; CRC, colorectal cancer.

Patient Interventions

Study characteristics. Following categories similar to those that the TFCPS used to develop CRC screening recommendations,[194] we divided the types of studies of interventions targeting patients into five categories: (1) patient reminders;[175,182-183,186] (2) small media (with[177-178,181] and without[174-176,185] decision aids); (3) group education;[184-185] (4) one-on-one interaction;[85,179-180] and (5) reducing structural barriers.[85,175,179,183,187] Table 34 Shows which studies employed which types of interventions; following this section and overview of results, we consider each kind of intervention in turn.

Patient reminders can be in the form of written materials such as postcards, letters, or other materials used to remind or alert patients of their need for CRC screening. Reminders can also be provided through telephone contacts with patients who are due for screenings. These reminders, when used as an intervention, are provided to patients who are due for a rescreening or who have never been screened; they are not reminders of an upcoming appointment that is already scheduled. Patient reminders are thought to be a means of effectively prompting people about their need for annual screening (or for screening related to whatever period recommended for the patient); the idea is that if patients are not scheduled to see a provider, they will initiate an appointment in order to remain current on cancer screening tests.

Small media interventions focus on providing respondents with educational materials; they can include videos and printed materials such as letters, brochures, and newsletters that are provided to patients explicitly to educate them about the disease under study (i.e., colorectal cancer), their risks for being diagnosed with the disease, and screening tests that are available. These materials are termed “small media” because they rely on mail, telephone, or distribution of

Table 34. Patient-level studies by category of intervention

Included Articles with Patient-Level Interventions	Patient Reminders	Small Media to Provide Education		Group Education	One-on-one Interactions	Reducing Structural Barriers
		Education Materials and Messages	Decision Aids			
Basch et al., 2006[180]					•	
Braun, et al., 2005[184]				•		
Campbell, et al., 2004[185]		•		•		
Church et al., 2004[183]	•					•
Costanza et al., 2007[176]		•				
Denberg et al., 2006[182]	•					
Dolan et al., 2002[181]			•			
Myers et al., 2007[175]	•	•				•
Pignone et al., 2000[177]			•			
Potter, et al., 2009[187]						•
Ruffin et al., 2007[178]			•			
Sequist, et al., 2009[186]	•					
Stokamer et al., 2004[85]					•	•
Tu et al., 2006[179]					•	•
Zapka et al., 2004[174]		•				

education materials. They are not educational media campaigns that would be provided through television advertisements and public service announcements (PSAs); neither are they national media campaigns such as the one conducted by the Centers for Disease Control and Prevention (CDC) called "Screen for Life," which uses PSAs on national TV stations to educate people about the need for cancer screening tests. Both the small media method of educating the public, as well as the large media campaigns, can be used to inform and motivate people to be screened for cancer and can be tailored to specific individuals or target general audiences.

We included in this category the three studies that tested aids in helping patients to make informed decisions (i.e., decision aids). Decision aids are mechanisms or interventions that have been developed to improve communication between health professionals and patients; their goal is to help involve patients in making decisions regarding their health care. Decision aids can include brochures, videotapes, or interactive computer programs.

Group education interventions are those conducted within a specified group setting and deliver information or motivation to encourage screening. Although these interventions often include handing out information or materials, we categorized studies that included this intervention as group education because they also provided a setting in which an individual was present to interact with the audience.

One-on-one education includes studies in which a provider (e.g., physician, nurse, health educator) works individually with patients to educate them about CRC screening and/or aid them in making decisions about which tests to complete and when to receive screening. These interventions tend to include some concentrated time with a patient to answer questions, address concerns, and help facilitate completion of screening tests. Studies included in this category provided this one-on-one education either by telephone[180] or in person.[85,179]

The final category includes studies that address reducing or eliminating structural barriers to screening. Many problems can make it difficult for people to seek screening for cancer. Barriers can include distance from screening location, limited hours of operation, no day care for children, limited access to screening tests, and language and cultural factors. These types of

interventions seek to increase screening by removing structural barriers. In this category, we included studies that tested the provision of FOBT tests through the mail, either alone[183] or in combination with an intervention that also addressed language and cultural barriers that may be barriers to screening among Japanese Americans.[179]

Overview of results. A total of 15 articles examined the impact of various interventions targeting the patient in an attempt to increase CRC screening.[85,174-187] All 15 focused on screening, not followup. All studies also partially addressed the "appropriate" use of screening by using the criteria for screening guidelines as "inclusion" or "exclusion" criteria (e.g., no FOBT in prior 12 months, no prior CRC diagnosis) in the sample. Seven studies[174-179,187] had an upper age limit (from 70 to 79 years) for their studies; eight did not.[85,180-186] This feature raises the issue of potentially inappropriate screening for older people. Three studies relied only on self-reported frequency of CRC screening,[178,183,185] which has been shown to overestimate screening rates.

Among these studies, four presented findings of an intervention to provide patient reminders, seven focused on the use of small media (e.g., video, letters) to educate patients about the need for screening and/or types of tests available or to help their decisionmaking process, two presented findings from group education interventions, and three focused on interventions that provided one-on-one interactions either by phone on in person to increase screening.

Five studies addressed barriers to screening by providing FOBTs to patients (i.e., by mail or in health clinics) who were due for screening. One of these implemented an intervention that also addressed cultural and language barriers.[179]

The impact of these interventions on CRC screening rates ranged from 0 percent to 41.9 percent when the intervention groups were compared with the control groups. Studies that examined the use of educational materials presented via small media[174-176,185] had no impact on screening rates (increase of 0 - 15.1 percentage point change [$P = 0.08$ for study with highest percentage change]); those that provided means for eliminating structural barriers, such as access to CRC screening tests or language barriers,[85,175,179,183,187] demonstrated the highest impact on screening rates overall (14.6 to 41.9 percentage point change). Those that used decision aids delivered to patients through small media had mixed results; two studies demonstrated an overall increase in CRC screening (14.2 to 23 percentage point change)[177-178] and the other demonstrated only a 3 percentage point increase in CRC screening.[181] Interventions that provided patient reminders in the mail or over the telephone had an impact on screening using any CRC test ranging from 5.4 percent to 11.7 percent and 15 percent.[175,182-183,186] Two studies tested an education intervention in a group setting and found no difference in screening rates among their samples.[184-185] Only one study measured increases in discussions between the patient and providers as an outcome of their intervention, reporting a 25.1 percent increase in discussions among patients in the intervention group compared with those in the control group.[177]

Patient reminders. *Study characteristics.* Four RCTs, one rated as good quality[186] and three rated as fair quality, [175,182-183] focused on testing reminders mailed to patients due for screening (Table 35). One study used usual care as a comparator; it involved a mailed reminder (brochure) sent to patients who had been referred for a screening colonoscopy after an appointment at a primary care practice.[182] Another study randomized subjects into one of four groups:[175] one group received a mailed standard intervention (Group 1: SI) that included an informational booklet and FOBT kit; a second group received a tailored intervention (Group 2: TI) that included the SI package plus tailored "message pages" of brief messages that addressed personal barriers to screening; a third group (Group 3: TIP) included the TI package plus a reminder telephone call; and the fourth was a control group. All three intervention groups received either a letter or a telephone call as a reminder to complete the FOBT. The intervention groups then

varied on the type of additional education materials they received or the type of contact that was made, such that G3 is the only group that received phone calls. These three groups were compared with a sample of patients who received usual care.

Table 35. Studies of patient reminders on increasing colorectal cancer screening rates

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results (95% CI)
Sequist et al., 2009[186] RCT, 15-month followup 11 Ambulatory Health Care Centers in Massachusetts N= 110 physicians, 21,860 patients Good	Compare the individual and joint impact of personalized mailings to patients and electronic reminders to primary care physicians to promote colorectal cancer screening within a multisite group practice	G1: Patients were mailed a package to remind them of need for CRC screening that included a FOBT kit, letter and pamphlet, and a telephone number they could call to make an appointment for endoscopy (n=10,930) G2: Usual care for patients (n=10,930) G3: Providers were given electronic reminders during office visits that patients were overdue for screening (n=55 or 10,912 patients) G4: Usual care such that providers received no reminders (n=55 or 10,948)	G1: 25.4% FOBT completion; 44% completed any CRC test G2: 20.4% FOBT completion (*P* < 0.001); 38.1% completed any CRC test (*P*< 0.001) G3: 41.9% completed any CRC test G4: 40.2% completed any CRC test (*P*=0.47) Interaction effect between the patient and provider interventions was small and not statistically significant (-0.6%; 95% CI, -1.2%- 0.1%; *P* = 0.08)
Church et al., 2004[183] RCT, 1 year Residents, 50 years of age or older, of Wright County, Minnesota N = 1,255 Fair	Test direct mailing of FOBT kits with and without reminders to general population	G1: (no reminders) Questionnaire mailed plus FOBT kit and instructional brochure (n = 434) G2: (reminders) Same package as G1, plus telephone reminders (n = 404) G3: Questionnaire only (n = 417)	G1: 16.9% FOBT completion rate (95% CI, 11.5-22.3%); 13.2% for any CRC test (95% CI, 8.4-18.2%) G2: 23.2% FOBT completion rate (95% CI, 17.2-29.3%); 14.1% for any CRC test (95% CI, 9.1-19.1%) G3: 1.5% FOBT completion rate (95% CI, -2.9-5.9%); 7.8% for any CRC test (95% CI, 3.2-12.0%)
Denberg et al., 2006[182] RCT, 4 months Primary care practices is there a city/state? N = 781 Fair	Test whether a mailed brochure after referral for screening colonoscopy will increase colonoscopy completion	G1: Follow-up mailing of educational brochure within 10 days after a primary care visit where a screening colonoscopy was recommended (n = 386) G2: Usual care (n = 395)	G1: 70.7% colonoscopy completion rate G2: 59% colonoscopy completion rate (11.7 percent point difference; 95% CI, 5.1-18.4%; *P* = 0.001)

Table 35. Studies of patient reminders on increasing colorectal cancer screening rates (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results (95% CI)
Myers et al., 2007[175] RCT, 2 years Primary practice patients in Philadelphia, Pennsylvania N = 1,546 Fair	Test whether targeted and tailored message delivery, both by mail and via phone outreach, will improve CRC screening rates	G1: "Standard Intervention" (SI) of mailed letter, information booklet, FOBT kit, and reminder letter (n = 387) G2: Standard intervention package plus 2 "tailored message pages" (TI) (n=386) G3: SI plus TI, and a reminder phone call (TIP) by an educator (n=386) G4: (control) Usual care (n = 387)	G1: 46% completion rate for any test (AOR, 1.7; 95% CI, 1.2-2.5) G2: 44% (AOR, 1.6; 95% CI, 1.2-2.1) G3: 48% (AOR, 1.9; 9.5% CI, 1.4-2.6) G4: 33% (*P* NR)

CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; G, group; N, sample size; NR, not reported; AOR, adjusted odds ratio; *P*, significance/probability of finding; RCT, randomized controlled trial.

Another study mailed packages of a letter, pamphlet, and FOBT kit to patients of an ambulatory health care center who were due for CRC screening and compared these patients with others who received usual care.[186] The fourth study randomized residents in a local community to mailed FOBT kits without reminders (G1), mailed FOBT kits with telephone reminders (G2), or a questionnaire about CRC (G3: control group).[183] Because both G1 and G2 of this study provided mailed FOBT kits to a random sample of local residents, the differences between these two groups reflects the impact from telephone reminders to complete the FOBT.

Three studies focused on patients 50 years of age or older; one study limited its intervention to persons 50 to 80 years.[186] The times for followup varied: within 4 months of the initial referral for colonoscopy screening;[182] 6 months of the original mailing and 1 year to measure completion rates;[183] 15 months after the initial mailing;[186] or 24 months after the initial visit to their provider.[175] The three studies focusing on populations recruited through a provider setting measured their outcomes through medical chart review;[175,182,186] the fourth study with a randomized sample of residents relied on self-reported screening for their outcomes.[183]

Overview of results. All four studies found statistically significant increases in CRC screening rates, with absolute increases in screening from about 5.9 percentage points to about 15 percentage points. The colonoscopy study found an increase in completed colonoscopy from 59.0 percent in the control group to 70.7 percent in the intervention group (difference: 11.7 percentage points; 95% CI, 5.1 -18.4 percentage points).[182] The tailored intervention study found an increase in any CRC screening for all three intervention groups compared with controls (33 percent control versus 46 percent, 44 percent, and 48 percent; OR, 1.7; 95% CI, 1.3-2.5; OR, 1.6; 95% CI, 1.2-2.1; OR, 1.9; 95% CI, 1.4-2.6), but no difference among the interventions.[175] In the TIP group, 28 percent did not receive a telephone call. The study providing FOBT kits to patients of ambulatory care centers found that those who received mailings were more likely to obtain screening than those who did not (44.0 percent versus 38.1 percent, respectively, $P < 0.001$).[186] The population-based study that mailed FOBT kits to the intervention groups and followed them either with or without reminders reported an increase in completion of any CRC screening of 7.8 percent (95% CI, 3.2-12.0 percent) for the control group, 13.2 percent (8.4-18.2 percent) for the FOBT without reminders group, and 14.1 percent (9.1-19.1 percent) for the FOBT with

reminders group.[183] The difference between FOBT with reminders and controls was statistically significant. Overall baseline adherence to any CRC screening was 55.8 percent; the final adherence rate for any CRC screening was above 60 percent for the intervention groups, although these rates were self-reported. The primary care and population-based studies showed little increase in screening with increased intensity of intervention.[175,183]

Detailed results. The one study using only mailed patient reminders provided a brochure about CRC tests for patients who had been referred for a screening colonoscopy.[182] Patients in the intervention group were mailed the information brochure within 10 days of referral for the colonoscopy. Each brochure included the primary care physician's name, encouraged patients to schedule the procedure, and explained CRC and polyps, the risks of being diagnosed with CRC, the nature of bowel preparation, alternative screening tests, and the complication risks of colonoscopy. Those patients assigned to the control group had been referred for screening colonoscopy as well but received no reminder. The findings indicated that patients receiving the reminders were more likely to complete the test (within the 4-month follow-up period) than those who did not (11.7 percentage point difference; 95% CI, 5.1-18.4 percentage points; $P = 0.001$).

The second study examined three different types of interventions, all with varying intensity, and compared them with a control group that received usual care and none of the study intervention contacts.[175] In the standard intervention (G1), patients were mailed a package that included a CRC screening invitation letter, information booklet, FOBT kit, and reminder letter. The package also included instructions for completing a home FOBT and on arranging for a flexible sigmoidoscopy (FS). The TI patients (G2) received the SI package and two tailored message pages, which addressed personal barriers to FOBT and FS that were identified through analysis of baseline survey data collection. TIP patients (G3) received the SI and TI information and a telephone reminder to conduct the FOBT. During these telephone calls, a trained health educator reviewed the mailed materials and encouraged participants to consider screening. Although the investigators did find that groups that received some form of reminder were more likely to complete screening than those who received usual care ($P = 0.001$ or 0.002), they did not find differences among the intervention groups to indicate whether patients who received mail or telephone reminders (SI: AOR, 1.7; 95% CI, 1.3-2.5; TI: AOR, 1.6; 95% CI, 1.2-2.1), or a combination of the two (TIP: OR, 1.9; 95% CI, 1.4-2.6) were any more likely than any other to be screened.

The third study conducted in a clinic setting identified patients through their medical record system who were overdue for CRC screening (N = 21,860).[186] Patients ages 50 to 80 years were randomly selected to receive a package that included (1) a letter from the chief medical officer explaining that the patient is overdue for screening; (2) an educational pamphlet explaining the screening test options; (3) FOBT kit with instructions; and (4) a telephone line dedicated to having patients call to make endoscopy appointments. A second mailing was sent to nonrespondents at 6 months. Patients who received the mailing were more likely than the control group to complete a FOBT (25.4 percent versus 20.4 percent, respectively; $P < 0.001$) or any CRC test (44.0 percent versus 39.1 percent, respectively; $P < 0.001$).

The fourth study tested receipt of reminders versus no reminders and compared both with a control group.[183] The study identified a random sample of residents in Wright County, Minnesota, who were determined to be 50 years of age or older based on records from the Minnesota State Driver's License and Identification Card database. The sample was divided into three groups: the control group (Group 3) and two intervention groups that both received informational packages but differed in terms of whether they received telephone reminders for testing (Group 2) or not (Group 1). All three groups were mailed an initial survey on CRC and then either received no additional information until the follow-up survey in 1 year (Group 3) or

received a package of information approximately 2 months after the questionnaire that included an FOBT kit with instructions and educational material about CRC and screening test. Group 2 individual who did not return FOBT kits were mailed reminder letters 1 month later that included another FOBT kit and then, if they had still not returned an FOBT, they received a telephone call 1 month later. Of those in the "no reminder" group (Group 1), 49.6 percent of the participants accidentally received the first reminder letter with no further contact. They did not receive any of the subsequent reminders (i.e., two more mailings and telephone calls). The authors did not report the number of respondents in Group 2 who had been called Although the study did report self-reported completion of any CRC test, the findings specific to reminders demonstrated an overall increase of 6.3 percent in completion of FOBT for Group 2 received telephone reminders (received reminders: 23.2 percent FOBT completion rate; 95% CI, 17.2-29.3 percent) and Group 2 (no reminders: 16.9 percent FOBT completion rate; 95% CI, 11.5-22.3 percent).

Small media interventions. Seven RCTs were patient-directed small media interventions; that is, these studies that used various tools such as print materials or telephone calls to provide education to a targeted sample. We divided this set of studies into two categories: (1) four studies that focused on small media interventions that were not decision aids[174-176,185] and (2) three studies of decision aids.[177-178,181]

Small media: educational materials and messages. *Study characteristics*. As shown in Table 36, one study in this category was rated as good quality[174] and three were rated as fair quality.[175-176,185] The populations targeted for all four studies were at average risk for CRC and met recommendations for screening tests. All four studies focused on those 50 years or older.[174-176,185] The populations in three studies were recruited from primary care practices, and patients in each of the control groups were receiving usual care. Because these were patients already receiving care from a physician, "usual care" was defined as people who received none of the interventions.[175-176] The fourth study recruited church members from predominantly African-American churches located in rural areas of one state and compared their intervention with those in churches whose members received education on unrelated health topics.[185] Participants of two of the studies were predominantly non-Hispanic white;[174,176] the third primary care study included 39 percent multiracial (race unspecified) participants from an urban center,[175] and the fourth study included only African Americans.[185] Two interventions focused on mailing educational materials, followed by telephone contact;[175-176] the third intervention consisted of a mailed 15-minute videotape,[174] and the fourth intervention included a combination of print and video materials that were mailed at 2-month intervals over the 9-month intervention period.[185] The timing for measuring outcomes ranged from 6 months[174] to 24 months.[175] Three studies measured their outcome of receiving any CRC test by reviewing medical charts;[174-176] the fourth measured CRC screening through self-reported responses.[185]

Overview of results. The four studies that did not deal with decision aids demonstrated consistent findings with regard to education materials and information provided to patients via small media: such interventions had no influence on CRC screening rates that was found to be statistically significant (0 percent to 15.1 percentage point differences in rates among intervention and control groups across studies).

Table 36. Studies of small media: Educational materials and messages on increasing colorectal cancer screening rates

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results
Zapka et al., 2004[174] RCT, 6 months Primary care practices in central Massachusetts N = 938 Good	Test the effect on CRC screening of an educational video mailed to patients' homes before a physical examination	G1: Patients scheduled for an upcoming physical examination received a video in the mail prior to appointment (n = 450) G2: Usual care (n = 488)	G1: 55% overall screening rate G2: 55% screening rate
Campbell et al., 2004[185] RCT, 1 year follow-up African-American churches in rural North Carolina N = 287 (50 years or older) Fair	To test an intervention to improve multiple health behaviors among rural African American church members	G1: TPV materials distributed to church members via mail (n= 76) G2: LHA trained within experimental churches to provide CRC information through existing networks (n=51) G3: Combination of TPV and LHA (n=87) G4: Speakers came to churches and offered educational workshops on a variety of topics (e.g., HIV/AID); provided members education materials (n=69)	G1: 36.8% received FOBT test; 21.1% received another CRC test G2: 33.3% received FOBT test; 25.5% received another CRC test G3: 31.0% received FOBT test; 14.9% received another CRC test G4: 21.7% received FOBT test; 27.5% received another CRC test Differences in group are not statistically significant (p=0.08 for FOBT, NR for 'other' tests; only 'ns' noted).
Costanza et al., 2007[176] RCT, 17-22 months Primary care practice in Massachusetts N = 2,448 Fair	Test stage-based computer-assisted tailored telephone counseling to promote CRC screening in a primary care population.	G1: Mailed brochure followed by computer-assisted stage-based telephone counseling (n = 1,187) G2: Usual care (n = 1,261)	G1: 25% completed any CRC test G2: 24% completed any CRC test (*P* = 0.68)
Myers, et al., 2007[175] RCT, 2 years Primary practice patients in Philadelphia, Pennsylvania N = 1,546 Fair	Test targeted and tailored message delivery, both by mail and via phone outreach	G1: "Standard Intervention" (SI) of mailed letter, information booklet, FOBT kit, and reminder letter (n = 387) G2: Standard intervention package plus 2 "tailored message pages" (TI) G3: SI plus TI, and a reminder phone call (TIP) by an educator G4: (control) Usual care (n = 387)	G1: 46% screening rate (AOR, 1.7; 95% CI, 1.2-2.5) G2: 44% (AOR, 1.6; 95% CI, 1.2-2.1) G3: 48% (AOR, 1.9; 95% CI, 1.4-2.6) G4: 33% (*P* NR)

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; G, group; HIV/AIDs, human immunodeficiency virus/acquired immune deficiency syndrome LHA, lay health advisor; FOBT, fecal occult blood test; N, sample size; NR, not reported; ns, not significant; RCT, randomized controlled trial; SI, standard intervention; TI, tailored intervention; TPV, tailored print and video.

For one study, determining the increase in screening specific to the educational materials was somewhat challenging.[175] It included multiple strategies; the primary difference between the control group and the three intervention groups was that all the intervention groups received both an FOBT kit and some type of reminder to complete the test (either by letter or by letter and telephone). The differences between the three intervention groups are in the type of small media used to influence completion of CRC testing. These three groups did not differ in terms of completion of CRC screening for patients who received print material only compared with those who got print materials plus telephone reminders (2 percentage point difference in screening rates).[175]

The other two studies also had no effect on screening rates (0-1 percentage point difference in control and intervention groups).[174,176]

Detailed results. One good-quality study explored the effect of mailing an educational video to patients' homes just before they had an appointment for a physical examination.[174] The research team mailed a letter to potential participants who were 50 to 74 years of age and had an appointment with their primary care provider in the next 3 weeks. After conducting a baseline interview with all interested patients, they randomly assigned patients to receive an educational video through the mail or to usual care (i.e., no video). The 15-minute video included information to encourage discussion with their provider about CRC screening and increase the use of screening, particularly by FS. The mailed package with the video also included a letter encouraging the patient to view the video. After the video was mailed, the patients were interviewed by telephone between 4 and 6 months after the primary care appointment to determine whether they had obtained screening. This study reported no difference in screening rates among the intervention and control group participants (55 percent for both groups).

Another study involved rural churches in North Carolina with high proportions of African-American members.[185] The study aims included improving nutrition and physical activity, but those participating who were age 50 years or older were also encouraged to obtain CRC screening. The intervention included two components: a tailored communication to select church members randomly and another that involved group education provided by a lay health advisor. We categorized this study into both small media and group education interventions.

For the small media component of the intervention, individual computerized materials were developed based on information obtained through a baseline survey administered to all participants. The tailored package of information included newsletters along with four targeted videotapes mailed to participants' homes. These packages were mailed bi-monthly during months 2, 4, and 6 of the intervention; the fourth mailing occurred during month 9. The videotapes included testimonials from community members and pastors on each of the targeted behaviors of the intervention. Participants in this group were compared with those attending churches in the control group, each of which were offered health education sessions and speakers on topics of their choice not directly related to the study objectives. The second component of group education by lay health educators is described under that intervention type. Members of control churches were no more likely to obtain CRC screening than those who received tailored education ($P = 0.08$).

A fair-quality study used telephone counseling to attempt to increase CRC screening; the investigators initiated contact with patients by first mailing a baseline survey to potential participants who were active patients of primary care practices (i.e., documented visit in the prior 2 years).[176] Upon receiving the baseline survey from patients, the investigators randomized respondents to the control group to receive usual care or to the intervention group. For the intervention group, the researchers mailed a print brochure 2 months after receipt of the baseline survey; it provided basic CRC information and screening. Three months after receiving their

brochure, participants received tailored computer-assisted telephone counseling; for this, a computer generated an interview protocol based on patients' initial responses about their knowledge of CRC and screening tests. Trained interviewers administered the protocol to provide basic education (approximately 4 minutes) and motivational counseling (approximately 6 minutes) to obtain screening. Approximately 17 to 24 months after receipt of the telephone counseling, the investigators reviewed participants' charts to determine whether CRC tests had been completed. This study found no difference in overall screening rates between the intervention and control groups (25 percent versus 24 percent; $P = 0.68$).

Although the third study, described previously under patient reminders, found that groups that received some form of reminder were more likely to complete screening than those who received usual care ($P = 0.001$ or 0.002), the researchers did not find differences among the intervention groups to indicate whether patients who receive various types of small media interventions (i.e., print or telephone) were more (or less) likely to complete CRC screening.

Small media: decision aids. *Study characteristics*. As shown in Table 37, three RCTs, one rated as good quality[178] and the other two as fair,[177,181] used decision aids to help patients make informed decisions about CRC testing and the type of test to request. All three studies focused on patients 50 years of age or older; they either were attending appointments at an internal medicine practice[181] or a primary care practice[177] or were selected through a random sample of local residents living in urban, suburban, or rural communities.[178]

One primary care study compared an intervention group viewing an 11-minute CRC screening video decision aid followed by a brochure for the patient and a colored chart marker for the physician with a control group viewing an automobile safety video with no colored chart marker placed in the record.[177] The other primary care study randomized participants to either an interviewer-administered printed decision aid (modeled on the analytic hierarchy process) or to printed CRC screening educational materials.[181] The third study, which included only participants familiar with computers, compared a computerized, interactive decision aid with a standard informational, noninteractive website concerning CRC.[178]

All three studies had control groups comprising patients who got some type of exposure to a CRC-related website,[178] to an unrelated topic,[177] or to basic information about CRC.[181] Two of the three studies had comparison or control groups that received some form of CRC education.[178,181] Time to followup among the studies ranged from 2 to 3 months[177,181] to 24 weeks.[178] Two studies assessed the outcome of completed screening of any test through medical chart review;[177,181] the third used follow-up telephone interviews.[178]

Overview of results. Results from the three decision aids studies are mixed. One study demonstrated a statistically significant increase in CRC test completion[178] (23 percent difference; OR, 3.23; 95% CI, 2.73-3.50; $P = 0.035$). Another showed an increase in completion of CRC testing in the intervention group compared with the control group (14.2 percentage point difference; 95% CI, 3.0-25.4 percentage points).[177] This same study demonstrated that a higher proportion of patients in the intervention group than the control group reported discussing CRC screening with their provider during their appointment (68.5 percent and 43.4 percent, respectively; 25.1 percentage point difference; 95% CI, 12.7-37.6 percentage points). By contrast, the third study reported no significant difference in CRC test completion between the intervention and control groups.[181]

Table 37. Studies of small media: Decision aids on increasing colorectal cancer screening rates

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results
Ruffin et al., 2007[178] RCT, 24 weeks Residents in Michigan N = 174 Good	Test interactive website, Colorectal Web, to aid in decision-making of types of test to complete	G1: Participants completed baseline assessments and then were given a laptop to access interactive website, with posttest then administered (n = 87) G2: Same as G1 except asked to access a standard, noninteractive format website (n = 87)	G1: 56% completed any CRC test (23 percentage point difference; AOR, 3.23; 95% CI, 2.73-3.50; *P* = 0.035) G2: 33% completed any CRC test
Dolan and Frisina, 2002[181] RCT, 2 to 3 months Internal medicine practice in New York N = 95 Fair	Test a decision aid designed to help patients choose among currently recommended CRC tests	G1: Detailed written materials given to patients to explain the different CRC screening options (n = 49) G2: standardized interview consisting of a brief description of CRC (n = 46)	G1: 49% completed any CRC screening G2: 52% completed any CRC screening (*P* = 1.0)
Pignone et al., 2000[177] RCT, 3 months Three community primary care providers in North Carolina N = 249 Fair	Test whether a decision aid consisting of an educational video, targeted brochure, and chart marker increased CRC screening	G1: Video about CRC screening options, and a brochure about CRC screening (n = 125) G2 (control): Video about traffic safety (n = 124)	G1: 68.5% reported conversations with provider about CRC screening; 36.8% completed any CRC test G2: 43.4% reported conversations (25.1 percentage point difference; 95% CI, 12.7-37.6%); 22.6% completed any CRC test (14.2 percentage point difference; 95% CI, 3.0-25.4%) (*P* NR)

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; G, group; N, sample size; NR, not reported; RCT, randomized controlled trial.

Detailed results. The good-quality study obtained a random sample of residents 50 years of age or older who live in urban, suburban, or rural communities in Michigan.[178] The investigators first contacted potential participants by telephone and screened for their computer knowledge to ensure that participants could adequately search the websites in the study and meet other eligibility criteria. Participants were then scheduled for an appointment at a local community site for review of the websites. Participants were randomly assigned to view and explore one of two sites: (1) an interactive password-protected website, Colorectal Web (http://colorectalweb.org), which was designed to aid in their decision of types of CRC tests to obtain or (2) a standard, noninteractive informational website (control group) with similar content as the intervention website. During the computer sessions, participants were asked to review as much of the website as they desired. At the end of the session, participants completed a questionnaire specific to their preference for testing and decision phase of choosing to get screening. All participants were interviewed by telephone 2, 8, and 24 weeks after review of the websites to determine their intention to get screened and whether they had received any CRC test. Participants in the intervention group were more likely to have completed any CRC test within 24 weeks (56 percent) than the control group (33 percent) (AOR, 3.23; 95% CI, 2.73-3.50; $P = 0.035$).

The remaining two studies, rated fair quality, also tested different types of small media in aiding patient decisionmaking.[177,181] One study provided written materials to patients assigned to the intervention arm who were at an appointment at an internal medicine practice in New York.[181] Within a few days before a scheduled appointment with a provider, the consenting patients in the intervention group received short descriptions of CRC and the five types of screening tests available to them and completed a baseline survey. Trained interviewers also guided this group through an analytic hierarchy process specifically designed to help them make decisions that require integration of quantitative data with less tangible, qualitative considerations such as values and preferences. The control group was first interviewed face-to-face at the time of their appointment where the interviewer provided them with a brief description of CRC and asked them to complete the same survey as the intervention group. All patients were then urged to discuss CRC screening with their provider. After their visit, all patients were asked whether they discussed the screening with their provider and whether a decision had been made. A majority of all patients (88 total or 93 percent) indicated that they had discussed CRC screening with their provider, but the intervention group was no more likely than the control group to have completed any CRC test.

The study testing whether a video decision aid given to patients at the time of a primary care appointment in North Carolina would increase screening rates reported similar findings.[177] Three primary care practices with a total of nine physicians agreed to participate in the study. For study recruitment, patients were contacted by phone before a scheduled appointment and asked to participate. The intervention group for this study was asked to watch an 11-minute video on CRC that included information about susceptibility to CRC and availability of screening tests, specifically the FOBT and FS. The video included vignettes of patients who discussed their experiences with CRC screening. At the conclusion of the video, the patients were asked about their intent to request screening and then provided one of three color-coded brochures that were designed to provide information based on a person's intention to obtain screening. The researchers placed a laminated card with the same color as a patient's brochure in the patient's chart before he or she was seen by the provider. Patients in the controls watched a video of similar length on car safety and received a related brochure. No cards were attached to their charts. During the appointment, patients were asked to complete three surveys: one at baseline before seeing a video; one after viewing the video; and one after seeing the provider to assess whether a conversation about CRC occurred. The investigators completed medical record reviews within 3 months of the visits to determine whether CRC tests had been completed. The outcome reported related to discussions was whether a test was ordered. In the intervention group, 68.5 percent of patients and 43.4 percent of control group patients reported some conversation with their provider about CRC screening (25.1 percentage point difference; 95% CI, 12.7-37.6 percentage points). Screening tests were completed by 36.8 percent in the intervention group and 22.6 percent of the control group (14.2 percentage point difference; 95% CI, 3.0-25.4 percentage points).

Group education interventions. *Study characteristics*. Two RCTs tested an intervention to educate Native Hawaiians who are members in local civic clubs about the importance of CRC screening[184] or were trained to educate their fellow church members in rural predominantly African-American churches[185] (Table 38). In one study, civic clubs were randomly selected for the intervention and either a Native Hawaiian physician and cancer survivor or a non-Native

Table 38. Studies of group education on increasing CRC screening rates

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results
Braun et al., 2005[184] RCT, 16 week follow-up Civic clubs in Hawaii N=121 Fair	Test an intervention to improve CRC screening among Native Hawaiians	G1: Educational workshop delivered by Native Hawaiian physician and cancer survivor, FOBT kits provided, and follow-up reminder calls to submit test (n=69) G2: Educational workshop by non-Native Hawaiian nurse, FOBT test, 1 reminder call to submit test (n=52)	G1: 23 (33%) completed FOBT (41 were already up-to-date for CRC screening at baseline so n=28 eligible for screening) G2: 21 (40%) completed FOBT (36 were up-to-date at baseline so n=16 eligible to screen which means more were screened than needed to be) People in G1 were less likely to be screened than people in control group (AOR, 0.36; 95% CI, 0.14-0.97)
Campbell et al., 2004[185] RCT, 1 year follow-up African American churches in rural North Carolina N= 287 (50 years or older) Fair	Test an intervention to improve multiple health behaviors among rural African American church members	G1: TPV materials distributed to church members via mail (n= 76) G2: LHA trained within experimental churches to provide CRC information through existing networks (n=51) G3: Combination of TPV and LHA (n=87) G4: Speakers came to churches and offered educational workshops on a variety of topics (e.g., HIV/AID); provided members education materials (n=69)	G1: 36.8% received FOBT test; 21.1% received another CRC test G2: 33.3% received FOBT test; 25.5% received another CRC test G3: 31.0% received FOBT test; 14.9% received another CRC test G4: 21.7% received FOBT test; 27.5% received another CRC test Differences in group are not statistically significant (p=0.08 for FOBT).

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; LHA, lay health advisor; G, group; N, sample size; NR, not reported; RCT, randomized controlled trial; TPV, tailored print and video.

Hawaiian nurse provided an education session on the need for screening and provided participants with FOBT kits.[184] Any participants ages 50 or older were included in the intervention. The study followed participants over a 16-week period and used reports from the laboratory that received completed FOBTs to determine whether they had completed a FOBT kit. The second study targeted African-American churches in rural North Carolina with the aim of improving nutrition, exercise, and CRC screening.[185] Any church members within an intervention site could participate, but only those 50 years or older were targeted for CRC screening. The group education consisted of training volunteers to serve as lay health advisors, who then agreed to conduct group education sessions within their church over the 1-year study period. Outcomes for both studies were assessed through self-reported screening rates, with both focusing on FOBT completion rates as their primary outcome.

Overview of results. One study demonstrated a negative finding: those in the control group were statistically significant more likely to have completed a FOBT over the 16-week study period than those in the intervention group (AOR, 0.36; 95% CI, 0.14-0.97).[184] The second study found no difference between those who received group education and those in control churches ($P = 0.08$).[185]

Detailed results. The study based in Hawaii involved members of local civic clubs who were provided with an educational session specific to CRC screening at one of their regularly scheduled meetings.[184] The control group received the education from a non-Native nurse who addressed topics specific to CRC screening and the importance of screening among Native Hawaiians. She then distributed a FOBT kit along with basic instructions on completing the test, and a phone number of local providers they could contact for assistance. Within a month of the presentation, if a completed FOBT kit had not been received from participants, one reminder call was made to each and a replacement FOBT kit was mailed upon request. The intervention group differed in that the presenter at the workshop included a physician and survivor who were both Native Hawaiian. Participants in this group were also provided a FOBT and a demonstration on how to complete the test was also presented by the physician. Between 4 and 16 weeks after the presentation, multiple telephone calls were made to those who had not completed the FOBT kit and replacement kits were provided upon request. Information on the frequency and intensity of these reminder calls is not provided by the authors so this study is not categorized as one providing patient reminders since we were unable to determine the extent to which the control and intervention groups differed on this aspect of the intervention. The outcomes for the study were determined through copies of the FOBT results received from the laboratory that tested them. Overall, the authors reported that people in the intervention group were less likely to complete a FOBT than people in the control group (33 percent compared to 40 percent, respectively).

The study based in rural churches in North Carolina included two components of interventions, one that involved small media which is described elsewhere and a second that included training church members to serve as lay health advisors and conduct group education sessions with their peers.[185] Church members were asked to recommend people to serve as lay health advisors, who were then invited to attend a series of trainings. A total of 62 such advisors (47 women, 15 men) from six churches were trained through six sessions. The training included information specific to CRC screening, available tests, and a detailed training manual was provided to each participant. In addition to providing information to peers through existing social networks, the lay health advisors were expected to organize and conduct at least three church-wide activities focused on spreading information about nutrition, exercise, and/or CRC screening. Findings indicated that churches where these advisors were present were no more likely to have members who received FOBT or any CRC test than control churches. In addition, some churches included both tailored or small media education combined with lay advisors, but this combination produced no effect compared with a control group.

One-on-one interactions. *Study characteristics.* Three RCTs, two rated as good quality[179-180] and the other as fair quality,[85] tested one-on-one interactions with patients as a way to increase screening rates (Table 39). Interactions involved a nurse who conducted[85] a series of telephone calls to participants of a health plan,[180] and a health educator.[179] Two studies were conducted within a primary care or community clinic setting and relied on medical chart review for screening outcomes;[85,179] the third worked with a random sample of participants in a health benefit fund.[180] Two studies included patients who had not yet agreed to screening;[179-180] the other involved patients who had agreed to FOBT screening.[85] In two studies populations included those 50 years of age or older determined to be in need of screening based on national guidelines;[85,179] the third study focused on those 52 years of age and older who were self-reported as not current on their CRC screening (i.e., no FOBT in past 2 years, no FS in past 5 years, or no colonoscopy or barium enema in past 10 years).[180] All three studies were in urban settings; one had about two-thirds African-American participants,[180] another had about one- third

Table 39. Studies of one-on-one interactions on increasing colorectal cancer screening rates

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results
Basch et al., 2006[180] RCT, 6 months Members of a New York health benefit fund that includes CRC screening coverage N = 456 Good	Test the effectiveness of a telephone outreach approach versus a direct mail approach in a predominantly African-American population	G1: Tailored telephone outreach by a health educator through repeated calls (median = 5) to educate patients on the need for screening and build their self-efficacy in obtaining screening (n = 226) G2: Mailed package that included a letter and brochure about CRC screening (n = 230)	G1: 27% received any CRC test (n = 61) G2: 6.1% (n = 14) Rate difference = 20.9 percentage points; 95% CI, 14.34-27.46 RR 4.4 (2.6-7.7) (*P* NR)
Tu et al., 2006[179] RCT, 6 months Community clinic in Seattle, Washington N = 210 Good	Test a clinic-based, culturally and linguistically appropriate intervention promoting FOBT screening	G1: Bilingual materials including motivational video on CRC screening, pamphlet, FOBT instruction sheet, CRC informational pamphlet, CRC screening education from a health educator, and FOBT kit with instructions in Chinese and English (n = 105) G2: Usual care (n = 105)	G1: 69.5% received FOBT screening G2: 27.6% received FOBT screening (AOR, 6.38; 95% CI, 3.44-11.85) (*P* NR)
Stokamer et al., 2004[85] RCT, 6 months Primary care clinic at a VA in NYC N = 788 Fair	Test whether intensive patient education increases FOBT card return rates	G1: Educational session of 10 to 15 minutes with nurse, FOBT kit (n = 396) G2: Usual care (includes FOBT kit) (n = 392)	G1: 65.9% returned FOBT cards G2: 51.3% returned FOBT cards (*P*<0.001)

AOR, adjusted odds ratio; CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; G, group; N, sample size; NR, not reported; NYC, New York City; *P*, significance/probability of finding; RCT, randomized controlled trial; RR, relative risk; VA, veterans administration.

African-American participants,[85] and the third comprised almost entirely Chinese participants.[179] The time periods of each study varied: the one involving nurses[85] and the one targeting the health benefit fund followed patients for 6 months, [180] and the one with a culturally and linguistically sensitive health educator spanned a 14-month period from the initial interaction with patients.[179] The two studies based in a clinic included control groups that received usual care,[85,179] while the control group for the study of health benefit fund participants received print materials in the mail, which included a brochure about CRC and available screening tests.[180] All three studies relied on medical records review for measuring the outcome of completion of CRC screening, with one study first collecting self-reported data that was then compared with claims data in the health benefit fund database.[180]

Overview of results. All studies found statistically significant positive effects of their interventions. In the study of patients who had agreed to FOBT screening, 65.9 percent of intervention patients and 51.3 percent of the usual care group ($P < 0.001$) returned the FOBT cards; the median time to return the cards was shorter in the intervention group (36 versus 143 days, $P < 0.001$).[85] In the study of Chinese patients considering CRC screening, 69.5 percent of

intervention versus 27.6 percent of control patients had completed FOBT screening (AOR, 6.38; 95% CI, 3.44-11.85).[179] The third study, which provided intensive telephone counseling to participants of a health benefit fund, also demonstrated statistically significant differences in completion of any CRC test (rate difference = 20.9 percentage points; 95% CI, 14.34-27.46 percentage points).[180]

Detailed results. The good-quality study of telephone outreach compared these participants to a group of patients who received only a mailed brochure with information about CRC and available screening tests.[180] The sampling frame for the study included persons 52 years of age or older who were members of a health benefit fund that included CRC screening as a benefit. Potential participants were first contacted by telephone to assess their interest in the study and then randomly assigned to receive telephone education or print education. The control group was mailed a letter along with a print brochure that included information about CRC, how it can be prevented, and descriptions of screening tests. The participants were instructed to talk with their providers to seek screening. The intervention group received tailored telephone outreach that began within 2 weeks of randomization. A series of semistructured telephone calls were then conducted with the participant to discuss CRC screening and provide positive reinforcement for obtaining a screening test. The frequency and duration of calls varied, with a median of 5 calls to each participant and a median of 23.5 minutes with each participant. The topics of these calls included establishing a trusting rapport with participants, reinforcing accurate knowledge about CRC and screening, correcting misconceptions, and bolstering motivation to obtain CRC screening. All participants were contacted 6 months after randomization by telephone to obtain information about whether they had obtained any CRC screening test (i.e., single office FOBT, home FOBT, FS, or colonoscopy). This self-reported information was verified either through medical records from each participant's provider or through the health benefit fund's billing system. Patients who received tailored outreach were more likely to be screened than those that received only the mailed brochure (27 percent and 6.1 percent, respectively; RR, 4.4; 95% CI, 2.6-7.7).

The study that explored the role of nurses in encouraging completion of FOBT provided patients in the intervention arm with 10- to 15-minute educational sessions conducted by a nurse specifically trained for this intervention.[85] All patients had been referred by their physician to primary care nursing for education and distribution of FOBT kits. The intensive session included providing patients with a two-page informational handout on FOBT and CRC. The session also provided verbal instructions on how to perform an FOBT and explanation of the meaning of different results. The nurse answered questions and instructed the patients to return the FOBT cards within 2 weeks and/or call with any questions. Patients randomly assigned to the control group received usual care, which consisted of receipt of FOBT kit that included written instructions and no individual session with a nurse. The outcomes for the study were assessed through medical record review 6 months after the patient's appointment to determine whether the patients had returned FOBT cards. The intervention group was more likely to return FOBT cards than the control group (65.9 percent and 51.3 percent, respectively, $P < 0.001$).

In another study, predominately Chinese patients who had not yet agreed to screening attended an intensive education session with health educators who provided culturally and linguistically appropriate (78 percent of participants spoke Cantonese and 21 percent spoke Mandarin) education about CRC screening, including a motivational video, printed material, and FOBT kit.[179] Patients were randomly selected for participation through the electronic medical database and mailed bilingual letters signed by the medical director of the two participating clinics to invite them to participate. The health educator then tracked appointments through the clinic electronic scheduling system and met face-to-face with prospective participants during

their visit. Patients who agreed to participate either received usual care (no CRC information) or were asked to meet with the health educator who distributed the educational materials. Those patients assigned to the intervention group were able to watch the video at the clinic office or take it home. The control group received usual care but the study did not specify whether usual care included provision of an FOBT kit with bilingual instructions. The investigators assessed return of FOBT cards within 6 months of randomization through electronic medical records; this outcome was increased in the intervention group when compared with the control group (69.5 percent and 27.6 percent, respectively; OR, 6.38; 95% CI, 3.44-11.85).

Eliminating structural barriers. *Study characteristics.* This category includes five studies (Table 40); two were described under patient reminders;[85,175,179,183] two under one-on-one interactions;[85,175,179,183] and is described here in detail.[187] All provided FOBT kits as a means to improve access to screening tests. One study also attempted to address cultural and linguistic barriers among an Asian population of patients.[179] We rated two studies as good quality[179,187] and others as fair.[85,175,183] All five studies included people 50 years of age or older in their samples; one study specified an upper range of 79 years for study participants.[187]

Table 40. Studies of interventions to eliminate structural barriers on increasing colorectal cancer screening rates

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results
Potter et al., 2009[187] RCT, 6 month follow-up Family health center in San Francisco, California N= 514 Good	Determine whether providing FOBT kits during influenza season can contribute to higher CRC screening rates.	All patients were mailed multi-lingual flu shot information G1: Patients received a FOBT kit and instruction sheet at the time they obtained a flu shot (n=268; only 143 received FOBT kit since rest were ineligible due to being up-to-date for screening) G2: Patient received flu shot only (n=246)	G1: 83 (68.0%) became up-to-date with any CRC screening at follow-up (29.8 percentage point change from baseline; 95% CI, 23.7- 36.0) G2: 24 (20.7%) became up-to-date with any CRC test (4.4 percentage point change; 95% CI, -0.7- 9.7) *P* < 0.001
Tu et al., 2006[179] RCT, 6 months Community clinic in Seattle, Washington N = 210 Good	Test a clinic-based, culturally and linguistically appropriate intervention promoting FOBT screening	G1: Bilingual materials including motivational video on CRC screening, pamphlet, FOBT instruction sheet, CRC informational pamphlet, CRC screening education from a health educator, and FOBT kit with instructions in Chinese and English (n = 105) G2: Usual care (n = 105)	G1: 69.5% received FOBT screening (AOR, 6.38; 95% CI, 3.44-11.85) G2: 27.6% received FOBT screening (*P* NR)

Table 40. Studies of interventions to eliminate structural barriers on increasing colorectal cancer screening rates (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results
Church et al., 2004[183] RCT, 1 year Residents, 50 years of age or older, of Wright County, Minnesota N = 1,255 Fair	Test direct mailing of FOBT kits with and without reminders to general population	G1: (no reminders) Questionnaire mailed plus FOBT kit and instructional brochure (n = 434) G2: (reminders) Same package as G1, plus telephone reminders (n = 404) G3: Questionnaire only (n = 417)	G1: 16.9% FOBT completion rate (95% CI, 11.5-22.3%) G2: 23.2% FOBT completion rate (95% CI, 17.2-29.3%) G3: 1.5% FOBT completion rate (95% CI, -2.9-5.9%) (*P* NR)
Myers et al., 2007[175] RCT Primary practice patients in Philadelphia, Pennsylvania N = 1,546 Fair	Test targeted and tailored message delivery, both by mail and via phone outreach	G1: "Standard Intervention" (SI) of mailed letter, information booklet, FOBT kit, and reminder letter (n = 387) G2: Standard intervention package plus 2 "tailored message pages" (TI) (n = 386) G3: SI plus TI, and a reminder phone call (TIP) by an educator (n = 386) G4: (control) Usual care (n = 387)	G1: 46% screening rate (AOR, 1.7; 95% CI, 1.2-2.5) G2: 44% (AOR, 1.6; 95% CI, 1.2-2.1) G3: 48% (AOR, 1.9; 9.5% CI, 1.4-2.6) G4: 33% (P NR)
Stokamer et al., 2004[85] RCT, 6 months Primary care clinic at a VA in NYC N = 788 Fair	Test whether intensive patient education increases FOBT card return rates	G1: Educational session of 10 15 minutes with nurse with FOBT kit provided with verbal instructions (n = 396) G2: Usual care, including FOBT kit provided with written instructions (n = 392)	G1: 65.9% returned FOBT cards G2: 51.3% returned FOBT cards (*P*<0.001)

CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; G, group; N, sample size; NR, not reported; NYC, New York City; AOR, adjusted odds ratio; RCT, randomized controlled trial; VA, veterans administration.

Four of these studies took place in primary care settings or clinics.[85,175,179,187] All four used control groups that received usual care, and all assessed their outcomes through medical record review. The timing of followup of these four studies in this category was 6 months,[85] 9 months,[187] 14 months,[179] and 24 months.[175] One good-quality study provided primarily Chinese-Americans patients from a primary care clinic with access to a health educator and culturally and linguistically appropriate education materials, including bilingual instructions for FOBT.[179] Another good-quality study provided patients obtaining annual flu shots in a family health clinic with a FOBT kit.[187] One fair-quality study used a nurse to provide intensive counseling to patients who had agreed to FOBT.[85] The final study divided patients into three groups that received varying levels of tailored materials to encourage screening.[175]

The fifth study provided a random sample of residents in an urban area with a letter that included a questionnaire about CRC and screening tests.[183] These investigators then gave FOBT kits to two intervention groups with through the mail; one group received reminders to complete the FOBT and the other received no reminders. The investigators assessed screening rates

through self-reported information obtained on a follow-up survey mailed to all participants 1 year after the start of the study.

Overview of results. In all five studies completion of screening by FOBT rose as a result of the interventions (14.6 to 41.9 percentage point increases in screening by FOBT). The study that used a culturally and linguistic appropriate intervention demonstrated the largest increase in screening among the studies in this section (41.9 percent). Findings from four studies demonstrated that interventions to eliminate barriers were effective in increasing CRC screening by FOBT;[85,179,183,187] the fifth did not present findings specific to FOBT completion but rather demonstrated an increase in overall CRC screening rates.[175]

Detailed results. Four of the five studies in this category were described above. One good-quality study exposed patients of Asian origin to a culturally and linguistically sensitive educator.[179] Predominately Chinese patients who had not yet agreed to screening attended an intensive education session with health educators who provided culturally and linguistically appropriate education about CRC screening, along with a FOBT kit. The difference in return rates of FOBT cards between the intervention and control groups was statistically significant (AOR, 6.38; 95% CI, 3.44-11.85).

The second study compared groups getting an FOBT both with and without telephone reminders with a control group.[183] FOBT-specific findings demonstrated a statistically significant difference between the control group (1.5 percent; 95% CI, -2.9 - 5.9 percent) and both intervention groups (respectively 23.2 percent [95% CI, 17.2-29.3 percent] and 16.9 percent [95% CI, 11.5-22.3 percent]), for an overall difference in FOBT completion rates as high as 21.7 percentage points.

The third study compared groups getting three different types of interventions of varying intensity with a usual-care control group.[175] All three intervention groups received FOBT kits. The control group had a 33 percent completion rate of any CRC screening test; the three intervention groups had the completion between 44 percent and 48 percent (G1: AOR, 1.7; [95% CI, 1.2-2.5]; G2: AOR, 1.6 [95% CI, 1.2-2.1]; G3: AOR, 1.9 [95% CI, 1.4-2.6]) (*P*-values were not reported).

The nurse-based study provided patients in the intervention arm with 10- to 15-minute educational sessions conducted by a nurse specifically trained for this intervention.[85] The percentage of individuals returning FOBT cards was higher in the intervention group than the control group (65.9 percent versus 51.3 percent; $P < 0.001$).

The fifth study was conducted in a family health center in San Francisco, California.[187] Patients of the clinic (ages 50-79) were mailed multilingual flu shot campaign information and were given dates for obtaining flu shots. Half of the days were randomly selected in blocks of 2 or 3 for provision of flu shots only (control group) or flu shots with FOBT kits (intervention group). Before each flu shot clinic, investigators gave clinic staff a list of patients with appointments who were eligible for a FOBT. Patients were given a handout at the clinic to explain the need for regular CRC testing and then a FOBT kit after their flu shot (along with instructions in several languages). Patients were telephoned if they had not returned a completed kit at 3 weeks and again (if needed) at 6 weeks. FOBT screening rates in the control group increased by 4.4 percentage points from 52.9 percent at baseline to 57.3 percent ($P = 0.07$) they rose in the intervention group by 29.8 percentage points from 54.5 percent to 84.3 percent ($P < 0.001$); this yielded a 25.4 percentage point difference between groups ($P < 0.001$).

Provider-level interventions. *Study characteristics.* Two RCTs, both rated good quality, addressed reminder interventions targeted at provider behaviors or practices (Table 41).[186,188] In

Table 41. Study of an intervention to target provider behavior for increasing colorectal cancer screening or followup rates

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results
Ayanian et al., (2008)[188] RCT, 6 months N = 141 physicians and 717 patients Primary care practice in Massachusetts Good	Determine whether surveillance colonoscopy can be increased among overdue patients by reminders to their primary physicians	G1: Letters to physicians to notify them of potential need for colonoscopy (n = 358) G2: Usual care (n = 359)	G1: 9.2% completion rate for colonoscopy within 6 months G2: 4.5% completion rate (*P* = 0.009)
Sequist et al., 2009[186] RCT, 15 month follow-up 11 Ambulatory Health Care Centers in Massachusetts N= 110 physicians, 21,860 patients Good	Test an intervention that provided both patient and provider reminders for screening.	G1: Patients were mailed a package to remind them of need for CRC screening that included a FOBT kit, letter and pamphlet, and a telephone number they could call to make an appointment for endoscopy (n=10,930) G2: Usual care for patients (n=10,930) G3: Providers were given electronic reminders during office visits that patients were overdue for screening (n=10,912 patients) G4: Usual care such that providers received no reminders (n=10,948)	G1: 25.4% FOBT completion; 44% completed any CRC test G2: 20.4% FOBT completion (*P* < 0.001); 38.1% completed any CRC test (*P* < 0.001) G3: 41.9% completed any CRC test G4: 40.2% completed any CRC test (*P* = 0.47) Interaction effect between the patient and provider interventions was small and not statistically significant (-0.6%; 95% CI, -1.2%- 0.1%; *P* = 0.08)

G, group; N, sample size; *P*, probability/significance of findings; RCT, randomized controlled trial.

one case providers were reminded during an office visit that a patient was overdue for CRC screening;[186] in the other, reminder cards informed primary care physicians when a patient scheduled for an appointment (identified through medical record review) might need CRC followup.[188] The outcome of obtaining CRC screening or adherence to repeat colonoscopy was assessed through electronic medical record review within 6 months of mailing the initial letter to physicians for one study or 15 months after the study was initiated.[186] Both studies compared patients whose physicians received specific reminders with those who received usual care.

Overview of results. One study demonstrated only minimal increase in CRC screening among patients with providers who received reminders compared with those who did not (41.9 percent versus 40.2 percent; $P = 0.47$).[186] The other study reported a small increase in completion of colonoscopy within 6 months among patients whose physicians received the reminders (9.2 percent versus 4.5 percent; $P = 0.009$).[188]

Detailed results. One study focused on patients who may need surveillance colonoscopy and had received a prior colonoscopy with one or more adenomas detected but did not have a subsequent colonoscopy within 5 years.[188] The researchers sent physicians (n = 141) in two networks letters via interoffice mail to notify them of the potential need of a surveillance

colonoscopy for the patients randomized to the intervention arm (n = 358). The investigators did not report the number of physicians who mailed letters to the patients in the intervention arm; 6 months after the letters were initially sent to the physician, the researchers reviewed medical records to determine whether colonoscopies had been completed. At the same time, they also sent letters to physicians of patients in the control group to ensure that physicians were aware of the potential need for colonoscopy if clinically appropriate. Completion of colonoscopy was higher among patients whose physicians received reminders related to surveillance than among those in the control group (9.2 percent versus 4.5 percent; $P = 0.009$). The authors did not report whether the letter to the physicians, the follow-up letter to patients if it were mailed, or a combination of both was the factor that actually raised surveillance rates.

The second provider-level patient reminder study involved 11 ambulatory health care centers in Massachusetts and targeted patients overdue for CRC screening.[186] The investigators paired physicians with similar patterns of screening rates and referrals and then randomized one to receive the intervention. Throughout the 15-month study period, physicians in the centers received electronic reminders during office visits with patients overdue for screening. Before the intervention, the investigators educated physicians in both the intervention and control group on the use of the reminder system. Physicians could view the passive alert at any point during an office visit; those who received active alerts were required to acknowledge it before making any electronic orders. These active alerts provided current information about prior CRC screening for the patients and provided a "1 click" option for ordering tests. Screening rates were similar among patients of physicians receiving the electronic reminders compared to the control group (41.9 percent versus 40.2 percent; $P = 0.47$).

System-level interventions. *Study characteristics.* Five RCTs, all rated fair quality, were classified as a system-level intervention because they explored the impact of various interventions that had been implemented within an office or health care setting with the direct aim of changing the system of care (Table 42). Three studies used a patient navigator to guide the process of obtaining a screening colonoscopy[189] or a Prevention Care Manager (PCM), similar to a patient navigator) to assist patients in addressing barriers to obtain any CRC screening;[162,193] two studies enhanced their systems of managing patients as they obtained other types of care.[190-192] All studies focused on patients 50 years of age or older; one limited the age range of patients to those no older than 79 years.[192] Three included only women.[162,190-191,193] All included patients of health clinics or primary care practices. One study compared women in their intervention group to women who received an intervention to increase mammography use;[162] the remaining four studies used patients receiving usual care as their control groups. Usual care included patients who were in the clinic for an office visit and did not receive exposure to the system level intervention. All but one study[192] specifically included patients from low-income areas to increase CRC screening rates among populations with generally low rates. The outcome of interest in one study was whether a patient completed FOBT within the 6-month follow-up period and/or got endoscopic screening if they met national guidelines for these tests;[189]another focused on whether patients received an endoscopic screening procedure during the 1-year study.[192] The remaining studies assessed whether patients obtained any CRC test during the study period with the time for followup ranging from 11 months[162] to 24 months.[191] All outcomes were assessed through medical chart review.

Table 42. Studies of interventions to target the system level for increasing colorectal cancer screening rates

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results
Dietrich et al., 2006[193] RCT, 21-month followup 11 community and migrant health centers in New York City N= 1,413 women overdue for screening Fair	Evaluate the effect of a telephone support intervention to increase rates of breast, cervical, and CRC cancer screening among minority and low-income women.	G1: PCM worked with patients to address barriers, including providing motivational intervention. Physician recommendations were provided to all patients via letter or in the office. Mailing of FOBT was done but data NR. (n = 706) G2: Usual care which included one single call to answer questions and advise of need for screening. (n = 707)	G1: 63% obtained any CRC test in follow-up period (0.24 point change from baseline) G2: 50% obtained any CRC test (0.11 point change from baseline) 0.13 point difference between G1 and G2 (95% CI, 0.07-0.19) (*P*<0.001)
Dietrich et al., 2007[162] RCT, 11-month followup Medicaid Managed Care Organization (MMCO) in New York City N= 626 women (50 years or older) Fair	Test a "prevention care management" approach to improve breast, cervical, and colorectal screening rates among enrolled women in a MMCO.	All received an intervention to receive reminder calls for a mammogram. In addition: G1: Prevention Care Manager (PCM) worked with patients to overcome barriers and schedule appointments (n = 317) G2: Affinity Mammogram Outreach Program (AMOP) followed up with all patients to provide additional educational materials on all cancer screenings and a follow-up telephone call to remind them of need for screening (n = 309)	G1: 32% up-to-date for any CRC test at follow-up G2: 25% up-to-date for any CRC test at follow-up (AOR, 1.69; 95% CI, 1.03-2.77) *P* = 0.04
Jandorf et al., 2005[189] RCT, 6 months Primary care provider in New York City N = 78 Fair	Test the effectiveness of a patient navigator in increasing screening colonoscopy.	G1: Patient navigator plus placement of FOBT card in chart (n = 38) G2: FOBT card placed in chart; physicians were asked to recommend screening to patients (n = 40)	G1: 23.7% completion rate for endoscopy; 42.1% for FOBT G2: 5% completion rate for endoscopy (*P* = 0.019); 25.0% for FOBT (*P* = 0.086)
Ling et al., 2009[192] RCT, 1 year follow-up N= 10 primary care group practices, 599 patients, Pittsburg, Pennsylvania N = 599 Fair	Evaluate methods to promote endoscopic screening in primary care practice.	G1: Enhanced management practices (including training of physicians and office staff; implement office protocols; motivational interviews to counsel patients; assist patient in overcoming barriers) with a tailored letter to patients (n = 152) G2: Enhanced management practices with no tailored letter to patient (n = 190) G3: Nonenhanced management practices (includes training of physicians and office staff,	G1: 81 (53.3%; 95% CI, 45.4-61.2) completed endoscopic CRC screening G2: 103 (54.2%; 95% CI, 47.1-61.3) completed endoscopic test G3: 58 (43.6%; 95% CI, 35.2-52.0) completed endoscopic test G4: 47 (37.9%; 95% CI, 29.4-46.4) completed endoscopic test Enhanced management practices yielded 1.63-fold increase (95% CI, 1.11- 2.41; *P* = 0.01)

Table 42. Studies of interventions to target the system level for increasing colorectal cancer screening rates (continued)

Author, Year Study Design Population Setting Sample Size Quality	Study Aims	Study Groups	Results
Ling et al., 2009[192] (continued)		writing of office protocols) with tailored letter to patients (n=133) G4: Nonenhanced management practices with no tailored letter (control group) (n=124)	
Roetzheim et al., 2004;[190] Roetzheim, et al., 2005[191] RCT (cluster randomized at clinic level), 12-month followup[190] and 24-month followup)[191] 8 county-funded clinics in Florida N= 1,196 at baseline; 1,237 at 12-month followup; 1,296 at 24-month followup Fair	Assess the efficacy of the Cancer Screening Office Systems (Cancer SOS) to increase cancer screening in primary care settings serving disadvantaged populations.	G1: Patients were asked to complete a cancer screening checklist to indicate which tests they were due to receive; stickers were then placed on charts to flag providers of need for screening; staff trained and unannounced audits done; formal feedback of screening rates given to practices at 6 and 12 months (each time point at different independent random samples drawn from medical records) (n=600) G2: Usual care (n=596)	G1: 40.1% FOBT completion rate G2: 11.9% FOBT completion rate AOR 2.56 for FOBT completion rate; 95% CI, 1.65-4.01 (*P*< 0.0001) at 12 months No effect on FOBT completion at 24 months (AOR 1.17; 95% CI, 0.92-1.48; *P*= 0.19)

CI, confidence interval; CRC, colorectal cancer; FOBT, fecal occult blood test; G, group; MMOC, Medicaid Managed Care Organization; N, sample size; NR, not reported; *P*, probability; PCP, primary care provider; RCT, randomized controlled trial.

Overview of results. All five studies found statistically significant increases in CRC screening rates for their tests of interest; absolute increases in screening ranged from about 5 percentage points to 28.2 percentage points. The screening colonoscopy study found a statistically significant increase in completed endoscopy at 6 months (23.7 percent versus 5.0 percent; $P = 0.019$).[189] The two studies that included a PCM providing assistance in addressing barriers to screening demonstrated similar findings: women in a Medicaid managed care organization had a 14 percent increase in screening rates when the PCM worked with them compared with a 9 percent increase in the control group ($P = 0.04$);[162] among women in community and migrant health care clinics in New York City receiving the intervention had a 13 percentage point difference in screening rates compared with the control group (AOR, 0.13; 95% CI, 0.07-0.19).[193] In the study of primary care practice patients who received enhanced office and patient management practices at randomly selected practices, the investigators reported a 1.63-fold increase in CRC screening among patients in the intervention clinics compared with those in control clinics (95% CI, 1.11-2.41; $P = 0.01$).[192] In the study that randomized patients at the clinic level to complete cancer screening checklists placed in their medical charts at the time of an office visit, along with a sticker flagging the provider for the need for screening, demonstrated that patients in the intervention group were 2.56 times more likely to obtain an FOBT at the 12-month followup than the control group (AOR, 2.56; 95% CI, 1.65-4.01; $P < 0.0001$),[190] but this effect was diminished at 24 months (AOR, 1.17; 95% CI, 0.92-1.48; $P = 0.19$).[191]

Detailed results. The studies using PCM staff to help patients obtain CRC screening were each conducted in New York City clinics: one in a Medicaid managed care organization (MMCO)[162] and the other in 11 community and migrant health care clinics.[193] Neither study provided racial or ethnic statistics of the women in their samples. The MMCO study involved women who were receiving an intervention of patient reminders to obtain mammography screening; it randomly assigned women to receive PCM assistance in obtaining CRC screening. The PCM assistance included a detailed script read to patients to explain the importance of CRC screening and types of available tests and assistance overcoming any barriers to screening, including making appointments for patients to receive tests.[162] Those in the comparison group received educational materials about CRC screening and one telephone call to recommend that they obtain CRC screening. At the 11-month followup, those in the group receiving PCM assistance were more likely than the women in the comparison group to be up to date with any CRC screening ($P = 0.04$). The other study (by many of the same authors) applied a similar intervention to a different setting.[193] In this study, PCMs received 7 hours of training for their role, worked with patients to overcome barriers, and provided motivational counseling during the study. For two of 11 centers, the PCM could also mail FOBT kits to patients; differences related to this aspect of the intervention were not reported. Those in the comparison group received usual care, which in the participating clinics included a single call to patients to answer any questions about CRC screening and advise them about the need to be screened. Those receiving PCM assistance were more likely than the control group to obtain CRC testing (0.13 difference in screening rates; 95% CI, 0.07-0.19).

For the study in which a patient navigator helped patients obtain screening colonoscopy, patients eligible for the study had been referred for CRC screening after an appointment with a primary care provider.[189] Patients were "navigated" in an effort to improve compliance with referrals to screening colonoscopy. Patients, from a federally qualified health center in New York City serving predominantly minority and low-income patients, were 50 years of age or older and eligible for CRC screening. More than 70 percent were female, about 80 percent were Hispanic, and less than half of the participants spoke English. Those patients randomly assigned to the intervention received patient navigation; those assigned to the control group received usual care, which included placement of an FOBT card in the patient's chart to remind his/her physician of the need for screening. The patient navigator contacted patients in the intervention group 2 to 3 weeks after the patient agreed to participate and provided education about CRC screening by telephone. The patient navigator continued to provide written reminders, further telephone calls, and scheduling assistance to the intervention group. Using completion of an endoscopic examination as a key outcome, the authors reported that patient navigation improved completion of these tests within 6 months of physician recommendation (15.8 percent compliance in the navigated group versus 5 percent in the nonnavigated group; $P = 0.019$).[189]

Another study focused on several aspects of providing enhanced office and patient management among 10 primary care practices in Pennsylvania to increase endoscopy screening.[192] All patients determined to be eligible for the study were mailed letters from their physicians recommending endoscopic CRC screening and asked patients to phone for an appointment. These letters were either tailored or nontailored; findings specific to this aspect of the intervention were discussed earlier in the "small media" category. Patients in the control group had office visits in practices that had received educational workshops for their physicians and office staff on improving CRC screening and written protocols on systematically implementing screening. Clinics randomly assigned to the intervention received this information and assistance in implementing the office protocols and tracking patient acceptance of referral for endoscopic screening. The research team then conducted motivational interviewing with

patients who had not obtained screening within 3 months after receiving a physician recommendation (by mail) to do so. During these interviews, staff worked with the patients to address any barriers to obtaining screening (e.g., scheduling appointments, obtaining transportation, addressing insurance needs). Medical records were reviewed within a year after the initial letter was mailed to assess screening rates. The study demonstrated a 1.63-fold increased odds of completing a colonoscopy or FS among patients in the intervention (95% CI, 1.11-2.41; $P = 0.01$).[192]

The results of the final study in this category were published in two articles; one presented 12-month findings[190] and the 24-month results.[191] In this study, the investigators randomized eight county-funded clinics in Florida as control or intervention sites. Patients receiving care at the control sites received usual care specific to CRC screening. Those receiving care at the intervention sites were asked to complete a cancer screening checklist at the time of an office visit. The checklist indicated the tests they had previously received and when each was obtained. Based on these responses, medical charts were flagged with stickers to indicate to the provider whether a patient was due for CRC screening. Before implementing this process, the research team also trained staff about the need for CRC screening. Throughout the 12-month study, the team also made unannounced visits to the clinics to conduct chart audits and then gave formal feedback to staff of their screening rates. They also abstracted data from medical records of independent random samples of patients at baseline and at each of the two follow-up periods to determine the extent to which patients had obtained CRC screening. At 12 months, the study demonstrated a 28.2 percentage point increase among patients receiving care at the intervention sites compared to the control sites (40.1 percent versus 11.9 percent; $P< 0.0001$).[190] At 24 months, the difference in screening rates across sites was smaller (28.2 percent versus 12.6 percent; $P = 0.19$).[190]

KQ 4: Current and Projected Capacity to Deliver Colorectal Cancer Screening and Followup

If efforts to increase screening rates for CRC are successfully implemented, providers and health care systems must be able to handle the resultant increased demand for services, particularly for endoscopic procedures, that will be needed both for primary screening and for follow-up of abnormal screening results from noninvasive screening strategies. Note that to avoid confusion over the use of the word ‘surveillance’, we refer to monitoring of patients after receipt of abnormal results as ‘followup’. As shown in the analytic framework (Figure 1, Chapter 2), capacity to deliver CRC screening is an important variable in determining the population-level benefit from screening. This key question (KQ) addresses the current and projected capacity of the health care system to deliver CRC screening and followup for the US population.

In this section we have defined key terms as follows:

- Current capacity (or current potential volume): the sum of current volume and additional available capacity, where:
  - Current volume is the estimate of the current number of FS or colonoscopy procedures conducted in the present year; and
  - Additional available capacity is the number of additional FS or colonoscopy procedures that could be conducted in the current year;
- Projected capacity: future capacity to conduct FS or colonoscopy under various scenarios such as changes in workforce or changes in the number of facilities that provide procedures;

- Ability to meet projected demand: the ability of current capacity (or projected capacity if known) to meet the projected demand under various demand scenarios, such as screening the entire eligible US population with a specific test.

Although this KQ gave priority to projected capacity of FS or colonoscopy, we found no studies that examined this topic. Most common were studies that provided estimates of current volume of FS or colonoscopy and compared those estimates with a projected demand. In this section, not only do we compile the varying estimates of current capacity and projected demand across studies and evaluate the strength of evidence of these estimates, but we also compare the estimate of current capacity based on multiple studies with that of projected demand, based on multiple studies. This approach enables us to answer better than heretofore the question of the nation's ability to meet projected demand.

In addition to the concepts defined above, we found data on current volume by provider type and geographic variation in current volume and additional available capacity.[61,195-197] Because these measures are related to our outcomes of current volume and additional available capacity, we have completed summary tables and text for these and included them as Appendix G.[‡‡] We also found four studies that report on current volume and additional available capacity in individual states.[61,195-196,198] Because results from these studies did not change our conclusions from the national data, we have included them as part of Appendix G rather than in the main text.

We present our overall summary and strength of evidence tables for studies addressing this KQ at the beginning of this section. The remainder of this section provides a more detailed assessment of the individual studies that informed our conclusions and our assessment of the strength of evidence.

KQ 4 Overall Summary and Strength of Evidence

In Table 43, our overall grades of the strength of evidence appear in the far right column; grades for key domains to determine the strength of evidence (risk of bias, consistency, directness, and precision) are in the intermediate columns. In assessing research specific to KQ 4 about capacity for increasing CRC screening, we ultimately had grades of only low strength of evidence. Low means that we have only low confidence that the evidence reflects the true effect; further research is likely to change the confidence in the estimate of effect and is likely to change the estimate.[31]

Overall, evidence suggests that FS current volume is not sufficient to meet projected demand if a significant proportion of the population is screened by either FS or FOBT/FS. Current volume of colonoscopy is likely to be sufficient to meet projected demand if a significant proportion of the US population is screened by FOBT or FS but not by colonoscopy. Based on one study's estimates of additional available capacity, current capacity for FS is sufficient for a screening program by FOBT/FS or FS alone, and current capacity for colonoscopy may be sufficient for a screening program by colonoscopy alone. All these estimates represent steady-state scenarios.

[‡‡] Appendixes and Evidence Tables for this report are provided electronically at http://www.ahrq.gov/downloads/pub/evidence/pdf/crcuse/crcuse.pdf.
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Table 43. Strength of evidence for the current and projected capacity to deliver CRC screening

Number of studies	Risk of Bias	Consistency	Directness	Precision	Results	Overall strength of evidence
Current capacity: FS						
Brown et al., 2003[195] Seeff et al., 2004[196]	Moderate 2 cross-sectional/1 Good, 1 Fair	Inconsistency present	Direct	NR	Current volume: 2.8-4.9 million FS Additional available capacity: 6.7 million FS	Low
Current capacity: COLON						
Brown et al., 2003[195] Hur et al., 2004[199] Seeff et al., 2004[196] Vijan et al., 2004[200]	Moderate 4 Cross sectional/1 Good, 3 Fair	Inconsistency present	Direct	NR	Current volume:1.6-6.6 million colonoscopies Additional available capacity: 8.2 million colonoscopies	Low
Ability to meet projected demand: FOBT Demand scenario						
Ladabaum and Song, 2005[201] Brown et al., 2003[195] Hur et al., 2004[199] Seeff et al., 2004[196] Vijan et al., 2004[200]	Moderate Capacity: 4 Cross sectional/1 Good, 3 Fair Demand: 1 Modeling/1 Good	Capacity: Inconsistent Demand: Consistency unknown (single study)	Indirect	NR	Current capacity: 9.8-14.8 million colonoscopies Demand: 3.8 million colonoscopies	Low
Ability to meet projected demand: FS Demand scenario						
Ladabaum and Song, 2005[201] Brown et al., 2003[195] Seeff et al., 2004[196]	Moderate Capacity: 2 Cross sectional/1 Good, 1 Fair Demand: 2 Modeling/1 Good, 1 Fair	Capacity: Inconsistency present Demand: No Inconsistency	Indirect	NR	Current capacity: 9.5-11.6 million FS Demand: 10 million FS	Low
Ladabaum and Song, 2005[201] Brown et al., 2003[195] Hur et al., 2004[199] Seeff et al., 2004[196] Vijan et al., 2004[200]	Moderate Capacity: 4 Cross sectional/1 Good, 3 Fair Demand: 1 Modeling/1 Good	Capacity: Inconsistency present Demand: Consistency unknown (single study)	Indirect	NR	Current capacity: 9.8-14.8 million colonoscopies Demand: 2.7 million colonoscopies	Low

Table 43. Strength of evidence for the current and projected capacity to deliver CRC screening (continued)

Number of studies	Risk of Bias	Consistency	Directness	Precision	Results	Overall strength of evidence
Ability to meet projected demand: FOBT/FS Demand scenario						
Ladabaum and Song, 2005[201] Brown et al., 2003[195] Seeff et al., 2004[196]	Moderate Capacity: 2 Cross sectional/1 Good, 1 Fair Demand: 1 Modeling/1 Good	Capacity: Inconsistency present Demand: Consistency unknown (single study)	Indirect	NR	Current capacity: 9.5-11.6 million FS Demand: 6.9 million FS	Low
Ladabaum and Song, 2005[201] Hur et al., 2004[199] Seeff et al., 2004[196] Vijan et al., 2004[200]	Moderate Capacity: 4 Cross sectional/1 Good, 3 Fair Demand: 2 Modeling/1 Good, 1 Fair	Capacity: Inconsistency present Demand: Inconsistency present	Indirect	NR	Current capacity: 9.8-14.8 million colonoscopies Demand: 2.9-4.7 million colonoscopies	Low
Ability to meet projected demand: Colonoscopy Demand scenario						
Brown et al., 2003[195] Seeff et al., 2004[196] Vijan et al., 2004[200]	Moderate Capacity: 4 Cross sectional/1 Good, 3 Fair Demand: 3 Modeling/2 Good, 1 Fair	Capacity: Inconsistency present Demand: Inconsistency present	Indirect	NR	Current capacity: 9.8-14.8 million colonoscopies Demand: 4.8-8.1 million colonoscopies	Low
Ability to meet projected demand: Screening the unscreened using additional available capacity						
Seeff, et al., 2004[202]	Moderate 1 Cross sectional/1 Good	Consistency unknown (single study)	Direct	NR	Using 100 percent of additional available capacity, it would take 5 years to screen the unscreened population with colonoscopy	Low

Current capacity, current volume + additional available capacity. COLON, colonoscopy; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy. NR, not reported

If the US were to adopt a colonoscopy-only approach to CRC screening, either colonoscopy capacity would need to be substantially increased or at least 5 years would be required to do the "catch-up" screening required to screen people who have not been screened.

Overall capacity study characteristics. We found six studies (seven articles) of good or fair quality that reported national estimates of current capacity (current volume and/or available capacity), projected demand, and ability of current capacity to meet projected demand.[195-196,199-

[203] We rated one additional study as poor quality and did not include it because it did not incorporate increased demand for surveillance colonoscopy following use of FOBT in its demand estimates.[204]

All six included studies reported on current volume or additional available capacity for one or more of the following screening procedures: FS, colonoscopy, or CT colonography. No study reported on these outcomes for FOBT, although FOBT screening is included in the various demand scenarios that are examined. Five of the studies (five articles) included estimates of both current and projected demand.[195,199-200,202-203] One article reported only estimates of current capacity (current volume as well as additional available capacity).[196] One study modeled only projected demand under different demand scenarios.[201] Among the five studies that reported on both capacity and demand, a single study can have different quality ratings for these two separate parts of the study.

Of the five studies (six articles) that report on current capacity, two studies obtained the data through national surveys, either of endoscopic facilities[196,202] or of endoscopic providers[195]; both sets of respondents reported on the number of FSs or colonoscopies they perform per week or month. These studies both reported on volume of both FS and colonoscopy, and one of the two reported on additional available capacity of FS and colonoscopy as well. Two studies,[199-200] which reported only on current volume of colonoscopy, conducted secondary analyses of a database from the Clinical Outcomes Research Initiative (CORI), a voluntary consortium of 400 endoscopists at 42 sites in 22 states. The final study, which reported on current volume of CT colonography, used secondary data on CT scanners in the United States for its estimates.[203]

Six studies that reported projected demand used a variety of mathematical models to do so. For their modeling, investigators used various refinements of population estimates, e.g., population growth, percentage of population that are at high risk because of family history or inflammatory bowel disease, and the percentage of the population ineligible for screening because of comorbid conditions. Also, a critical assumption in the modeling of demand that varied across these studies was the percentage of persons participating in screening overall; this figure ranged from 40 percent to 100 percent. A subset of key assumptions for each study is noted in the tables.

Overall capacity study results. Table 44 provides an overview of the results for KQ 4. In each row are the types of procedures for which the outcomes of capacity and demand were available (total FS, total colonoscopy, and screening colonoscopy); the columns contain the outcomes of current capacity (current volume and additional available capacity) and projected demand under various demand scenarios. For each demand scenario, we also present an assessment of whether current capacity is able to meet projected demand.

Studies varied in their estimates of current volume of FS procedures (2.8 million to 4.9 million) and screening colonoscopy procedures (1.6 million to 6.6 million) (Table 44). A single study provided estimates of additional available capacity of 6.7 million FSs and 8.2 million colonoscopies.

Results of the modeling studies suggest that current volume of FS is not sufficient to meet projected demand if a significant proportion of the population is screened by FS or FOBT/FS. Current volume of colonoscopy is likely to be sufficient to meet projected demand if a significant proportion (70 percent to 75 percent) of the US population is screened by FOBT or FS but not by colonoscopy. Only one estimate of additional available capacity is available; based on this study's results, current capacity for FS is sufficient for a screening program by FOBT/FS or FS alone. Based on this study's estimates of additional available capacity for colonoscopy,

Table 44. Overview of results of capacity studies

Type of Procedure	Current Capacity		Projected Demand: FOBT Scenario		Projected Demand: FS Scenario		Projected Demand: FS/FOBT Scenario		Projected Demand: Colonoscopy Scenario	
	Current Volume	Additional Available Capacity	Number	Able To Meet Demand?	Number	Able To Meet Demand?	Number	Able To Meet Demand?	Number	Able To Meet Demand?
FS (total)	2.8-4.9 million	6.7 million			10 million	Yes*	6.9 million	Yes*		
Colonoscopy (total)	4.0-14.2 million		3.8 million	Yes	2.7 million	Yes	2.9-4.7 million	Yes		
Colonoscopy (screening)	1.6-6.6 million	8.2 million							4.8-8.1 million	Yes*

FOBT, fecal occult blood test; FS, flexible sigmoidoscopy.
* If additional available capacity is included in calculations.

current capacity for colonoscopy may be sufficient for a screening program by colonoscopy alone.

All these estimates represent steady-state scenarios. None of these models incorporated current estimates of the unscreened. In the single study that modeled available capacity to screen the unscreened population, using 100 percent of additional available capacity, it would take 3 years at current screening patterns, 6 years using 100 percent FS or FOBT/FS, or 5 years using 100 percent colonoscopy to screen the unscreened population.

National-Level Estimates of Current Capacity of Endoscopy Screening

This section consists of two parts. We first describe the studies that present data on current volume of endoscopy screening. We next describe studies of additional available capacity of endoscopy.

Current volume of endoscopy. *Study characteristics.* Four studies provided national-level estimates of current volume of endoscopy; all four provided estimates for colonoscopy[195-196,199-200] and two also did so for FS (Table 45).[195-196] Two studies reporting estimates for both FS and colonoscopy[195-196] obtained the data through national surveys, either of endoscopic facilities[196] or of endoscopic providers.[195] In these studies the facility or provider reported the number of colonoscopies they perform per week or month. The remaining two studies,[199-200] which reported only on current volume of colonoscopy, report analyses of a database from the Clinical Outcomes Research Initiative (CORI), a voluntary consortium of 400 endoscopists at 42 sites in 22 states. The year for which current volume was reported in these studies varied from 2000 through 2003. Current volume in each of these studies was compared with projected demand (described in the section below, "National Estimates of Ability to Meet Projected Demand for Endoscopy, by Different Demand Scenarios").

We rated one study as good quality[196] and three studies as fair.[195,199-200] Two of the three rated fair quality[199-200] received this rating because they extrapolated data from a limited dataset of voluntary gastroenterologist physicians to estimate the number of colonoscopies performed by the entire number of gastroenterologists in the United States. The third study[195] was rated fair quality because of limitations in measurement of the outcome.

Table 45. National estimates of current volume of endoscopy screening

Author, Year Study Design Setting	Data Collection or Estimation	Results	Quality Rating for National Estimates of Current Volume
Seeff et al., 2004 (CDC)[196] Cross-sectional National sample of endoscopy practices	Current volume and additional estimated by survey of national sample of practices performing FS or colonoscopy	Current volume (2002): 2.8 million FSs 14.2 million colonoscopies 1.5 million FSs for screening (54%) 6.6 million colonoscopies for screening (47%)	Good
Brown et al., 2003 (NCI)[195] Cross-sectional and modeling National sample of physicians US population	Current volume estimated by survey of national sample of primary care physicians, gastroenterologists, and general surgeons	Current volume (2000): 4.9 million FSs 4.0 million colonoscopies 1.6 million colonoscopies for screening (40%) Average colonoscopies per month performed by: general surgeons, 8; gastroenterologists, 32	Fair
Hur et al., 2004[199] Secondary data analysis and modeling US population	Current volume of colonoscopy estimated from CORI database; 2001 data used and inflated to reflect national trends	Current volume (2003): 6.47 million colonoscopies 1.98 million colonoscopies for screening (29%)	Fair
Vijan et al., 2004[200] Secondary data analysis and modeling US population	Current volume of colonoscopy conducted by gastroenterologists estimated from CORI database; estimates were increased by 33% to include nongastro-enterologist providers	Current volume (2002-2003): Average 21 colonoscopies per endoscopist per month Estimated 1.27 million colonoscopies per year conducted by gastroenterologists for screening Estimated 1.69 million colonoscopies per year conducted by all types of providers 46% of colonoscopies for screening Average number of colonoscopies per month: 21 (range 0-102)	Fair

CORI, Clinical Outcomes Research Initiative; FS, flexible sigmoidoscopy.

Overview of results. Studies varied in their estimates of current volume of FS and colonoscopy. Differences between this study and the three fair-quality studies (giving data for, variously, 2000 to 2003) were greater for estimates of current volume of screening colonoscopy (1.6 to 6.6 million colonoscopies per year among four studies) than for FS (2.8 to 4.9 million per year in two studies). Differences may reflect differing methods of data collection or underlying issues of validity of self-report or report of volume by clinic administrators; they may also be consistent with increases in current volume of colonoscopy over a short period and concurrent decreases in current FS volume.

Detailed assessment, colonoscopy. In the good-quality study, authors from the Centers for Disease Control and Prevention (CDC) surveyed a national sample of 1,809 endoscopic facilities in the United States.[196] They identified practices using lists of facilities known to have purchased or leased lower endoscopic equipment between 1996 and 2000 and then screened practices by telephone to ensure that they did in fact conduct CRC screening. A physician or clinic

administrator completed this survey. The survey, which achieved a response rate of 74 percent, found that, in 2002, 6.6 million screening colonoscopies had been conducted.

Three studies rated fair quality produced similar estimates of the current volume of colonoscopy, but their results differed from those from the CDC study.[195,199-200] One study, conducted by the National Cancer Institute (NCI),[195] surveyed a national sample of primary care physicians, gastroenterologists, and general surgeons to estimate the current volume of colonoscopy among these providers nationally. The study did not adjust estimates of current volume for procedures by other types of providers. The NCI study estimated current colonoscopy volume in 2000 to be 4.0 million, including 1.6 million colonoscopies for screening. The two studies using data from the CORI database[199-200] reported results similar to those of the NCI study. The first found that, in 2003, the estimated current volume (provided by gastroenterologists alone) was 6.47 million colonoscopies, with 1.98 million for screening; [199] the second estimated that, in 2002-2003, the current volume for screening colonoscopy, adjusted to estimate colonoscopies done by all provider types, was 1.69 million.[200]

Several differences in methods may account for the widely varying estimates among the four studies. Results from the two CORI-based investigations are likely based on nonrepresentative data, as the dataset includes volunteer physicians participating in this registry. Of the two studies with the stronger methods, the CDC study was conducted 3 years later than the NCI study and asked for actual numbers of procedures; the NCI study gave categories for response with ranges such as "11-20 procedures." The highest category was "more than 20 procedures" per month, which may have set a potentially inaccurate ceiling on numbers for very active endoscopists. The CDC study also surveyed endoscopy practices, whereas the NCI study surveyed three types of providers; thus, the latter study may have missed perhaps up to 8 percent of colonoscopies (based on data from the CDC study).

Studies varied as to whether the investigators included surveillance colonoscopies in estimates of current volume. In the two CORI studies, one included such procedures[200] and the other did not.[199] In the NCI study, the authors could not determine whether respondents classified followup procedures as screening or diagnostic.[195] (We contacted the author of the CDC study but received no response.) All four studies provided estimates of the percentage of all colonoscopies that are conducted for screening purposes: 29 percent,[199] 40 percent,[195] and 46 percent.[196,200] Two studies estimated the average number of procedures per month: 32 for gastroenterologists and 8 for colorectal surgeons[195] and, in another study, 21 for gastroenterologists.[200]

Detailed assessment, FS. Two estimates of current volume for FS were available. The NCI study estimated the 2000 current volume of FS at 4.9 million;[195] the CDC study estimated that the 2002 FS current volume was 2.8 million.[196]

Additional available capacity of endoscopy. *Study characteristics.* The CDC study reported on additional available capacity of FS and colonoscopy at the national level (Table 46).[196] This study was a survey of a national sample of 1,809 endoscopic practices; they reported the number of colonoscopies they perform per week and the weekly maximum number they could perform.

Table 46. National estimates of additional available capacity of endoscopy screening

Author, Year Study Design Setting	Data Collection	Results	Quality Rating
Seeff et al., 2004[196] Cross-sectional National sample of endoscopy practices	Additional available capacity estimated by survey of sample of practices performing FS or colonoscopy	Current volume (2002): 2.8 million FSs 14.2 million colonoscopies 1.5 million FS for screening (54%) 6.6 million colonoscopies for screening (46%) Additional available capacity: 6.7 million FSs (239%) 8.2 million colonoscopies (58%)	Good

FS, flexible sigmoidoscopy.

Overview of results. The CDC article reported additional available capacity in 2002 of 6.7 million for FS (239 percent of current volume) and 8.2 million for colonoscopy (58 percent of current volume).[196]

Detailed assessment. The CDC study asked respondents (clinic physicians or administrators) to estimate the weekly number of FSs and colonoscopies that the practice performed per week, and the weekly potential maximum the practice could perform. Available capacity was determined by subtracting the current volume from the maximum. For national estimates, these investigators imputed missing values of these numbers and incorporated weights into their analysis to make estimates generalizable to all US health care practices that use endoscopic equipment for CRC screening.

National Estimates of Ability to Meet Projected Demand for Endoscopy, by Different Demand Scenarios

Projected demand. *Study characteristics.* Six studies provided estimates at the national level of ability of current volume or additional available capacity to meet projected demand for endoscopy (Table 47). Many of these studies evaluated ability to meet demand for colonoscopy, even under screening scenarios using FOBT or FS, as it is capacity for colonoscopy that is most likely restricted and is of most interest.

We rated three studies as good quality[195,201-202] and two studies as fair quality;[199,203] for a sixth study, we rated separate parts as good and fair.[200] The studies rated fair quality received this rating because of either the representativeness of the data used to estimate capacity or the assumptions made for modeling demand. We rated an additional study as poor quality and excluded it because it did not incorporate increased demand for surveillance colonoscopy following use of FOBT in its estimates.[204]

Two studies collected and analyzed survey data of physicians or endoscopic facilities to estimate current volume and additional available capacity.[195,202] Of the four other studies that estimated capacity, two studies used secondary data from a survey of endoscopic practitioners,[199-200] one study used secondary data providing the number of CT scanners,[203] and the final study modeled only demand and did not have estimates of current or additional available capacity.[201]

Table 47. National estimates of ability of current volume or additional available capacity of flexible sigmoidoscopy or colonoscopy to meet projected demand for endoscopy, by different demand scenarios

Author, Year Study Design Setting	Data Collection or Data Inputs for Capacity/Volume	Model Description to Project Demand	Results	Quality Rating
Demand scenario: all FOBT screening				
Ladabaum et al., 2005[201]	None	Current and projected demand (in various screening scenarios) estimated by Markov model	Assuming 75% uptake, demand for colonoscopy would be 3.8 million if all screening by FOBT	Good
Demand scenario: FS screening every 5 years				
Ladabaum et al., 2005[201]	None	Current and projected demand (in various screening scenarios) estimated by Markov model	Assuming 75% uptake, demand for FS would be 10 million and demand for colonoscopy would be 2.7 million if all screening by FS	Good
Brown et al., 2003[195] Cross-sectional and modeling National sample of MDs; US population	Current volume estimated by survey of national sample of primary care physicians, gastroenterologists, and general surgeons	Demand estimated by microsimulation model that incorporates population estimates, assumptions about test performance and screening program policy	Assuming 70% adherence: screening of national population with FS every 5 years would require the delivery of “almost 10 million” FSs in 2000 (2 times current volume)	Fair
Demand scenario: annual FOBT/FS every 5 years				
Ladabaum et al., 2005 (2887)[201]	None	Current and projected demand (in various screening scenarios) estimated by Markov model	Assuming 75% adherence, demand for FS would be 6.9 million and demand for colonoscopy would be 4.7 million if all screening by FOBT/FS	Good
Vijan et al., 2004[200] Secondary data analysis and modeling US population	Current volume of colonoscopies conducted by gastroenterologists estimated by analysis of CORI database	Demand estimated by Markov model; number of lifetime colonoscopies and FSs per patient for the US population under various scenarios	Assuming 70% adherence, an FOBT/FS screening strategy would require an incremental number of 1.2 million colonoscopies (above baseline of 1.69 million per year) Assuming 100% adherence, an FOBT/FS screening strategy would require an incremental number of 2.39 million colonoscopies (above baseline of 1.69 million per year)	Fair (volume estimates) Good (demand estimates)
Demand scenario: all colonoscopy screening				
Ladabaum et al., 2005[201]	None	Current and projected demand (in various screening scenarios) estimated by Markov model	Assuming 75% uptake, demand for colonoscopy would be 8.1 million if all screening by colonoscopy	Good

Table 47. National estimates of ability of current volume or additional available capacity of flexible sigmoidoscopy or colonoscopy to meet projected demand for endoscopy, by different demand scenarios (continued)

Author, Year Study Design Setting	Data Collection or Data Inputs for Capacity/Volume	Model Description to Project Demand	Results	Quality Rating
Vijan et al., 2004[200] Secondary data analysis and modeling US population	Current volume of colonoscopies conducted by gastroenterologists estimated by analysis of CORI database	Demand estimated by Markov model; number of lifetime colonoscopies and FSs per patient for the US population under various scenarios	Assuming 70% adherence, a colonoscopy screening strategy every 10 years would require an incremental number of 5.0 million colonoscopies (above baseline of 1.69 million per year) Assuming 100% adherence, a colonoscopy screening strategy every 10 years would require an incremental number of 6.3 million colonoscopies (above baseline of 1.69 million per year)	Fair (volume estimates) Good (demand estimates)
Brown et al., 2003[195] Cross-sectional and modeling National sample of MDs; US population	Current volume estimated by survey of national sample of primary care physicians, gastroenterologists, and general surgeons	Demand estimated by microsimulation model that incorporates population estimates, assumptions about test performance, and screening program policy	Assuming 70% adherence, screening of national population with colonoscopy every 10 years would require 4.8 million screening/ surveillance colonoscopies in 2000 (3 times the current volume of 1.6 million)	Fair
Demand scenario: screening the unscreened by various strategies				
Seeff et al., 2004[202] Modeling US population	Additional available capacity estimates from Seeff et al., 2004	Current unscreened population at average risk estimated using census data, adjusted for estimates of persons at higher risk and using screening rates from NHIS	41.8 million persons unscreened Using 100% of additional available capacity, it would take 3 years at current screening patterns or 6 years using 100% FS or FOBT/FS to screen the unscreened population Using 100% of additional available capacity, it would take 5 years to screen the unscreened population with colonoscopy For a program using FOBTs, there would be enough capacity for the necessary follow-up colonoscopies within 1 year	Good

Table 47. National estimates of ability of current volume or additional available capacity of flexible sigmoidoscopy or colonoscopy to meet projected demand for endoscopy, by different demand scenarios (continued)

Author, Year Study Design Setting	Data Collection or Data Inputs for Capacity/Volume	Model Description to Project Demand	Results	Quality Rating
Demand scenario: Increasing demand for CT colonography				
Ladabaum et al., 2005 (2887)[201]	None	Current and projected demand (in various screening scenarios) estimated by Markov model	Assuming 75% uptake, demand for colonoscopy would be 6.2 million CTC and 3.3 million colonoscopies if all screening by CTC	Good
Hur et al., 2004[199] Secondary data analysis and modeling US population	Current colonoscopy volume estimated from CORI database	Demand for colonoscopy predicted from mathematical model	Current volume: 6.47 million colonoscopies 1.98 million colonoscopies for screening (29%) If CTC used as primary modality for CRC screening, assuming 55% adherence to screening and 67% of screening is CTC, in the initial 5-year period after implementation of CTC, demand for colonoscopy could decrease by 1.78 million; partially offset by 0.34 million follow-up colonoscopies for CTC with positive findings (10 mm polyp)	Fair
Pickardt et al., 2008[203] Modeling US population	Current volume of CTC estimated from secondary data on CT scanners in the US	Markov model used to estimate demand for the US population	Assuming 60% compliance with screening, 67% of screening is CTC, and rise in number and percentage of CT scanners performing CTC (from n = 718/10% to n = 10,000/90%), there is sufficient capacity to screen 10 years from now in a steady-state scenario	Fair

CORI, Clinical Outcomes Research Initiative; CRC, colorectal cancer; CT, computed tomography; CTC, computed tomography colonography; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; MDs, physicians; NHIS, National Health Interview Survey.

All six studies used census data with specific refinements (such as omitting persons who are above average risk or who may be too "sick" for screening) as inputs into mathematical models to estimate current and projected demand. The types of refinements of population estimates, the types of models, and the assumptions regarding demand (most importantly, what percentage of the population would be included in a future screening scenario) used to construct the models varied widely among the studies. The percentage of the population included in future screening scenarios ranged from 40 percent to 100 percent.

Overview of results. Six studies provided some data on the ability of current capacity or volume to meet projected demand under various steady-state scenarios. For each scenario, we present estimates of projected demand from across all studies and compared these levels of projected demand with estimates of current capacity from across all studies.

In the first scenario, in which 75 percent of the US population is screened by FOBT alone, the projected demand for colonoscopy is 3.8 million.[201] Based on estimates of current capacity

from across the studies, current capacity is likely sufficient to meet the demand for colonoscopy. If a similar proportion (70 percent to 75 percent) of the US population is screened using either FS or combined FS/FOBT, an estimated 6.9 million to 10 million FSs and 2.7 million to 4.7 million colonoscopies are needed. Current volume of FS is not sufficient, but current capacity, including estimates of additional available capacity, is likely sufficient to meet projected demand; current volume of colonoscopy is sufficient. Finally, if 70 percent of the US population is screened by a colonoscopy alone, the projected demand is 4.8 million to 8.1 million colonoscopies. Current volume is not sufficient to meet the projected demand, but current capacity, including additional available capacity, may be sufficient. All of these estimates represent steady-state scenarios; none of these models incorporated current estimates of the unscreened.

In the single study that modeled the extent to which available capacity was sufficient to screen the unscreened population, the investigators determined that, using 100 percent of additional available capacity, it would take 3 years at current screening patterns, 6 years using 100 percent FS or FOBT/FS, or 5 years using 100 percent colonoscopy to screen the unscreened population.

Detailed assessment, FOBT screening scenario. One good-quality study used a Markov model to estimate endoscopic demand under various screening demand scenarios.[201] It reported that if 75 percent of the US population were screened by FOBT alone, 3.8 million colonoscopies would be needed for followup of abnormal FOBTs, for post polypectomy surveillance, or for diagnosis of symptomatic CRC or followup after CRC treatment.

Detailed assessment, FS screening scenario. Two studies, one rated good and one rated fair, reported similar estimates on the number of FS needed if a large proportion of the population were screened with FS every 5 years. One study, which used a Markov model to estimate endoscopic demand under various screening demand scenarios, found that if 75 percent of the US population were screened by FS alone, 10.0 million FSs and 2.7 million colonoscopies would be needed annually.[201] The NCI study also used a microsimulation model that incorporated population estimates and assumptions about test performance to estimate demand for FS.[195] They found that if 70 percent of the US population were screened by FS every 5 years, the number of FS procedures required annually would be "almost 10 million," which is approximately twice their estimate of FS current volume.

Detailed assessment, FOBT/FS screening scenario. Two studies, both rated good, reported on the number of colonoscopies needed if a proportion of the population were screened with FS every 5 years and FOBT every year. One used a Markov model to estimate endoscopic demand under various screening demand scenarios and found that if 75 percent of the US population were screened by FOBT/FS, 6.9 million FSs and 4.7 million colonoscopies would be needed annually.[201] The other study, which estimated current volume using the CORI database and demand based on a Markov model, found that, assuming 70 percent adherence to a FOBT/FS screening strategy, an incremental number of 1.2 million colonoscopies would be needed above the baseline of 1.69 million per year (total of ~2.9 million screening colonoscopies).[200]

Detailed assessment, colonoscopy screening scenario. Three studies, two rated good and one rated fair, reported on projected demand if 70 percent to 75 percent of the US population were screened by colonoscopy alone. The study that estimated demand scenarios found that if 75 percent of the US population were screened by colonoscopy alone, 8.1 million screening colonoscopies would be needed annually.[201] The study that estimated current volume using the CORI database and demand based on a Markov model, found, assuming 70 percent adherence to a colonoscopy screening strategy every 10 years, that an incremental number of 5.0 million colonoscopies would be needed above a baseline of 1.69 million per year (total of 6.69 million

screening colonoscopies).[200] The NCI study found that if 70 percent of the US population were screened by colonoscopy every 10 years, the number of screening colonoscopy procedures required annually would be 4.8 million (which was three times the estimated current volume in that study).[195]

None of these studies gave estimates of additional available capacity. Of the two studies that estimated current volume in addition to projected demand, projected demand far exceeded current volume. This pattern suggested that a colonoscopy screening strategy for a large proportion of the population could not be supported. However, if the estimates of current available capacity from Seeff and colleagues[202] are taken into account (an additional 8.2 million colonoscopies per year), the current endoscopy infrastructure might possibly support a colonoscopy strategy of this sort.

Detailed assessment, screening the unscreened by various scenarios. One study was unique in that it modeled the ability of additional available capacity (rather than current volume) to screen all current average-risk unscreened persons in the US population (rather than modeling various screening strategies for the entire US population).[202] This study, rated good quality, modeled the time needed to screen the current unscreened US population (41.8 million persons) by various strategies. This study found that, using 100 percent of additional available capacity, it would take 3 years at current screening patterns or 6 years using 100 percent FS or FOBT/FS to screen the average-risk unscreened population. Using 100 percent of additional available capacity, it would take 5 years to screen the unscreened population with colonoscopy.

Detailed assessment, increasing demand for CT colonography (CTC) scenario. Three studies, one rated good and two rated fair, modeled increasing demand for CTC. Two had as outcomes the effect on demand for colonoscopy;[199,201] the third asked whether projected CTC capacity is sufficient to meet projected CTC demand.[203] The good-quality study using a Markov model to estimate endoscopic demand under various screening demand scenarios reported, assuming 75 percent uptake, that demand for colonoscopy would be 6.2 million if all screening was done by CTC.[201] The fair-quality study, estimated capacity from data from the CORI database and modeled demand based on a mathematical model. Assuming 55 percent adherence to any kind of screening and 67 percent of screening being CTC (overall 37 percent utilization of CTC), these investigators reported that, in the initial 5-year period after implementation of CTC, demand for colonoscopy could decrease by 1.78 million. This would be partially offset by 0.34 million follow-up colonoscopies for CTC with positive findings.[199] Because assumptions for utilization of CTC varied widely between the two studies, they cannot be directly compared.

The third study asked a very different question: whether projected capacity of CTC is sufficient to meet projected demand.[203] The authors assumed 60 percent compliance with any kind of screening, 67 percent of screening being CTC, and a rise in the number and percentage of CT scanners performing CTC from 718 and 10 percent to 10,000 and 90 percent. Given these factors, they concluded that the nation will have sufficient capacity to screen 10 years from now in a steady-state scenario.

KQ 5: Effective Approaches for Monitoring Use and Quality of Colorectal Cancer Screening

Valid data on the use and quality of CRC screening are central to efforts to decrease morbidity and mortality from CRC in the United States. To understand the current status of CRC screening and the effects of interventions to increase the use and quality of screening, we must have both valid measures of CRC screening use and quality of those services and effective

monitoring approaches to obtain data on these measures. KQ 5 examines the approaches for monitoring use and quality of CRC screening in populations and the effectiveness of these monitoring approaches.

As a starting point for defining an effective approach for monitoring use and quality of CRC screening, we identified frameworks for public health monitoring (or surveillance) systems from both the United States and Canada.[47,205] To avoid confusion over the term 'surveillance', we have opted to use it to describe surveillance colonoscopy (colonoscopy for patients who have had a previous colonic polyp (and, usually, polypectomy)) and have replaced the term 'surveillance' with regard to data collection related to CRC test use to the term 'monitoring'. Therefore, all discussions about data systems will be referred to as those that monitor use or quality. These frameworks provide complementary lists of characteristics or attributes of monitoring systems that are applicable to the design of an ideal approach to monitoring CRC use and quality. Although the notion of a monitoring system may be more common for infectious diseases than for cancer or other chronic conditions, these frameworks are intended to be applicable to both chronic and infectious diseases. Also, although monitoring systems are often thought of in terms of disease incidence and mortality (rather than health care utilization or health care quality), public health is beginning to monitor risk factors and preventive services such as CRC screening, not just diseases.

The frameworks that we identified provide a comprehensive and logical way to think about evaluating existing approaches to monitoring the use and quality of CRC screening, and they provide guidance for the design of optimal monitoring approaches. Table 48 describes characteristics or attributes of monitoring systems that the review team found applicable to CRC screening; it also gives working definitions adapted from the US and Canadian frameworks. In addition to these characteristics, the frameworks described more global system performance characteristics of usefulness, effectiveness, and/or efficiency. The items in this table are considered to contribute to overall system performance, including effectiveness; in addition to these characteristics, a critical component of effectiveness as defined in one framework is how well the system achieves its intended results.[205]

Table 48. Characteristics of public health monitoring systems that contribute to effectiveness

Characteristic	Working definition
Data quality	Completeness and validity of the data in the system
Timeliness	Interval between occurrence of an event and reporting of the event
Acceptability	Willingness of persons and organizations to participate in the monitoring system
Simplicity	Structure and ease of operation
Flexibility	Ability of the system to accommodate changes in operating conditions or information needs
Compliance	Degree to which a system complies with all relevant legislation, regulations, and policies
Stability	Reliability (ability to collect, manage and provide data properly without failure) and availability (ability to be operational when it is needed) of the monitoring system
Cost	Indirect and direct costs

Adapted from Health Canada, 2004[205]

In our literature search, all the articles identified relevant to KQ 5 pertained only to the first system characteristic, data quality. We found no articles that measured other characteristics of a monitoring system or that compared any of these characteristics between systems. Also, we found no articles that addressed the monitoring of quality of CRC screening, just monitoring of CRC screening use.

Specifically, most of the articles that we identified evaluated the accuracy of measures of CRC screening as obtained from various data sources (self-report, medical record review, or administrative data);[35,39-40,206-207] these studies add to the evidence from a recent systematic review[208] and other literature that appeared before our time period of included articles. We also

found one study that described an attempt to solve one of the barriers in using administrative data to determine screening rates, that of distinguishing screening from diagnostic endoscopies,[209] and two studies that evaluated novel means of combining more than one data source to produce hybrid measures of CRC use.[35,210]

Other than establishing the quality of data on CRC screening use by evaluating the accuracy of measures of CRC screening as obtained from various data sources (self-report, medical record review, or administrative data), we found no other studies that measured or compared any of the other characteristics of monitoring systems (such as acceptability or cost). Thus, although this body of literature gives indications of data quality of the various sources for monitoring CRC use, it provides little evidence to inform the larger questions of what monitoring approaches, overall, are effective.

Our overall summary and strength of evidence tables for studies addressing this KQ are presented at the beginning of this section. The remainder of this section provides a more detailed assessment of the individual studies that informed our conclusions and our assessment of the strength of evidence.

KQ 5 Overall Summary and Strength of Evidence

In Table 49, our overall grades of the strength of evidence appear in the far right column; grades for key domains to determine the strength of evidence are in the intermediate columns. In assessing research specific to KQ 5 about effectiveness of varying approaches to monitoring CRC use and quality, we found varying grades between low and high depending for different aspects of this KQ. The grade can be interpreted as the confidence that the evidence reflects the true effect. For example, a grade of low means that further research is likely to change the confidence in the estimate of effect, and is likely to change the estimate.

Overall, the evidence suggests that self-reported rates of CRC screening are higher than rates obtained by medical record review or administrative data (high strength of evidence). Nevertheless, rates of agreement between self-reported CRC screening and information found in medical records or administrative data are at least moderate (moderate strength of evidence), indicating that all three methods are generally appropriate for monitoring CRC screening use. The evidence suggests, although strength of evidence is low, that concordance among data sources is higher for rates of endoscopy screening than for rates of FOBT screening. Evidence was insufficient for using algorithms to determine whether a colonoscopy identified in administrative data was conducted for screening or for diagnostic purposes. The evidence also suggests that using a hybrid method (administrative data plus medical record review or self report of CRC screening) will increase the reported prevalence of screening, but whether validity is increased is not known (low strength of evidence).

Table 49. Strength of evidence for approaches to monitoring effectiveness of CRC screening use and quality

Number of studies; Number of subjects	Risk of Bias Design/Quality	Consistency	Directness	Precision	Results	Overall strength of evidence
Effective approaches of monitoring use and quality of CRC screening						
No study	NA	NA	NA	NA	NA	Insufficient
Validity of self-report, administrative data, and medical record review ot measure CRC screening use: Comparing prevalence of CRC screening rates by various sources						
Hall et al., 2004[206] Schenck et al., 2007[39] Schenck et al., 2008[40] Fiscella et al., 2006[207] Schneider et al., 2008[35] 4: 190,358	Low 4 Cross sectional/3 Good, 1 Fair	No inconsistency	Direct	NR	Self-reported CRC screening rates are higher than rates obtained by medical records or administrative data	High
Validity of self-report, administrative data, and medical record review to measure CRC screening use: Concordance among data sources for CRC screening measures						
Hall et al., 2004 [206] Schenck et al., 2007[39] Schenck et al., 2008[40] Fiscella et al., 2006[207] 3: 4,165	Low 3 Cross sectional/3 Good	Inconsistency present	Direct	Precise	Concordance between self-reported CRC screening and medical record or administrative data was at least moderate (agreement >70% or kappa > 0.4)	Moderate
Validity of self-report, administrative data, and medical record review to measure CRC screening use: Concordance among data sources for CRC screening measures, by screening test						
Hall et al., 2004 [206] Schenck et al., 2007[39] Schenck et al., 2008[40] 2: 2,691	Low 2 Cross sectional/2 Good	Inconsistency present	Direct	Precise	Concordance between self-report and medical record or administrative data is higher for endoscopy than for FOBT	Low
Distinguishing screening from diagnostic endoscopy using an algorithm for administrative data						
Haque et al., 2005[209] El-Serag et al., 2006[64] 1: 523	Moderate 2 Cross sectional/2 Fair	No inconsistency	Direct	NR	Algorithms have not been able to distinguish between diagnostic and screening endoscopic exams in administrative data	Low
Ability of a hybrid method (using administrative data and self-report) to increase validity of measurement						
Pignone et al., 2009[210] Schneider et al., 2008[35] 2: 194,952	Moderate 2 Cross sectional/2 Fair	Consistent	Direct	NR	Hybrid methods will increase reported prevalences of CRC screening, but whether validity is increased is unknown.	Insufficient

CRC, colorectal cancer; FOBT, fecal occult blood test; NA, not applicable; NR, not reported.

Overall study characteristics. We found seven studies of good or fair quality that reported data on effectiveness of approaches to monitor use of CRC screening.[35,39-40,206-207,209-210] Three studies that were specific to validation of a set of survey questions developed by the National Cancer Institute[211] were not included as they did not meet our inclusion criteria.[212-214] Four

studies took place within a managed care setting or a health plan[35,206,209-210] and three included Medicare patients seen in non-managed care settings.[39-40,207] All were cross-sectional studies that compared two or more data sources on CRC screening to evaluate the accuracy of the method of interest.

Overall study results. Included studies addressed only data quality; we found no studies that described or compared other monitoring system attributes. Although none of the three data sources can be considered a gold standard, all three appear to be generally appropriate for monitoring CRC screening status. However, self-reported rates of CRC screening are consistently higher than rates obtained from either medical records or administrative data.

The included studies reported a wide range of measures of concordance (agreement and/or kappa statistic, which accounts for agreement expected by chance) comparing CRC screening measures from the three data sources.[35,39-40,206-207] In most studies that report accuracy of self-report for FOBT, any endoscopy, or any testing, concordance between self-report and medical record or administrative data was at least moderate (agreement greater than 70 percent or kappa greater than 0.40). Concordance appears to be higher for endoscopy than for FOBT.

One problem with using administrative data is that distinguishing screening from diagnostic examinations is difficult; the single study reviewed was not able to use an algorithm to do so effectively.[209] Two studies demonstrated that administrative claims will underreport CRC screening rates (by showing that survey or medical record review will pick up additional screenings that were false negatives in the claims data), but they do not demonstrate conclusively that measuring CRC screening rates using hybrid methods is a more valid or a more effective approach overall.[35,210]

The following chapter is divided into three sections, based on the purpose of the studies. The first category includes studies that compared two or three types of data sources to evaluate data validity.[35,39-40,206-207] The second category includes one study, which evaluated the use of a computer algorithm to distinguish diagnostic from screening endoscopy in administrative data.[209] The final category includes two studies that used combinations of administrative, medical record, and survey data to assess the accuracy of these novel ways of CRC screening measurement.[35,210]

As with other KQs, tables in this section list studies by quality (good followed by fair) and then alphabetically by last name of the first author of the article(s). Appendix C[§§] presents the evidence tables with the details of these studies.

Validity of Self-Report, Administrative Data, and Medical Record Review to Measure CRC Screening Status

Study characteristics. We found five studies of good or fair quality that reported data on the validity of various data sources of CRC screening rates.[35,39-40,206-207] The single study rated fair did not report detail on methods to ensure valid medical record abstraction.[35]

Two studies took place within a managed care setting or a health plan;[35,206] of these, one included all plan members 51 years or older,[35] and one used slightly different age cutoffs for men and women (45 and older for men and 55 and older for women).[206] Three studies evaluated measures of CRC screening in Medicare populations.[39-40,207] Of these, two included Medicare patients ages 55 to 80[39-40] and the third included Medicare patients 65 and older.[207]

[§§] Appendixes and evidence tables cited in this report are available at http://www.ahrq.gov/downloads/pub/evidence/pdf/crcuse/crcuse.pdf.

All studies were cross-sectional studies that compared two or more data sources on CRC screening to evaluate the accuracy of the method of interest. One study compared self-report of CRC screening with medical record review only,[206] whereas the remaining studies examined all three sources of data—self-report, medical records, and administrative data. One study used secondary data from the Medicare Current Beneficiary Survey (MCBS);[207] the remaining four studies involved surveys of patients for self-reported CRC screening history.

In general, these studies asked questions about several types of screening tests, followed by questions about the time frame when the tests occurred. Two studies reported that their questions were modeled after national studies such as the NHIS and BRFSS.[35,206] Studies generally compared the prevalences of CRC screening as measured by different data sources and/or reported agreement, defined as the percentage of persons for whom the two data sources agreed and a kappa statistic.

Overview of results. Results of the studies were of two main types (Tables 50 and 51). In the five studies that compared prevalence rates of CRC screening from self-report with prevalence rates from medical record data or administrative data, the rates of FOBT, FS, and colonoscopy are generally higher as measured by self-report than by medical record data or by administrative data (Table 50). In the two studies that compared medical record data with administrative data, both in Medicare patients, administrative data may have slightly higher prevalence rates than those reported by the medical records. The range of concordance among the studies that compared the three data sources (Table 51) was wide. In most studies that reported accuracy of self-report for FOBT (two studies), for endoscopy (two studies), and for any testing (one study), concordance between self-report and medical record or administrative data was at least moderate (agreement greater than 70 percent or kappa greater than 0.40). Concordance appears to be higher for endoscopy than for FOBT.

Detailed assessment. In the first study, conducted by CDC staff and authors from three health plans (in Georgia, Minnesota, and North Carolina), participants were recruited who had been enrolled in their plan for at least 5 years and were ages 45 years and older (men) or 55 and older (women).[206] The investigators stratified the sample by site and sex and oversampled African-Americans members. Participants were recruited by letter and telephone; the cooperation rate was 64.8 percent. Investigators examined participants' medical records for the previous 5 years. The study found that a higher percentage of respondents received testing when measured by self-report than by medical record audit (Table 51). The authors calculated a kappa statistic and used a cutoff of 0.40, above which indicates at least fair agreement (by the authors' definition of poor less than 0.40; fair to good of 0.40-0.75; and excellent of > 0.75). They concluded that agreement was fair to good for FS and colonoscopy among most groups and poor for FOBT in two or three HMOs (Table 51).

In the second study, researchers compared Medicare claims data with self-report from the MCBS of having received an FOBT, FS, or colonoscopy among white, African-American, or Hispanic enrollees who were at least 65 years, did not reside in a long-term care facility, and were not enrolled in a Medicare HMO.[207] The survey was conducted in 2000; the study did not mention the time frame for administrative claims review nor distinguish screening from diagnostic procedures in either data source. Only race-specific prevalences were reported, as the goal of the study was to examine disparities in screening rates as measured by different data sources. In this study, rates of screening were as follows: white, self-report 38 percent; white, claims 30.1 percent; minority, self-report 34.8 percent; and minority, claims 20.4 percent (Table 50). The kappa score measuring agreement between self-report and claims was 0.37 for whites and 0.19

Table 50. Assessing validity of CRC screening measures: Comparing prevalence of CRC screening rates by various data sources

Author, Year Study Design Population Setting Sample Size Quality	Study Aim	Data Sources	Results
Hall et al., 2004[206] Cross-sectional Three HMOs in Georgia, Minnesota, and North Carolina N: 363 (black men), 847 (white/other men), 920 (women) Good	Examine the accuracy of self-report of CRC screening among members of 3 health plans	Medical record review to determine whether any of the tests had been recorded within 5 years Survey of sampled health plan members for self-reported CRC screening history	Among 3 demographic groups in 3 health plans (data combined), the percentage of respondents who received testing was higher when measured by self-report (survey) than by medical record review Black men; white/other men; women: FOBT Survey 22.2; 20.3; 25.9 Medical record review 11.6; 9.5; 14.1 FS Survey 38.4; 42.0; 50.0 Medical record review 29.6; 30.6; 34.1 Colonoscopy Survey 13.7; 14.6; 15.7 Medical record review 8.1; 11.1; 9.6 Endoscopy Survey 44.4; 49.8; 58.6 Medical record review 34.4; 37.8; 39.8
Fiscella et al., 2006[207] Cross-sectional Medicare beneficiaries, age ≥ 65, community dwelling who were included in the MCBS; white race compared with minority (Hispanic plus non-Hispanic African American) N: 1,474 Good	Determine whether estimates of racial disparities in receipt of CRC screening and other preventive procedures differ between self-report and Medicare claims data	Prevalence of receipt of FOBT, FS, or colonoscopy as measured by: Self-report (survey) of having any of the tests in the last year (MCBS) (indication was not specified) Medicare claims, including both screening and diagnostic codes (administrative data)	CRC screening White: Survey 38.0 Administrative 30.1 Minority: Survey 34.8 Administrative 20.4

Table 50. Assessing validity of CRC screening measures: Comparing prevalence of CRC screening rates by various data sources

Author, Year Study Design Population Setting Sample Size Quality	Study Aim	Data Sources	Results
Schenk et al., 2007[39] Cross-sectional Medicare beneficiaries, white or African-American between the ages of 55-80, no history of CRC, in 10 urban counties in North Carolina who had responded to a telephone survey in 2002 on CRC screening N: 561 Good	Compare ascertainment of endoscopy screening among 3 data sources: self-report, Medicare claims, and medical record review	Prevalence of receipt of FS (in last 4 years) or colonoscopy (in last 5 years) as measured by: Self-report in 2002 on a telephone survey; FS vs. colonoscopy were described and queried for separately; respondents were asked if the exam was part of a check up or because of a problem Medicare claims: inpatient, physician, and hospital outpatient claims from 1/1998-12/2002 (screening vs. diagnostic exams were distinguished) (administrative data) Medical record review: record abstraction between 1/1998 and 12/2002 from the primary care provider (or a provider identified by an algorithm) and for some, the MD performing the procedure. Exams were classified as screening if the test was conducted for screening or as part of a well-adult visit, and all others were classified as diagnostic	Prevalence of endoscopy in the past year Overall: Survey 50.1 Administrative 44.9 Medical record review 42.3 By sociodemographic characteristics: Age 55-64; 65-74; 65-80 Survey 50.8; 52.4; 44.0 Administrative 35.6; 43.9; 50.7 Medical record review 32.2; 40.7; 50.0 All African Americans; all whites; all women, all men: Survey 40.9; 52.9; 46.8; 55.3 Administrative 41.7; 45.9; 43.6; 47.0 Medical record review 42.4; 42.2; 42.7; 41.6 Less than high school; high school diploma; more than high school: Survey 28.7; 46.9; 59.8 Administrative 39.4; 45.9; 45.8 Medical record review 38.3; 41.8; 43.6

Table 50. Assessing validity of CRC screening measures: Comparing prevalence of CRC screening rates by various data sources

Author, Year Study Design Population Setting Sample Size Quality	Study Aim	Data Sources	Results
Schenk et al., 2008[40] Cross-sectional Medicare beneficiaries, white or African-American between the ages of 55-80, no history of CRC, in 10 urban counties in North Carolina who had responded to a telephone survey in 2002 on CRC screening N: 561 Good	Compare ascertainment of FOBT among 3 data sources: self-report, Medicare claims, and medical record review	Prevalence of receipt of FOBT as measured by: Self-report in 2002 on a telephone survey: at-home FOBT described and respondents asked whether they had ever had a test and the date of most recent test; respondents were asked if the exam was part of a check up or because of a problem Medicare claims: billing for FOBT (diagnostic or screening codes) from 1/1998 to 12/2002 (administrative data) Medical record review: record abstraction between 1/1998 and 12/2002 (distinguishing in-office tests from home kits where possible)	Prevalence of FOBT in the past year Overall: Survey 28.7 Administrative 21.2 Medical record review: 19.4 By sociodemographic characteristics: Age 55-64; 65-74; 65-80 Survey 35.2; 27.9; 28.4 Administrative 19.3; 21.0; 23.6 Medical record review: 19.3; 19.8; 19.6 All African Americans; all whites; all women, all men Survey 32.0; 27.8; 30.6; 25.9 Administrative 18.8; 22.4; 25.5; 15.3 Medical record review: 12.5; 21.9; 21.7; 16.7 Less than high school; high school diploma; more than high school Survey 26.6; 26.0; 31.6 Administrative 20.2; 20.4; 22.8 Medical record review: 19.1; 16.3; 22.4
Schneider et al., 2008[35] Cross-sectional 5 health plans in the US N: 189,193 administrative data and 1,250 survey respondents Fair	Describe a field test of a screening measure included in the HEDIS	Prevalence of specific CRC screening tests or any CRC screening compared among: Survey data Administrative data Hybrid of administrative and medical record review data	Among members in each of 5 health plans, the percentage of respondents who received testing was generally higher when measured by self-report than by administrative data By health plan A; B; C; D; E: FOBT Survey 25.4; 26.3; 20.5; 21.8; 25.1 Administrative 23.6; 15.0; 31.1; NA; 24.7 FS Survey 29.7; 39.6; 33.9; 33.6; 30.6 Administrative 14.2; 17.9; 18.4; 15.3; 15.4 Colonoscopy Survey 19.9; 39.0; 33.6; 33.7; 40.7 Administrative 12.8; 12.1; 9.4; 10.5; 14.2

Table 50. Assessing validity of CRC screening measures: Comparing prevalence of CRC screening rates by various data sources

Author, Year Study Design Population Setting Sample Size Quality	Study Aim	Data Sources	Results
Schneider et al., 2008[35] (continued)			Any CRC screening Survey 53.2; 69.7; 55.0; 62.1; 66.2 Administrative 41.5; 38.6; 47.1; 27.3; 44.4 Hybrid 41.5; 53.5; 52.6; 38.8; 45.6 Survey respondents were more likely than nonrespondents to have evidence of CRC screening (62.7% vs. 46.5%; *P* < 0.001)

CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HEDIS, Health Plan Employer Data and Information Set; HMO, health maintenance organization; MCBS, Medicare Current Beneficiary Survey; N, number; NA, not applicable.

Table 51. Assessing validity of CRC screening measures: Concordance among data sources for CRC screening measures

Author, Year Study Design Population Setting Sample Size Quality	Study Aim	Data Sources	Results
Hall et al., 2004[206] Cross-sectional Three HMOs in Georgia, Minnesota, and North Carolina N: 363 (black men), 847 (white/other men), 920 (women) Good	Examine the accuracy of self-report of CRC screening among members of 3 health plans	Medical record review to determine whether any of the tests had been recorded within 5 years Sampled health plan members were asked whether they had ever been tested and date of most recent test	Concordance between self report and medical records is reported as the range of the nine values (for each of 3 demographic groups in each of 3 HMOs) for each of the following items: FOBT Agreement: 0.78-0.86* Kappa: 0.23-0.62† FS Agreement: 0.63-0.89 Kappa: 0.31-0.77 Colonoscopy Agreement: 0.86-0.94 Kappa: 0.30-0.69 Any endoscopy Agreement: 0.61-0.92 Kappa: 0.30-0.83

Table 51. Assessing validity of CRC screening measures: Concordance among data sources for CRC screening measures

Author, Year Study Design Population Setting Sample Size Quality	Study Aim	Data Sources	Results
Fiscella et al., 2006[207] Cross-sectional Medicare beneficiaries, age ≥ 65, community dwelling who were included in the MCBS; white race compared with minority (Hispanic plus non-Hispanic African American) N: 1,474 Good	Determine whether estimates of racial disparities in receipt of CRC screening and other preventive procedures differ between self-report and Medicare claims data	Prevalence of receipt of FOBT, FS, or colonoscopy as measured by: Self-report of having any of the tests in the last year (MCBS) (indication was not specified) Medicare claims, including both screening and diagnostic codes (administrative data)	Concordance between self-report and administrative data (measured by kappa score) for CRC screening White 0.37 Minority 0.19
Schenk et al., 2007[39] Cross-sectional Medicare beneficiaries, white or African-American between the ages of 55-80, no history of CRC, in 10 urban counties in North Carolina who had responded to a telephone survey in 2002 on CRC screening N: 561 Good	Compare ascertainment of endoscopy screening among 3 data sources: self-report, Medicare claims, and medical record review	Prevalence of receipt of FS (in last 4 years) or colonoscopy (in last 5 years) as measured by: Self-report in 2002 on a telephone survey; FS vs. colonoscopy were described and queried for separately; respondents were asked if the exam was part of a check up or because of a problem Medicare claims: inpatient, physician, and hospital outpatient claims from 1/1998-12/2002 (distinguished screening vs. diagnostic exams) (administrative data)	Measures of concordance for endoscopy use Administrative to medical record review Agreement: 95 (93-97) Kappa: 0.89 (0.81-0.98) Self-report to medical record review Agreement: 70 (66-73) Kappa: 0.39 (0.31-0.47) Self-report to administrative Agreement: 70 (66-74) Kappa: 0.40 (0.32-0.49) Agreement regarding test type (FS or colonoscopy) Claims to medical record review: 93 (88-97) Self-report to medical record review: 82 (75-89) Self-report to claims: 77 (70-85) Agreement regarding test purpose (screening or diagnostic): Administrative to medical record review: 52 (43-61) Self-report to medical record review: 65 (55-74) Self-report to administrative: 29 (20-36)

Table 51. Assessing validity of CRC screening measures: Concordance among data sources for CRC screening measures

Author, Year Study Design Population Setting Sample Size Quality	Study Aim	Data Sources	Results
Schenk et al., 2007[39] (continued)		Medical record review: record abstraction between 1/1998 and 12/2002 from the primary care provider (or a provider identified by an algorithm) and for some, the MD performing the procedure; exams were classified as screening if the test was conducted for screening or as part of a well-adult visit, and all others were classified as diagnostic	
Schenk et al., 2008[40] Cross-sectional Medicare beneficiaries, white or African-American between the ages of 55-80, no history of CRC, in 10 urban counties in North Carolina who had responded to a telephone survey in 2002 on CRC screening N: 561 Good	Compare ascertainment of FOBT among 3 data sources: self-report, Medicare claims, and medical record review	Prevalence of receipt of FOBT as measured by: Self-report in 2002 on a telephone survey; description of at-home FOBT provided, and persons asked whether they had ever had a test and the timing of most recent test Medicare claims: billing for FOBT (diagnostic or screening codes) from 1/1998 to 12/2002 (administrative data) Medical record review: record abstraction between 1/1998 and 12/2002 (distinguishing in-office tests from home kits where possible)	Measures of concordance for FOBT Administrative to medical record review Agreement: 82 (79-85) Self-report to medical record review Agreement: 70 (66-74) Self-report to administrative Agreement: 67 (63-71) Sensitivity analyses included: excluding claims of FOBT on day of medical visit; including all medical record review of FOBTs (likely including in-office, single card FOBTs with digital rectal exams); did not appreciably change the measures

CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HEDIS, Health Plan Employer Data and Information Set; HMO, health maintenance organization; MCBS, Medicare Current Beneficiary Survey; N, number.
*Agreement is the percentage of persons for whom the two data sources agree.
†Kappa statistic is a measure of agreement that accounts for agreement expected by chance.

for minorities. The authors also calculated ORs for reporting a procedure in the absence of a claim, or vice versa. Minorities were more likely to report receipt of CRC screening in the absence of a claim (OR, 1.92, 95% CI, 1.32-2.79), with little change after adjustment for age, gender, income, educational level, health status, proxy response, and supplemental insurance. Having a claim for CRC testing in the absence of self-report did not differ by race or ethnicity.

The North Carolina Quality Improvement Organization (the Carolinas Center for Medical Excellence) did two studies to evaluate all three data sources, namely self-report, medical records, and administrative data, for measuring CRC screening among Medicare patients. One study evaluated these data sources for measuring endoscopy[39] and the other for measuring FOBT.[40] Included persons were Medicare beneficiaries who were white or African-American, between the ages of 55 and 80, with no history of CRC, and residing in 10 urban counties in North Carolina who had responded to a telephone survey in 2002 on CRC screening.

The *survey* provided explanations of the FOBT, FS, and colonoscopy procedures, attempting to distinguish in-office FOBT from home FOBT, and also asked respondents if the examination was part of a check up or because of a problem. For the *medical record review*, the investigators linked patients to a medical provider (to complete the medical record review) using a hierarchical approach. First, they asked survey respondents to name a provider; if that provider could not be located or if the response to the question was missing or unusable, they used a claims algorithm to identify a likely primary care provider. If the abstracted record from the primary care provider did not contain information about an endoscopy noted in claims data, then the claims data were used to identify the physician who had performed the procedure and the researchers then abstracted the medical record from this physician as well. Specific to the endoscopy study, medical record review captured whether the test was done for screening or diagnostic reasons. Specific to the FOBT study, data on the four most recent FOBTs were abstracted, including the reason for the test and the nature of the test (sending three samples collected at home to the laboratory, a digital rectal examination [DRE] with a FOBT performed in the office, or not specified). For the *claims data*, Medicare inpatient, physician, and outpatient claims for endoscopies were obtained for the 5-year period 1/1/1998 through12/31/2002. Screening and diagnostic codes were available for both FOBT and endoscopic procedures.

In the first study, self-reported FS within the past 4 years or colonoscopy in the past 5 years was compared with evidence in claims or medical record review that the procedure had been done. Prevalence of endoscopy screening was highest when measured by self-report (50.1 percent) followed by claims data (44.9 percent) and medical record review (42.3 percent); sociodemographic subgroups differed somewhat in these percentages (Table 50). The authors also found high agreement (95 percent; kappa = 0.89) between claims and medical records and good agreement (70 percent) between self-report and medical records and self-report and claims (kappa = 0.39-0.40) (Table 51). Also, all three data sources were able to distinguish the type of procedure done (FS versus colonoscopy), based on agreement between the data sources (77 percent to 93 percent), but none showed reliable levels of agreement regarding whether the test was screening or diagnostic (Table 51).

The second North Carolina study evaluated measurement of FOBT in the past year in a similar fashion.[40] Overall, the level of self-report of FOBT was higher (28.7 percent) than the level measured by claims (21.2 percent) or medical record review (19.4 percent); again, subgroups differed somewhat in these rates (Table 50). Lower rates of agreement were found among the three data sources for FOBT (67 percent to 82 percent) than for endoscopy (Table 51). The authors concluded that no data source could be established as providing valid information about FOBT among Medicare enrollees.

The final study, which we rated fair quality, was a field test of a National Committee for Quality Assurance (NCQA) performance measure.[35] The investigators randomly selected 200 persons age 51 or older from each of five health plans who had been enrolled continuously for at least 2 years and who lacked evidence of recent CRC screening; they conducted both a survey and medical record review. For the survey, they selected an additional 400 persons per plan were selected (for a total of 600 per plan). The response rate to the survey, which asked about CRC

screening and time frames in which they occurred, was 48.1 percent. CRC screening status was ascertained from administrative data, from the survey, and from a hybrid method of administrative records plus medical record review (for overall, not test-specific, screening status). Among members in each plan, the percentages of respondents who received testing were generally higher when measured by self-report than by administrative data (Table 50). Of note, survey respondents were more likely than nonrespondents to have evidence of CRC screening (62.7 percent versus 46.5 percent; $P < 0.001$).

Distinguishing Screening from Diagnostic Endoscopy Using an Algorithm for Administrative Data

Study characteristics. Two studies evaluated an algorithm's ability to distinguish between screening and diagnostic endoscopy (Table 52).[64,209] We rated both studies as fair quality, the first because of the limitations in their methods used to ensure validity of the medical record review data[209] and the second because of limited reporting of the outcome.[64] One study took place in a sample of patients from one HMO;[209] the second in VA patients from one medical center.[64]

Overview of results. Algorithms that use concomitant diagnostic codes to distinguish whether an endoscopy is screening or diagnostic have not been able accurately to distinguish the two types of endoscopies.

Detailed assessment. In the first study, using data from a large staff-model HMO, the algorithm classified an endoscopy as diagnostic if administrative data included certain conditions in the year before the examination or either specific signs or symptoms or an FOBT within 45 days before the examination. All participants in this HMO ages 50 to 70 who had been continuously enrolled for 5 years and who had completed an endoscopy during that time were eligible for the study. The investigators selected a stratified random sample of 220 participants based on the algorithm's classification of the endoscopy (for each of FS and colonoscopy, 30 diagnostic and 80 screening). They then reviewed medical charts and classified the examination as diagnostic based on the chart review if it was a follow-up to a previous abnormality or if clear-cut conditions or signs were present, using the same list as the algorithm. The algorithm had a low sensitivity for diagnostic endoscopies (48.1 percent for FS and 23.8 percent for colonoscopy). Overall, the agreement was better for sigmoidoscopies (kappa = 0.76) than for colonoscopies (kappa = 0.44).

In the second study, national VA datasets were used to identify all FOBT, FS, DCBE, and colonoscopy procedures performed in the VA between 1998 and 2003. All FOBTs were designated screening. All FS, DCBE, and colonoscopy procedures were classified as screening, followup, or diagnostic based on an algorithm considering diagnoses in the year before the procedures. A random sample of 303 medical records from a single VA hospital was reviewed by two gastroenterologists blinded to the designated status given by the algorithm. Agreement between the reviewers was achieved in 92 percent of cases; they resolved differences by discussion. Results from the medical record review were compared with the designation by the algorithm; only sensitivity and specificity for the algorithm's ability to identify screening colonoscopy were reported, 70.1 percent and 71.l6 percent, respectively.

Table 52. Comparison of classification of diagnostic versus screening procedure using an algorithm for administrative data

Author, Year Study Design Population Setting Sample Size Quality	Study Aim	Data Sources	Results
Haque et al., 2005[209] Cross-sectional Large HMO in southern California N: 220 Fair	Develop an automated data algorithm designed to distinguish screening and diagnostic endoscopy; the algorithm was compared with medical record review as the gold standard	Administrative data: endoscopies were identified using ICD-9 and CPT-4 codes and were classified as diagnostic vs. screening using presence of a list of diagnostic codes and signs and symptoms (that would suggest the procedure were diagnostic) Medical record review to establish whether diagnostic or screening exam	FS Sensitivity of diagnostic classification: 48.1 Specificity of diagnostic classification: 12.1 Sensitivity of screening classification: 87.9 Specificity of screening classification: 51.9 Kappa 0.76 Colonoscopy Sensitivity of diagnostic classification: 23.8 Specificity of diagnostic classification: 15.6 Sensitivity of screening classification: 84.4 Specificity of screening classification: 76.2 Kappa: 0.44
El-Serag et al., 2006[64] Cross-sectional A single Veterans Administration hospital N:303 Fair	Investigate whether colonoscopy use increased disproportionately in the VA system and changes in rates of FS, DCBE, and FOBT use	Administrative data: Inpatient and outpatient databases searched for codes indicating FS, FOBT, DCBE, and colonoscopy Indications for tests were classified using an algorithm based on diagnoses in the one year before the test Medical record review to establish whether diagnostic or screening exam	Colonoscopy Sensitivity of screening classification: 70.1 Specificity of screening classification: 71.6

CPT, Current Procedural Terminology; DCBE, double contract barium enema; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HMO, health maintenance organization; ICD, International Classification of Diseases; N, number.

Evaluating Novel Ways to Combine Data Sources for CRC Screening Measurement

Study characteristics. We found two studies that evaluated novel ways to combine data sources to improve routine measurement of CRC screening use.[35,210] We rated these studies as fair quality; one lacked data to assess the outcome fully,[210] and the other did not ensure valid medical record abstraction.[35,209] Both studies took place within a managed care or health plan setting. One study attempted to improve measurement of CRC screening use by augmenting administrative data with survey data, and the second by augmenting with medical record data. Although one study compared the rates of CRC screening from the hybrid method with both administrative and survey data for the entire sample, [35] the second could compare its rates only

with administrative data,[210] because the survey was conducted only among persons for whom no evidence of CRC screening had been found in the administrative data.

Overview of results. In both studies, reported rates of CRC screening increased when administrative data were combined with either survey data or medical record data. The investigators provided no evidence (other than reporting prevalences) of the validity of these hybrid methods.

Detailed assessment. In one study, the researchers recruited a sample of members in a single health plan (Aetna), ages 52 to 80, from 32 primary care practices in Florida and Georgia that were taking part in a randomized trial of a CRC decision aid and practice-level academic detailing.[210] Participants with no evidence of screening in the claims data were surveyed about completion of any CRC tests and the time frame (within 1 year, 1 to 5 years, 5 to 10 years, or more than 10 years). The researchers excluded from their calculations persons with evidence of medical exclusions in the claims data and persons found to be at above-average risk on the survey. Insurance claims were examined for evidence of FOBT within 1 year, FS or barium enema within 5 years, or colonoscopy within 10 years. The indication for the test was not specified in the survey and the authors do not discuss using screening versus diagnostic codes in analyzing the claims data. The authors reported that the prevalence of current screening among average-risk persons by claims data was 27 percent; combining claims data and survey data and accounting for survey nonresponse, they estimated that 47 percent to 59 percent of member patients were actually up-to-date.

In the NCQA field test, described above, the investigators constructed samples in five geographically dispersed health plans of persons both with and without administrative claims evidence of CRC screening.[35] Among those with such evidence, the researchers selected a sample for the survey; of those without evidence in the claims, they selected a sample for both medical record review and the survey. The hybrid method combined administrative and medical record data to provide an estimate based on both. Among members in each of the five health plans, the percentages of respondents who received testing were generally higher when measured by the hybrid method than by administrative data, but they were lower than those recorded by survey data (Table 53).

Table 53. Evaluating novel ways to combine data sources for CRC screening measurement

Author, Year Study Design Population Setting Sample Size Quality	Study Aim	Data Sources	Results
Pignone et al., 2009[210] Cross-sectional Aetna members ages 52-80 from 32 primary care practices in Florida and Georgia taking part in a randomized trial of a CRC decision aid and practice-level academic detailing N: 5,759 age-eligible in claims and 1,595 survey responders Fair	Evaluate the independent and combined yield of claims and direct survey for identifying CRC screening among average-risk health plan beneficiaries	Insurance claims for FOBT within 1 year, FS or barium enema within 5 years, or colonoscopy within 10 years (indication not specified) Survey of persons with no evidence of screening in claims data to ask about completion of any of the same CRC tests and time frame (within 1 year, 1-5 years, 5-10 years, or > 10 years)	Prevalence of current screening among persons without medical exclusions, by claims data alone: 27% Prevalence combining claims data plus self-reported data (not including nonresponders to the survey): 47% Prevalence combining claims data plus self-reported data (assuming nonresponders were screened at the same rate as average-risk responders): 59%
Schneider et al., 2008[35] Cross-sectional 5 health plans in the US N: 189,193 in administrative data and 1,250 survey respondents Fair	Describe a field test of a screening measure included in HEDIS	Prevalence of specific CRC screening tests or any CRC screening compared among: Survey data Administrative data Hybrid of administrative and medical record review data	Among members in each of 5 health plans, the percentage of respondents who received testing was generally higher when measured by self-report than by administrative data The percentage of persons who received testing as measured by the hybrid method generally fell between percentages based on survey or administrative data Plans A; B; C; D; E Any CRC screening by: Survey 53.2; 69.7; 55.0; 62.1; 66.2 Administrative 41.5; 38.6; 47.1; 27.3; 44.4 Hybrid 41.5; 53.5; 52.6; 38.8; 45.6 Survey respondents were more likely than nonrespondents to have evidence of CRC screening (62.7% vs. 46.5%; *P*<0.001)

CRC, colorectal cancer; FOBT, fecal occult blood test; FS, flexible sigmoidoscopy; HEDIS, Health Plan Employer Data and Information Set; N, number.

Chapter 5. Discussion

The RTI International-University of North Carolina Evidence-based Practice Center (RTI-UNC EPC) prepared this report for the National Institutes of Health (NIH) State-of-the-Science Conference on Enhancing Use and Quality of Colorectal Cancer Screening, which is scheduled for February 2010. This chapter summarizes and discusses the findings of our review of peer-reviewed literature concerning improving the appropriate use and quality of colorectal cancer (CRC) screening.

We adopted three outcomes on which to focus: use of CRC screening, patient-physician discussions about CRC screening, and quality of CRC screening. The screening tests included in our review are the at-home fecal occult blood test (FOBT), flexible sigmoidoscopy (FS), colonoscopy, and double contrast barium enema. We attempted to find studies on the uses of tests recently introduced to clinical practice for CRC screening, including the fecal immunochemical test, fecal DNA testing, and computed tomographic colonoscopy, but found no studies concerning the trends in use and quality of these tests. We further examined "appropriate" use in terms of three constructs: underuse, overuse, and misuse. This report presents findings from a systematic review of literature from January 1998 to September 2009 of four key questions (KQs):

KQ 2: What factors influence the use of CRC screening?

KQ 3: What strategies are effective in increasing the appropriate use of CRC screening and followup?

KQ 4: What are the current and projected capacities to deliver CRC screening and surveillance at the population level?

KQ 5: What are the effective approaches for monitoring the use and quality of CRC screening?

We also present background information on trends in the use and quality of CRC screening (KQ 1), relying on national studies and relevant articles from our extensive search for KQs 2 through 5. Finally, we comment on research needs (KQ 6).

Results for KQ 2 are largely descriptive. KQ 3, KQ 4, and KQ 5 are more analytic; each asks for information about the effectiveness of different approaches and an interpretation of comparisons presented in study analyses. For this reason, we provide strength of evidence evaluations for KQ 3, KQ 4, and KQ 5 but not for KQ 2; the strength of evidence tables and overall grades can be found in Chapter 4 in the relevant sections. We refer readers to Chapter 2 for methods for rating the quality (internal validity, or risk of bias) of individual studies and for grading the overall strength of evidence for specific groups of studies.

In the remainder of this chapter, we first give an overall summary of our findings, for all KQs. We then consider some implications of our findings and discuss the limitations of the review. Finally, we present suggestions for future research (KQ 6).

Summary of Findings

As summarized in Table 54, our extensive literature review for KQ 1 found many problems of underuse, overuse, and misuse of CRC screening. To guide our systematic reviews for KQs 2

Table 54. Summary of the evidence and strength of evidence grades by key question

Key Question	Strength of Evidence Grades*	Conclusions
KQ 1: What are the recent trends in the use and quality of colorectal cancer screening?	**NA**[†]	(1) Both CRC screening and patient-physician discussions of CRC screening are underused. Self-reported screening rates by national surveys, which are likely to be overestimates of actual screening, in 2005-2006 were about 50- 60%; an even smaller percentage of people had had a discussion about CRC screening with their primary care physician. Less certain, but likely, is underuse of surveillance colonoscopy (colonoscopy for patients who have had a previous colonic polyp [and, usually, polypectomy]) in some individuals who have previously had a polypectomy for an advanced adenoma. (2) Screening is also overused, insofar as people who are unlikely to benefit may be screened. This includes people over age 85 or people with severe comorbidities. Surveillance colonoscopy is also probably overused. Polypectomy for polyps less than 5 mm (for which benefit is uncertain but increased risk is clear) may also be considered an overuse category. (3) Problems of misuse also arise. These include use of in-office rather than home FOBT, nonreturn of FOBT cards, lack of adequate followup of positive FOBT results, and colonoscopy that does not reach the cecum, that has too rapid withdrawal time, or that misses important lesions. (4) We found no reliable data among studies included in this review on the trends of use or quality of fecal immunochemical test (FIT), fecal DNA testing, or computed tomographic colonoscopy.
KQ 2: What factors influence the use of colorectal cancer screening?[‖]	**NA**[‡]	(1) Several factors are consistently associated with reduced CRC screening (i.e., $P < 0.05$ or confidence intervals that do not overlap or include 1.0). They include: • low patient income[1-2,42,46,107,114,120,122-123,126,130,150-151,156] • **low education**[21,46,151] • **being uninsured**[21,46,56,113-114,128,151,160] • being Hispanic[1,21,46,111,115-116,119-120,126,141,147,151,163] or Asian[1-2,114,147] • not being acculturated into the United States (i.e., **English language proficiency**, US or foreign born, years living in US) [1-2,118,120-122,141,147,149,161] • **having less/reduced access to care, such as lack of a regular source of primary care**[1-2,21,42,46,56,107-108,111,120,128,130,133-134,151,157,163,215] **or no visits in previous year to provider**[2,21,46,55,107,126,132,137,151,158,166] • **lack of a physician recommendation to be screened**.[21,46,55-57,107,111,136,142,148,153,159]

Table 54. Summary of the evidence by key question (continued)

Key Question	Strength of Evidence Grade*	Conclusions
KQ 2: What factors influence the use of colorectal cancer screening? (continued)	**NA§**	(2) Factors positively associated with CRC screening (i.e., $P < 0.05$ or confidence intervals that do not overlap or include 1.0) include • **having private insurance**[21,46,107,113-114,124,128,151] • being non-Hispanic white,[21,46,106,120,125,128,138,142,151] • completing a higher levels of education[21,46,151] • **participating in regular screenings for other cancers**[21,42,46,108,122-123,133-134,151,156,158,215] • having a family history of CRC or personal history of another cancer[2,21,42,46,107,122,134,151,158] • **having regular access to care, having effective provider-patient communication**[56,135,140,154,167] (3) We only found one study each that examined the association between screening and either specific physician characteristics or patient-physician connectedness, thereby providing insufficient evidence to draw conclusions about these relationships. (4) We found six studies that examined the association of system variables with CRC screening.[66,110,127,139,143,173] Several single system variables were associated with higher screening rates; the only variable associated with higher screening in more than one study was use of nonphysician staff in assisting patients with understanding or completing screening. (5) We found no studies that examined factors associated with overuse or misuse of CRC screening or surveillance.
KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**High**	(1) Interventions that provide patient reminders lead to small to moderate increases in CRC screening (four studies, with absolute increases of 5.0 percent, 5.9 percent, 11.7 percent, and 15.0 percent).[175,182-183,186]
	High	(2) Four studies of small media (educational print or video messages) to increase CRC screening show no benefit.[177-178,181,185]
	Low	(3) Evidence concerning decision aids to increase screening is mixed. With two of three studies showing benefit, some types of decision aids may be effective for increasing screening (14.0 to 23.0 percentage point increases in screening rates reported in the two positive studies).[175,182-183]
	Low	(4) Two studies on group education interventions to increase CRC screening showed no benefit.[184-185]
	High	(5) One-on-one interactions, especially intensive contact with patients, increase screening rates, sometimes to a large degree;[85,179-180] observed percentage point increases included 14.6 percentage points for FOBT completion,[85] 20.9 percentage points for any CRC test,[180] and 41.9 percentage points for FOBT completion.[179]
	High	(6) Interventions that provided a means for eliminating structural barriers, such as improving access to CRC screening tests or reducing language barriers,[85,175,179,183,187] demonstrated the highest impact on screening rates overall (ranging from an increase of 14.6 to 41.9 percentage points).

Table 54. Summary of the evidence by key question (continued)

Key Question	Strength of evidence	Conclusions
KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup? (continued)	**Low**	(7) Use of small media with or without decision aids vs. no intervention increases discussions with providers (25.1 percentage point difference from one study).[177]
	Low	(8) One study found providing reminders to physicians to be slightly effective in raising appropriate surveillance colonoscopy rates;[188] one study found no difference in CRC screening among patients whose providers received reminders.[186]
	High	(9) Five studies on system-level interventions[162,189-193] consistently reported increased screening rates for patients for whom a patient navigator or prevention care manager (PCM) was provided or when organizational processes and procedures were changed to help patients obtain timely CRC screening.
	Insufficient	(10) We found no evidence to determine the efficacy of any intervention to reduce overuse or misuse of CRC screening,
KQ 4: What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Low**	(1) Current volume of FS is 2.8-4.9 million and additional available capacity is 6.7 million.[195-196]
	Low	(2) Current volume of colonoscopy is1.6-6.6 million and additional available capacity is 8.2 million.[195-196,199-200]
	Low	(3) Based on one study's estimates of additional available capacity, current capacity for colonoscopy is sufficient for a screening program by FOBT.[195-196,199-201]
	Low	(4) Based on one study's estimates of additional available capacity, current capacity for FS is sufficient for a screening program by FS alone.[195-196,201]
	Low	(5) Based on one study's estimates of additional available capacity, current capacity for colonoscopy is sufficient for a screening program by FS alone.[195-196,199-201]
	Low	(6) Based on one study's estimates of additional available capacity, current capacity for FS is sufficient for a screening program by FOBT/FS.[195-196,201]
	Low	(7) Based on one study's estimates of additional available capacity, current capacity for colonoscopy is sufficient for a screening program by FOBT/FS.[196,199-201]
	Low	(8) Based on one study's estimates of additional available capacity, current capacity for colonoscopy is sufficient for a screening program by colonoscopy.[195-196,200]
	Low	(9) If the United States were to adopt a colonoscopy-only approach to CRC screening, colonoscopy capacity would need to be substantially increased or at least 5 years would be needed to do the "catch-up" screening required to screen people who have not yet been screened.[202]

Table 54. Summary of the evidence by key question (continued)

Key Question	Strength of evidence	Conclusions
KQ 5: What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**High**	(1) Self-reported rates of CRC screening are higher than rates obtained from either medical records or administrative data.
	Medium	(2) Concordance between self-reported CRC screening and medical record or administrative data was at least moderate (agreement > 70.0 percent or kappa > 0.4).
	Low	(3) Concordance between self-report and medical record or administrative data is higher for endoscopy than for FOBT.
	Low	(4) Algorithms have not been able to distinguish between diagnostic and screening endoscopic exams in administrative data.
	Insufficient	(5) Hybrid methods will increase reported prevalences of CRC screening, but whether validity is increased is unknown.

CRC, colorectal cancer; DNA, Deoxyribonucleic acid; FOBT, fecal occult blood test; FIT, fecal immunochemical test; mm, millimeters; NA, not applicable; P, probability; US, United States.
* Strength of evidence grades and definitions (see Chapter 2 for details): High=High confidence that the evidence reflects the true effect. Further research is very unlikely to change our confidence in the estimate of effect. Moderate=Moderate confidence that the evidence reflects the true effect. Further research may change our confidence in the estimate of effect and may change the estimate. Low=Low confidence that the evidence reflects the true effect. Further research is likely to change our confidence in the estimate of effect and is likely to change the estimate. Insufficient=Evidence either is unavailable or does not permit estimation of an effect.
† KQ 1 is a background question that does not employ exhaustive systematic review methodology. Thus, strength of evidence grades are not applicable for this topic.
‡ KQ 2 was also not done through an exhaustive systematic review methodology, so we did not grade strength of evidence for this topic.
§Strength of evidence graded for KQ 3, KQ 4, and KQ 5 only.
‖ Those that are mutable are in bold font to highlight areas where interventions and policies could be implemented to improve screening rates.

to 5, we developed an analytic framework (Figure 1, Chapter 2). Our review helped us to specify better the important factors in the analytic framework that may be helpful in considering ways to improve the appropriate use and quality of CRC screening.

From the patient's point of view in Figure 1, we found that access to health care in general (including having health insurance and a regular source of primary care) is a necessary predisposing factor to CRC screening. Our KQ 2 review found specifically that having health insurance and a regular physician are strongly associated with higher levels of CRC screening. People without health insurance and a regular source of primary care have very low screening rates. This is not surprising; the nature of CRC screening, and the absence of a national program outside of primary care to deliver screening to the uninsured, is such that having a regular source of primary care is essential to improving CRC screening rates.

As shown in the analytic framework (Figure 1), however, access to care alone is insufficient to guarantee high levels of screening. After patients have access to care, they still need a simple and reliable mechanism by which to engage with physicians and/or others in the health care system to understand the idea of screening and the pros and cons of screening strategies. Few health care systems build such discussions into routine care, as shown by our KQ 1 finding of suboptimal numbers and quality of discussions about CRC screening. With such a varied range of screening strategies for CRC screening, this lack of a mechanism to promote and assist patient understanding and choice is a major barrier to appropriate use. An important finding in our KQ 2 review is that unscreened patients did not know about the need for CRC screening, and "just didn't think about it." The great majority of patients with physicians who recommend screening

actually complete screening. Ideally, this recommendation would be accompanied by a reasonable discussion of screening options.

Helping patients understand CRC screening entails more than giving information in a one-sided, noninteractive manner. Our KQ 3 review found that small media messages with such materials as brochures alone were ineffective in increasing appropriate screening. Certain decision aid designs may be a useful approach in assisting patients to understand the pros and cons of screening and to make informed decisions about which screening strategy is right for them. The evidence to date on the effectiveness of decision aids is insufficient to determine the best design and delivery models; more research is needed.

In developing systems that can reliably help patients understand CRC screening and choose an appropriate screening strategy, several groups of disadvantaged patients need special attention. Patients who are not fluent in the English language, patients whose culture differs from that of the prevailing US medical culture, and (probably) patients with low levels of health literacy need specially designed approaches to help them understand CRC screening. Our KQ 2 review showed the screening rates of Hispanic people and of people not acculturated into the United States to be significantly lower than those of non-Hispanic whites and/or those born or living in the United States for longer periods of time.

Because of the few studies of the association between physician characteristics or health care systems and CRC discussions/screening, we cannot say whether certain types of physicians, or certain types of systems within which physicians work, are or are not more associated with appropriate screening. Some evidence indicates (KQ 2) that system factors such as involving nonphysician staff and having electronic medical records may be associated with appropriate screening.

Although access to care (e.g., a regular source of primary care that one visits at least annually), together with health insurance coverage for screening, combined with patient understanding and physician recommendation of screening, increases appropriate screening for many people, though some groups still need further assistance with completing screening. This step, between patient decision and appropriate test use, appears straightforward in the analytic framework (Figure 1); we found it is often more complex than depicted in this framework.

Because CRC screening strategies require people to carry out unusual procedures of preparation and testing, and then to navigate the medical system to complete screening, assisting people in the details of completing screening is sometimes necessary to reach high rates of appropriate screening. Our KQ 3 review found that, in some populations, employing more intensive one-on-one approaches, eliminating or reducing structural barriers for patients, and making overall system changes successfully increase appropriate screening. These sometimes intensive approaches are likely not necessary for all populations, although reducing barriers and streamlining and simplifying the screening process are likely to be helpful for all.

We developed our analytic framework and conducted our review with the understanding that, from the major guideline groups, a range of appropriate options for CRC screening exists. In contrast to this view, however, the United States might decide to favor a strategy of preferring an initial colonoscopy over other strategies. Our review of KQ 4 indicates a considerable degree of uncertainty about whether the nation has existing—or even latent—capacity to meet the need in this latter assumption. That is, we cannot conclude that the country can either conduct “catch-up” screening of people who have not been screened or to continue steady-state screening and the resulting surveillance for the longer term. Thus, if the United States were to embark on an initial

colonoscopy-preferred strategy, and if the above approaches to increasing screening use were effective, then inadequate capacity to screen the eligible population is a real possibility.

Almost all the literature we found and reviewed for KQ 2 and KQ 3 focused on the problem of underuse of CRC screening. Despite our finding in KQ 1 that CRC screening discussions are also underused, we uncovered little evidence concerning factors associated with, or interventions to improve, underuse of screening discussions.

KQ 1 also showed considerable problems with overuse and misuse of CRC screening. No studies reviewed in KQ 2 examined factors associated with overuse of screening; no studies reviewed in KQ 3 examined interventions to reduce overuse of CRC screening. Similarly, little of the literature for KQ 3 examined interventions to reduce misuse in screening.

As shown in our analytic framework (Figure 1), an important (and probably necessary) factor between decisions about screening and *appropriate* use (minimizing overuse and misuse as well as underuse) is monitoring. Our review in KQ 1 found several monitoring systems for self-report of CRC screening use; these include the National Health Interview Survey (NHIX) and the Behavioral Risk Factor Surveillance System (BRFSS). However, few systems monitor overuse and misuse. We found no systems in the United States for reducing overuse and no corrective steps to minimize misuse. We found no direct evidence about monitoring to review in KQ 5. Table 54 highlights our primary findings and conclusions from KQs 1 to 5.

We have adapted general recommendations for monitoring systems (Table 55) to show what types of data systems might be considered. Some initial systems are being started and could be encouraged and expanded. A national program of breast and cervical cancer screening and a mammography consortium both provide important information to monitor screening for these cancers. A complementary approach might be to expand data collection in the Surveillance, Epidemiology and End Results (SEER) program areas to include screening rates and even misuse data; such information might then be correlated with incidence and pathology data from SEER.

Table 55. Features of an ideal monitoring system for CRC screening use and quality

Characteristics of Monitoring System	Important Features of an Ideal System for CRC screening
Data quality: Use (both underuse and overuse)	• Includes the following variables: – overall screening rates by test type – inappropriate screening rates owing to age or severe comorbidities – percentage of persons with whom adequate screening discussions are held – percentage of FOBT cards that are returned – percentage of persons who attend their screening endoscopy appointment – results of screening tests and the percentage of persons with positive tests who receive complete diagnostic evaluation – percentage of persons with appropriate and inappropriate screening and/or followup – number/rate of polypectomies for colonic lesions < 5 mm
Data quality: Appropriate use or misuse	• Includes the following colonoscopy indicators[216-217] – cecal intubation rates – adenoma detection rates for adenomas ≥10 mm – colonoscopy withdrawal time – percentage of colonoscopies with adequate bowel preparation – complication rates
Data quality: Additional elements	• Links screening monitoring to pathology and tumor registry or SEER data • Represents entire US population
Acceptability	• Has a high participation rate of practices • Has a low burden to report data
Compliance	• Meets all legal standards for data sharing
Costs	• Is low cost • Is sustainable without research funding
Usefulness	• Is designed to meet users' needs. For example, has goals to evaluate quality of screening or to document outcomes of screening in a community-based setting.

FOBT, fecal occult blood test; SEER, Surveillance Epidemiology and End Result.

Implications of This Review

Although we found a gradual increase in CRC screening over the past 10 to 12 years, this increase still leaves the nation at a lower screening rate for CRC than for breast (or even prostate) cancer.[194] Finding interventions to increase appropriate CRC screening has clearly been challenging, perhaps more so than for other cancers. Perhaps because of the complexity (and even invasiveness) of the CRC tests, or because of the problem of having to choose among screening strategies, many people have not understood the need for CRC screening, and others have not been able to complete screening. Medical practice systems have often been inadequate in informing patients, discussing their questions, and assisting them in the complexities of completing CRC screening.

Our summary of our findings highlights certain aspects of our analytic framework (Figure 1) and points to a logical series of steps to improve appropriate CRC screening. The first step concerns access to health care, including having health insurance and a regular source of primary care, as a necessary predisposing factor. The nature of CRC screening is that a physician (or nonphysician medical staff) must be involved in the decision to screen and in the completion of testing.

After access to care, the second step is to find ways for all patients to engage in a discussion at some level. The design and intensity of the discussion will depend on the patient's prior understanding of CRC screening and the health care system. Such discussions take place with a trained health educator (e.g., physician or nonphysician staff), perhaps with an effective and

tested decision aid, and focus on the pros and cons of CRC screening and the various screening options open to the patient. This interaction would need to be different for people with special circumstances, such as lack of fluency in English or lack of acculturation to the United States, than for most patients.

The third step in this progression is to simplify procedures for completing CRC screening for everyone. This includes providing proactive assistance to people from disadvantaged groups to complete screening after the screening decision has been made.

The further implications of this review are related to the implications for interventions to increase appropriate CRC screening use and quality (including reducing underuse, overuse, and misuse) and to three cross-cutting themes that underlie our findings: access to CRC screening; communication about CRC screening; and the organization of CRC screening. These three issues are among the strongest, potentially modifiable barriers to improving the use and quality of CRC screening.

Interventions to improve screening. Although we found high strength of evidence and positive effects for patient reminders, one-on-one interactions, eliminating structural barriers, and overall system changes as interventions to improve screening, still not clear is whether any set of interventions would effectively increase appropriate screening rates to high levels across the country. The health system may or may not have the ability to implement these interventions on a broad scale within medical practices and for the general population. To implement and maintain these interventions properly, an effective monitoring and feedback system (KQ 5) is needed. These systems are not in place in most primary care practices or health care systems.

How to overcome the focus in US medical care on nonpreventive care, and how to overcome the time and cost barriers to implementing and maintaining the systems within busy primary care practices, is also unclear. For example, incentives to primary care practices for improving CRC screening rates may or may not work. Partly because of the lack of positive incentives and the required time and effort from primary care practices, the durability of interventions that initially seem successful may be questionable. Another important issue is how interventions to improve CRC screening integrate with other medical practice systems.

Finally, the cost-effectiveness of the sometimes intensive interventions to gain sometimes small increases in screening is also unknown. Until these more fundamental issues are resolved, the question of whether widespread implementation of any interventions will have a large, sustained effect at reasonable cost (including time and effort of the patient, the physician, and the medical practice) remains unanswered.

Access to CRC screening. A critical underlying issue in this literature is access to care, a necessary precursor to access to CRC screening. Among the more striking findings from our review of factors associated with lower rates of CRC screening (KQ 2) is that people without health insurance, people with no source of usual care, people with no recent physician visits, and people with lower income status have quite low CRC screening rates. Improved communication and medical care organization can be effective only for people who are connected to a primary care provider.

Communication about CRC screening. One positive finding of this report is the overall importance of communication specific to CRC screening between medical staff and patients in improving appropriate CRC screening (i.e., reducing underuse, overuse, and misuse). CRC screening requires a great deal of patient understanding and effort (e.g., knowing which tests to take and when, and how to get them done). Communicating such information to patients and guiding them in making decisions specific to their medical and family history all take time. To

make appropriate decisions about individually optimal screening, to carry out the preparation and follow-through correctly, and to obtain screening at recommended intervals all require patient knowledge, motivation, and assistance from medical personnel. When few CRC discussions take place (KQ 1), when many eligible patients do not know that they should be screened (KQ 2), when medical personnel make few recommendations for screening (KQ 2), when many people do not receive periodic health examinations (at which some time might be devoted to discussions of CRC screening [KQ 2]), and when few intensive one-on-one interventions exist to assist patients to decide, prepare, and follow-through (KQ 3), suboptimal screening rates should not be surprising.

An instructive case study for the importance of communication is the situation of Hispanic and Asian populations in the United States, especially because these groups have low rates of CRC screening (KQ 2). Although access to care certainly accounts for some of the disparity in screening rates for Hispanics, even when studies adjust for access, multiple good-quality studies using national population-based data show that screening rates for Hispanics or Asians continue to remain below those of non-Hispanic whites.[1,46,111,120,141,147,151] This finding suggests that other factors, such as language and cultural differences, are also likely to be important determinants of screening.

Determining whether differences in CRC screening test use are mediated primarily through differences in language or differences in cultural beliefs about health and prevention is challenging, since language use is often a central part of the definition of acculturation.[121,149] Determining whether lower screening rates in Hispanics or Asians is driven mainly by cultural beliefs, by possible distrust of the medical health system, or by language is important. If the differences in screening test use reflect true differences in informed choices not to have screening based on culturally mediated values and preferences, then some of the difference in screening test use may be appropriate. However, accumulating evidence suggests that language and possibly literacy barriers contribute to lack of knowledge about the risk that CRC poses and about the potential benefits of screening. Poor communication, at the level of the health care system as a whole, at the community level, and at the level of the patient-physician interaction, clearly contributes to low CRC screening rates in racial and ethnic groups. Language and literacy barriers likely lead to even poorer communication among subpopulations that prefer to obtain health information in a language other than English.

Organization of CRC screening and monitoring. CRC screening in the United States requires the involvement of primary care physicians. Most receive no regular feedback on their CRC screening rates, as might occur in the Veterans Health Administration (VA) or other integrated health care system. Few medical practices involve nonphysician office staff in discussing CRC screening with patients; few reach out to patients who have not been screened or who miss screening appointments. As suggested by the VA's success with CRC screening (KQ 1), by the association of use of nonphysician staff with higher CRC screening rates (KQ 2), and by randomized controlled trials (RCTs) of organizational change (KQ 3) to improve screening, organizational change supported by monitoring and feedback systems (KQ 5) could have a positive effect on screening. Nonetheless, drawing conclusions on how to reduce overuse and misuse will always be difficult without adequate monitoring of these outcomes.

A second important aspect of organization is external to the primary care practice. It involves coordination of various parts of the health care system involved in CRC screening. Because these parts of the health care system are often fragmented, barriers arise that patients must navigate to complete screening. These same barriers work against monitoring the progress of patients as they

move through the system or even providing assistance to those who cannot surmount the obstacles. Finally, these barriers create problems for providing consistent and timely information to patients and for establishing systems to reduce overuse and misuse.

Limitations of this Review

Limitations of the Evidence Base

Reporting. Our ability to draw conclusions on the effectiveness of CRC screening interventions is limited by the relative paucity of detail on specific elements of the interventions. Studies inconsistently adhered to reporting standards such as STROBE[218] and CONSORT,[219] making critical appraisal of internal validity and assessment of applicability challenging. In particular, many studies did not report on the intensity of the intervention (e.g., the number and length of sessions and the time period of interaction with clients), the existence of protocols governing the intensity of intervention, or fidelity to such protocols. In addition, a number of studies used multiple components of interventions (e.g., reminders paired with one-on-one interactions) to increase CRC screening but only provided overall findings. Reporting findings in this way made discerning the incremental impact of each component difficult if not impossible to assess. CRC screening interventions represent an opportunity to translate effective interventions into a variety of clinical settings; the absence of information on fidelity limits their translation.

Heterogeneity of the interventions and the intervention sites. Categorizing the interventions was complicated by the heterogeneity of approaches, even for interventions that we eventually placed in the same category. The problem of classification was also complicated by the diversity of the sites in which the interventions occurred. In a sense, for example, an intervention that would be considered a "reminder" in one location might be considered a small media intervention in a different location.

Choice of appropriate comparators. The evidence base for interventions is marked by heterogeneity in comparators in addition to appreciable diversity in the CRC screening measure itself. Although appropriate comparators can and should differ by the specific outcomes being addressed, studies often did not justify the choice of comparator(s), either on its own merits or in relation to usual care. In most cases for studies included in KQ 3, investigators did not define "usual care"; this ambiguity hampers accurate interpretation of comparisons. For that reason, our conclusions regarding the effectiveness of CRC screening interventions are necessarily limited.

We also note that a potential Hawthorne effect may exist for studies comparing CRC screening interventions with usual care as opposed to a "sham" control. In cases involving comparisons of different types of CRC screening interventions, all interventions may receive a Hawthorne boost. This possibility makes distinguishing the different effects of the various interventions difficult.

Choice of appropriate outcomes. As with the comparators, we encountered problems assessing the studies for each key question because of the way researchers defined and operationalized CRC screening. For studies that examined factors related to screening (KQ 2), many investigators used different definitions for CRC screening, partly because of a national trend toward colonoscopy and away from FOBT and sigmoidoscopy during the period of this review. Some teams considered subjects screened if they had ever received one type of test; others were more precise in including both the test and the recommended timeframe in their calculation of up-to-date screenings; while others included any CRC test code in their analysis,

regardless of whether the test was provided as a screening or diagnostic procedure, thereby increasing the challenge in determining which factors were truly related to screening..

Even with these variations in the guidelines, how researchers operationalized the outcome of being up to date was inconsistent in this body of literature. Thus, assessing both the effectiveness of interventions (KQ 3) and the factors associated with screening (KQ 2) was overly challenging, particularly with regard to assessing the appropriateness of screening.

KQ 4 also presented challenges in assessing capacity outcomes and systematically applying these to a wide range of modeling assumptions; these problems in turn made synthesizing the findings difficult. Studies pertaining to this topic were also inconsistent in how they considered the difference between screening and diagnostic colonoscopy. Some modeling studies were unclear about whether they included surveillance colonoscopy in their calculation that would result from increased number of screening tests.

Across KQs 2, 3, and 4, we observed a heavy reliance on self-reported data that are not verified through other sources; this problem, too, complicates drawing reliable conclusions. Questions to assess self-report were not standardized, despite an NCI-led effort to develop standardized survey questions that have been subsequently evaluated in validation studies.[211-214]

Study design and sample size. Most KQ 2 studies were cross-sectional rather than cohort designs; thus, we could not easily examine time relationships. For this reason, there were no studies that examined factors associated with appropriate annual or serial use of FOBT, for example, and only focused on one-time or current use. Many studies did not report *a priori* hypotheses about their primary outcomes. Limited sample sizes resulted in studies that were not powered to find differences between experimental and control or comparison groups when such differences might in fact have existed.

In addition, the time periods in which investigators followed patients during intervention implementation for KQ 3 studies or measured capacity for KQ 4 studies varied considerably. Sometimes time frames were not specified at all. Again, these deficiencies hampered our ability to draw any conclusions across the studies. For KQ 3 studies in particular, time periods for following patients ranged from 3 to 24 months. Establishing a more common time for followup would improve the overall strength of evidence for these studies.

Appropriate adjustment for confounding. The evidence base is also limited by variations in the specific confounders and effect modifiers that investigators included or controlled for in their analyses. This issue arose particularly for examining factors influencing screening (KQ 2) and for quantifying capacity and projected demand (KQ 4). Omitting important confounders and effect modifiers (e.g., patient factors known to impact test use, temporal factors such as large macro-media campaigns such as when Katie Couric had a colonoscopy on national television), especially cointerventions in comparison arms, limits the interpretability and utility of the evidence from such investigations. Furthermore, using the studies that did account for confounders and effect modifiers is hampered by the lack of consistent definition and inclusion of key variables.

These deficiencies together appreciably limit the consistency and validity of the evidence. As a result, we found several bodies of evidence for important outcomes that we could grade only as low strength of evidence.

Limitations of the Review

We limited our search to articles published in English, primarily because the focus of this review was the United States. Issues of the use and quality of CRC screening likely vary by

country. Our review does not address the nature, outcomes, or interventions developed in other countries. We excluded RCTs with samples sizes less than 30 and observational studies with samples sizes less than 100. We also limited the studies to those reporting on data collected from January 1998.

For time and resource reasons, we did not conduct dual independent, blinded review of articles for abstraction of information into evidence tables. Instead, one reviewer performed the initial review, and a second reviewer examined that input and recommended changes or corrections when needed. These two reviewers reconciled any differences by consensus discussion. We did apply dual independent review for assessing the quality of individual articles and grading the strength of evidence, and often involved a third team member to resolve disagreements about these issues. These are, generally speaking, standard approaches for the RTI-UNC EPC.

The paucity of similar articles—taking populations, patient characteristics, settings, and the heterogeneity and complexity of the interventions and the outcomes measured—precluded any efforts to pool findings statistically.

Future Research Directions

The last key question (KQ 6) is to assess "What research is needed to make the most progress and have the greatest public health impact in promoting the appropriate use of colorectal cancer screening?" We found numerous gaps in the available research that could be addressed to help us better understand and influence CRC screening rates. We summarize our suggestions for future research in Table 56.

Table 56. Suggested research agenda to improve the appropriate use and quality of CRC screening (priority areas in bold font)

Key Question	Topic	Research Agenda
1: Trends in appropriate use and quality	Underuse	Coordinate reporting from BRFSS and NHIS systems with Medicare, HEDIS, and other administrative data to provide a single national source for use and trends. Standardize questions and measures. Develop new sources of use data from medical practices.
	Overuse	**Develop monitoring systems for screening of patients unlikely to benefit because of age or comorbidities. Develop monitoring systems for polypectomy rates for diminutive polyps. Develop monitoring systems for surveillance after polypectomy.**
	Misuse	**Develop monitoring systems for use of in-office FOBT testing; nonreturn of FOBT cards; nonfollowup of positive FOBT tests; adverse events rates from colonoscopy; rates of inadequate colonoscopic insertion and too-rapid withdrawal.**
2. Factors influencing the use and quality of appropriate CRC screening	Patient characteristics	Examine patient factors associated with better understanding of screening, and with having a regular source of care after having health insurance. Examine patient preferences for receiving information about CRC screening, and preferences among CRC screening tests.
	Physician characteristics	Examine physician characteristics associated with underuse of discussion and screening; and with overuse and misuse of screening.
	Systems	Examine the interaction of various systems and different patient populations with CRC screening. Are different systems associated with underuse, overuse, or misuse in different patient populations? Consider systems within primary care practices and systems that include primary care and colonoscopy testing facilities.

3. Intervention strategies to improve appropriate screening	Underuse	**Develop and test promising interventions that need more research, especially integrated with other practice systems and especially in combinations, paying special attention to what strategies work best (and are most cost-effective) in various patient populations. Should use outcomes of CRC screening and discussions.**
	Overuse and misuse	**Develop and test strategies, including monitoring systems, to reduce overuse and misuse.**
4. Current capacity, projected demand, and projected capacity to meet screening and surveillance needs	Current capacity	Studies examining national and regional current capacity for FS and for colonoscopy.
	Projected capacity	Studies examining projected capacity under various realistic screening and training scenarios, perhaps including trained nurse endoscopists (and projections in the context of future physicians trained?).
5. Effective approaches for monitoring appropriate use and quality	Underuse Overuse Misuse	**As in KQ 1, develop and evaluate national or regional monitoring systems that provide routine data on use and quality in a useful and timely form, with feedback mechanisms to encourage improvement.**

BRFSS, Behavioral Risk Factor Surveillance Survey; CRC, colorectal cancer; FOBT. fecal occult blood test; HEDIS, Healthcare Effectiveness Data and Information Set; KQ, key question; NHIS, National Health Interview Survey,

The priority for research should be RCTs of interventions to implement appropriate CRC screening (i.e., minimizing underuse, overuse, and/or misuse) and monitoring linked to improvement initiatives. In our review, we became aware of multiple studies of the operating characteristics of potential new CRC tests. Although improving screening tests is a reasonable research agenda (especially finding ways to reduce the need for the most invasive and expensive tests), screening could be balanced with research to find ways to implement screening programs that we already know are effective, working to minimize underuse, overuse, and misuse. To focus research primarily on developing newer screening tests without placing higher priority on implementation of the existing effective tests leaves the people of the United States with inadequate screening. At least as important as newer screening tests are improved access, improved communication, and improved organization. We present in this review results of the uses of CRC tests within the VA system, where access to health care and insurance coverage are addressed by being members of that system, demonstrating that in this system, the use of screening is greater than among the general public. We found that rates among respondents in a nationally representative sample of respondents in the 2005 National Health Interview Survey (NHIS) who reported being covered by military insurance were statistically significantly more likely to have been screened when compared to all other insured and uninsured respondents (31.6 percent of those without insurance versus as high as 43.0 percent among insured respondents, compared to 67.9 percent among those with military insurance [$P < 0.0001$]).[46] These findings indicate that when an organization is designed to provide screening to a population with consistent access to care, CRC screening rates can increase to levels seen for breast cancer screening with mammography.

Not only must we understand the organizational and system features important to increasing screening, but research also needs to examine the effectiveness of strategies that target several of the screening steps discussed above. Only when all three steps are accomplished—access to primary care, discussion and recommendation, and providing assistance and reducing barriers to complete screening—would we expect screening rates to markedly improve. The interventions of client or patient reminders, one-on-one interactions, and interventions to eliminate structural barriers seem to hold promise in increasing screening. Their impact could be increased if combined with further interventions to assist patients in traversing the health care system to

complete screening. Patient reminders were an effective intervention in increasing cancer screening rates (including CRC screening) in a 2002 meta-analysis.[220] In that meta-analysis, organizational change (such as the use of separate prevention clinics, use of a planned prevention visit, designation of nonphysician staff to do specific preventive care activities) was the most potent intervention in increasing preventive care.[220] This study suggests that a combination of interventions may have the greatest impact on screening rates.

Interventions should be tested that work to optimize CRC screening together with other appropriate screening programs. Some of these interventions could target clinicians. We included two studies that examined the impact of provider-level interventions (for screening[186] or surveillance colonoscopy[188]). Considering the central place that clinicians and their staff have in the screening steps, this is a potentially promising target to improve screening rates, particularly if it increases discussions between patients and providers.

In addition, cost-effectiveness studies of successful interventions to improve screening and monitoring, and then pragmatic trials that are focused on implementation of successful strategies within actual primary care practice are urgently needed. Different intensities of interventions, and even wholly different interventions, will likely be needed for different populations. Interventions should be targeted at the specific steps that are problems for specific populations (e.g., those who speak other languages than English at home could likely benefit from more basic interventions to increase awareness and discussions, whereas those who are already obtaining screening on an irregular basis may benefit most from patient reminders).

Further, we also need continued research into measuring current volume and projected demand for screening strategies. Finally, we found little evidence that adequate monitoring systems that assess the full spectrum of appropriate CRC screening (including overuse, underuse, and misuse) are in widespread use, and are being used to improve screening. Such monitoring systems are critically important for continued improvement of CRC screening. There is clearly a large and important research agenda for the future.

This research should target more than overcoming the underuse of CRC screening, as important as that is. We found little research interest in reducing underuse of patient-physician discussions about CRC screening, or in reducing overuse and misuse of CRC screening. This research should be a priority in that the issues of high overuse and high misuse are prevalent in today's US health care.

Conclusions

Our review suggests that the United States is yet some distance from fully realizing the promise of appropriate and high-quality CRC screening. Problems of underuse, overuse, and misuse are not being adequately addressed at present. By focusing our research effort on the issues that matter most—access to screening, communication between patient and medical staff, the organization of care—and by further researching how to implement effective and cost-effective strategies into actual primary care practice, we will have the greatest opportunity to reduce the burden of suffering of CRC for the people of the United States.

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List of Abbreviations

ACS	American Cancer Society
AHRQ	Agency for Healthcare Research and Quality
AOR	adjusted odds ratio
BRFSS	Behavioral Risk Factor Surveillance Survey
CAD	computer-aided detection
CAHPS	Consumer Assessment of Healthcare Providers and Systems
CCME	Carolina Center for Medical Excellence
CDC	Centers for Disease Control and Prevention
CHIS	California Health Interview Survey
CI	confidence interval
CONSORT	Consolidated Standards of Reporting Trials
CORI	Clinical Outcomes Research Initiative
CPT	current procedural terminology
CRC	colorectal cancer
CT	computed tomography
CTC	computed tomographic colonography
CTS	Community Tracking Study
DCBE	double contrast barium enema
DERS	Direct Endoscopic Referral System
DNA	deoxyribonucleic acid
DRE	digital rectal examination
FAP	familial adenomatous polyposis
FIT	fecal immunochemical test
FSS	fee-for-service
FFS + SUPP	fee-for-service Medicare + supplemental insurance
FIT	fecal immunochemical test
FOBT	fecal occult blood test
FS	flexible sigmoidoscopy
gFOBT	guaiac-based fecal occult blood test
G	group
GI	gastrointestinal
GI	gastroenterologist
HEDIS	Healthcare Effectiveness Data and Information Set
HINTS	Health Information National Trends Survey
HMO	health maintenance organization
HNPCC	hereditary nonpolylposis colorectal cancer
ICD	International Classification of Diseases
iFOBT	immunochemical fecal occult blood test
KQ	key question
LHA	lay health advisors
MCA	managed care activity
MCBS	Medicare Current Beneficiary Survey
MEPS	Medical Expenditure Panel Survey
MeSH	Medical Subject Heading

MMC	Medicare managed care
MMSA	metropolitan or micropolitan statistical areas
MR	magnetic resonance
MRI	magnetic resonance imaging
MSTF	Multi-Society Task Force
MSTF	Multi-Society Task Force
NCI	National Cancer Institute
NCQA	National Committee on Quality Assurance
NHIS	National Health Interview Survey
NIH	National Institutes of Health
N	number
NR	not reported
OMAR	Office of Medical Applications of Research
OR	odds ratio
PCP	primary care physician
PET	positron emission tomography
PHE	periodic health examination
PSA	prostate-specific antigen
PSAs	public service announcements
RCTs	randomized controlled trials
RDD	random digital dialing
RR	relative risk
RTC	Randomized Control Trial
RTI-UNC EPC	RTI International–University of North Carolina Evidence-based Practice Center
SES	socioeconomic status
SI	standard intervention
STROBE	STrengthening the Reporting of OBservational studies in Epidemiology
TEP	Technical Expert Panel
TFCPS	Task Force on Community Preventive Services
TI	tailored intervention
TIP	tailored intervention plus reminder phone call
US	United States
USPSTF	US Preventive Services Task Force
VA	Veterans Administration

Glossary

Ability to meet projected demand: the ability of current capacity (or projected capacity if known) to meet the projected demand under various demand scenarios, such as screening the entire eligible US population with a specific test.

Acceptability—Willingness of persons and organizations to participate in the monitoring system

Appropriate use (of CRC screening)— minimizing overuse and misuse as well as underuse

Compliance—Degree to which a system complies with all relevant legislation, regulations, and policies

Consistency—degree to which reported effect sizes from included studies appear to go in the same direction

Cost—Indirect and direct costs

Current capacity (or current potential volume)—the sum of current volume and additional available capacity, where:

- Current volume is the estimate of the current number of FS or colonoscopy procedures conducted in the present year; and
- Additional available capacity is the number of additional FS or colonoscopy procedures that could be conducted in the current year.

Data quality—Completeness and validity of the data in the system

Directness—the extent to which evidence links the compared interventions directly to health outcomes

Discussions-- discussions of CRC screening between physicians and patients includes a conversation covering such areas as pros and cons of screening options and eliciting patient preferences and is meant as more than simply the physician recommending testing

Flexibility—Ability of the system to accommodate changes in operating conditions or information needs

Followup—clinical procedures and tracking of patients who have received an abnormal colorectal cancer screening result

Lay health advisors—people with no clinical training who serve as educators of peers for various health issues

Monitoring—tracking and data collection of the use and/or quality of colorectal cancer screening (such as with a national surveillance data system)

Overall Strength of Evidence (SOE)—reflects a global assessment that takes the required domains (i.e., risk of bias, consistency, prevision, directness) directly into account. Levels of SOE include:

- High—High confidence that the evidence reflects the true effect. Further research is very unlikely to change our confidence in the estimate of effect.
- Moderate—Moderate confidence that the evidence reflects the true effect. Further research may change our confidence in the estimate of effect and may change the estimate.
- Low—Low confidence that the evidence reflects the true effect. Further research is likely to change our confidence in the estimate of effect and is likely to change the estimate.
- Insufficient—Evidence either is unavailable or does not permit estimation of an effect.

Patient level intervention terms:

- Small media—educational materials provided as videos and/or printed materials such as letters, brochures, and newsletters to inform people about specific diseases or health issues
- Decision aids—mechanisms or interventions that have been developed to improve communication between health professionals and patients; their goal is to help involve patients in making decisions regarding their health care
- Group education—workshop or presentation conducted within a specified group setting to deliver educational information or motivation to encourage screening
- One-on-one interactions—studies in which a provider (e.g., physician, nurse, health educator) works individually with patients to educate them about CRC screening and/or aid them in making decisions about which tests to complete and when to receive screening. These interventions tend to include some concentrated time with a patient to answer questions, address concerns, and help facilitate completion of screening tests.
- Eliminating structural barriers—interventions that seek to increase screening by removing structural barriers (e.g., offer more screening times or locations, provide transportation to a service, etc.)
- Patient reminders—provided to patients (e.g., via mailed letters or phone calls) who are due for a rescreening or who have never been screened to prompt people about their need for annual screening (or for screening related to whatever period recommended for the patient)

Precision—degree of certainty surrounding an effect estimate with respect to a given outcome (i.e., for each outcome separately)

Projected capacity—future capacity to conduct FS or colonoscopy under various scenarios such as changes in workforce or changes in the number of facilities that provide procedures.

Quality (of CRC tests) — “underuse,” “overuse,” and “misuse” of screening tests rather than test performance

Quality rating—internal validity or risk of bias (of studies)

Risk of bias—degree to which the included studies for any given outcome or comparison have a high likelihood of adequate protection against bias (i.e., good internal validity)

Simplicity—Structure and ease of operation

Stability—Reliability (ability to collect, manage and provide data properly without failure) and availability (ability to be operational when it is needed) of the monitoring system

Surveillance—in terms of data collection, we opted to replace the term ‘surveillance’ with regard to data collection with the term ‘monitoring’. In terms of surveillance of colorectal cancer screening results, because of initial abnormal results, we have used the term ‘followup’ instead.

Surveillance colonoscopy—colonoscopy for patients who have had a previous colonic polyp (and, usually, polypectomy)

Timeliness—Interval between occurrence of an event and reporting of the event.

Appendix A

Appendix A. Colorectal Cancer Search Strategy

#1	Search "Colorectal Neoplasms" [MeSH] OR "Mass Screening"[Majr]	154648
#2	Search (("Colonoscopy"[Mesh] OR "Colonography, Computed Tomographic"[Mesh])) OR "Sigmoidoscopes"[Mesh] OR "stool test" OR "fecal immunochemical testing" OR (FIT AND fecal) OR fobt OR fobt OR occult blood OR "DNA Stool"	26681
#3	Search "Polyps"[Mesh] AND "Biopsy"[Mesh]	967
#4	Search #2 OR #3	27451
#5	Search #1 AND #4	9033
#6	Search #1 AND #4 Limits: Publication Date from 1998, Humans, English	4660
#7	Search #1 AND #4 Limits: Publication Date from 1998, Humans, Review, English	705
#8	Search ("Randomized Controlled Trials"[MeSH] OR "Randomized Controlled Trial"[Publication Type]) OR "Single-Blind Method"[MeSH] OR "Double-Blind Method"[MeSH] OR "Random Allocation"[MeSH]	336385
#9	Search #6 AND #8	263
#10	Search ("Case-Control Studies"[MeSH] OR "Cohort Studies"[MeSH] OR "Epidemiologic Studies"[MeSH] OR "Cross-Sectional Studies"[MeSH] OR "Organizational Case Studies"[MeSH] OR "Cross-Over Studies"[MeSH] OR "Follow-Up Studies"[MeSH] OR "Seroepidemiologic Studies"[MeSH] OR "Multicenter Studies"[MeSH] OR "Evaluation Studies"[MeSH]) OR Longitudinal Studies OR observational studies	1150609
#11	Search #6 AND #10	1340
#12	Search #7 OR #9 OR #11	2150
#13	Search ("Colorectal Neoplasms/diagnosis"[Majr] OR "Colorectal Neoplasms/prevention and control"[Majr])	29131
#14	Search "Mass Screening"[Majr]	48233
#15	Search #13 AND #14	2175
#16	Search #15 NOT #12	1752
#17	Search #15 NOT #12 Limits: Publication Date from 1998, Humans, English	1019
#19	Search "United States"[Mesh] OR United States Limits: Publication Date from 1998, Humans, English	676580
#20	Search #17 AND #19 Limits: Publication Date from 1998, Humans, English	399
#21	Search #4 NOT #12	25301
#22	Search #15 AND #21	1128
#23	Search #15 AND #21 Limits: Publication Date from 1998, Humans, English	591
#25	Search #19 AND #23	211

Total PUBMED = 2265

Cochrane Reviews = 7 = 6 New

Cochrane Central Trials Registry = 138 = 38 New

Total Unduplicated Database = 2309

Update Search Strategy (September 21st 2009)

#1	Search "Colorectal Neoplasms" [MeSH] OR "Mass Screening"[Majr]	158767
#2	Search (("Colonoscopy"[Mesh] OR "Colonography, Computed Tomographic"[Mesh])) OR "Sigmoidoscopes"[Mesh] OR "stool test" OR "fecal immunochemical testing" OR (FIT AND fecal) OR fobt OR fobt OR occult blood OR "DNA Stool"	27659
#3	Search "Polyps"[Mesh] AND "Biopsy"[Mesh]	987
#4	Search #2 OR #3	28442
#5	Search #1 AND #4	9346
#6	Search #1 AND #4 Limits: **Entrez Date from 2009, Humans, English**	277
#7	Search #1 AND #4 Limits: **Entrez Date from 2009, Humans, Review, English**	29
#8	Search ("Randomized Controlled Trials"[MeSH] OR "Randomized Controlled Trial"[Publication Type]) OR "Single-Blind Method"[MeSH] OR "Double-Blind Method"[MeSH] OR "Random Allocation"[MeSH]	346335
#9	Search #6 AND #8	21
#10	Search ("Case-Control Studies"[MeSH] OR "Cohort Studies"[MeSH] OR "Epidemiologic Studies"[MeSH] OR "Cross-Sectional Studies"[MeSH] OR "Organizational Case Studies"[MeSH] OR "Cross-Over Studies"[MeSH] OR "Follow-Up Studies"[MeSH] OR "Seroepidemiologic Studies"[MeSH] OR "Multicenter Studies"[MeSH] OR "Evaluation Studies"[MeSH]) OR Longitudinal Studies OR observational studies	1192822
#11	Search #6 AND #10	77
#12	Search #7 OR #9 OR #11	118
#13	Search ("Colorectal Neoplasms/diagnosis"[Majr] OR "Colorectal Neoplasms/prevention and control"[Majr])	30104
#14	Search "Mass Screening"[Majr]	49616
#15	Search #13 AND #14	2272
#16	Search #15 NOT #12	2250
#17	Search #15 NOT #12 Limits: **Entrez Date from 2009, Humans, English**	67
#18	Search "United States"[Mesh] OR United States	2377508
#19	Search #17 AND #18	20
#20	Search #4 NOT #12	28324
#21	Search #15 AND #20	1592
#22	Search #15 AND #20 Limits: **Entrez Date from 2009, Humans, English**	32
#23	Search #18 AND #22	6

Total PUBMED = 124

Cochrane Reviews = 2 = 2 New

Cochrane Central Trials Registry = 19 = New 14

Total Unduplicated Database = 140

Appendix B

GENERAL INFO			PUBLICATION TYPE	
Reviewer initials	Ref ID	Author, Year	Not original research (e.g., review, letter, editorial)	Published as abstract only (or conference proceeding, poster)

POPULATION	OUTCOMES	SETTING	INTERVENTIONS
Wrong population--High risk population (diagnosis of other illness, e.g., cancer, FAP, HNPCC, UC, Crohns)--Refer to study population exclusion criteria box from table	Wrong outcome--refer to study outcomes exclusion box from table	Not U.S.	Wrong intervention--Not colonocsopy, Sigmoidoscopy, CTC, FIT, gFOBT, or DNA stool

	DESIGN		OTHER		BACKGROUND	
Not about screening	Exprimental (RCT or non-randomized controlled trial) N < 30	Observational N < 100	Does not address a KQ	Other--specify	Exclude but save for background	Systematic review

INCLUDE?	KEY QUESTIONS (CHECK ALL THAT APPLY)		
Article should be included If article is to be included, proceed; if not STOP here	KQ1: What are the recent trends in the use and quality of CRC screening?	KQ2: What factors influence the use of CRC screening?	KQ3: Which strategies are effective in increasing the appropriate use of CRC screening and followup?

ALL THAT APPLY)	Comments, if necessary
KQ4: What are the current and projected capacities to deliver CRC screening and surveillance at the population level?	KQ5: What are the effective approaches for monitoring the use and quality of CRC screening?

Appendix C

Acronyms

ACS	American Cancer Society
AHRQ	Agency for Healthcare Research and Quality
AOR	adjusted odds ratio
BRFSS	Behavioral Risk Factor Surveillance Survey
CAD	computer-aided detection
CAHPS	Consumer Assessment of Healthcare Providers and Systems
CCME	Carolina Center for Medical Excellence
CDC	Centers for Disease Control and Prevention
CHIS	California Health Interview Survey
CI	confidence interval
CONSORT	Consolidated Standards of Reporting Trials
CORI	Clinical Outcomes Research Initiative
CPT	current procedural terminology
CRC	colorectal cancer
CT	computed tomography
CTC	computed tomographic colonography
CTS	Community Tracking Study
DCBE	double contrast barium enema
DERS	Direct Endoscopic Referral System
DNA	deoxyribonucleic acid
DRE	digital rectal examination
FAP	familial adenomatous polyposis
FIT	fecal immunochemical test
FSS	fee-for-service
FFS + SUPP	fee-for-service Medicare + supplemental insurance
FIT	fecal immunochemical test
FOBT	fecal occult blood test
FS	flexible sigmoidoscopy
gFOBT	guaiac-based fecal occult blood test
G	group
GI	gastrointestinal
GI	gastroenterologist
HEDIS	Healthcare Effectiveness Data and Information Set
HINTS	Health Information National Trends Survey
HMO	health maintenance organization
HNPCC	hereditary nonpolylposis colorectal cancer
ICD	International Classification of Diseases
iFOBT	immunochemical fecal occult blood test
KQ	key question
LHA	lay health advisors
MCA	managed care activity
MCBS	Medicare Current Beneficiary Survey
MEPS	Medical Expenditure Panel Survey
MeSH	Medical Subject Heading
MMC	Medicare managed care

MMSA	metropolitan or micropolitan statistical areas
MR	magnetic resonance
MRI	magnetic resonance imaging
MSTF	Multi-Society Task Force
MSTF	Multi-Society Task Force
NCI	National Cancer Institute
NCQA	National Committee on Quality Assurance
NHIS	National Health Interview Survey
NIH	National Institutes of Health
N	number
NR	not reported
OMAR	Office of Medical Applications of Research
OR	odds ratio
PCP	primary care physician
PET	positron emission tomography
PHE	periodic health examination
PSA	prostate-specific antigen
PSAs	public service announcements
RCTs	randomized controlled trials
RDD	random digital dialing
RR	relative risk
RTC	Randomized Control Trial
RTI-UNC EPC	RTI International–University of North Carolina Evidence-based Practice Center
SES	socioeconomic status
SI	standard intervention
STROBE	STrengthening the Reporting of OBservational studies in Epidemiology
TEP	Technical Expert Panel
TFCPS	Task Force on Community Preventive Services
TI	tailored intervention
TIP	tailored intervention plus reminder phone call
US	United States
USPSTF	US Preventive Services Task Force
VA	Veterans Administration

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening

STUDY:	**Authors, ref ID:** Afable-Munsuz A, Liang SY, Ponce NA, Walsh JME.[1] **Year of publication:** 2009 **Dates of data collection:** 2000-2005 **Trial name:** NA				
OBJECTIVE OR AIM:	This study aimed to examine the relationships between acculturation and CRC screening among older Mexican, Puerto-Rican and Cuban adults.				
DESIGN:	**Setting:** US **Study design:** Cross-sectional retrospective study **Duration (mean followup):** NA **Overall study size (N enrolled/N analyzed):** 38,347				
Sample size: **Describe intervention:**	**Mexican** Sample Size: 2,304	**Puerto Rican** Sample Size: 503	**Cuban** Sample Size: 484	**Black** Sample size: 4,803	**White** Sample size: 28,306
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; this study used data from the 2000, 2003 and 2005 National Health Interview Survey (NHIS)				
INCLUSION CRITERIA:	Latinos 50 years and older, never diagnosed with CRC, and who were surveyed in the 2000, 2003 and 2005 National Health Interview Survey (NHIS)				
EXCLUSION CRITERIA:	NA				
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**Mexican** NR	**Puerto Rican** NR	**Cuban** NR		
• Conducted interview in English only	58%	60%	25%		
• Born in the U.S.	56%	21%	5%		
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**Mexican** NA	**Puerto Rican** NA	**Cuban** NA		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Afable-Munsuz A, Liang SY, Ponce NA, Walsh JME.[1] **Year of publication:** 2009 **Dates of data collection:** 2000-2005 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** • Authors examined bivariate and adjusted relationships between acculturation measures and all three CRC screening outcomes. • Authors used chi-square tests to examine unadjusted associations between nativity and language of interview and the three outcomes. • Using logistic regression, models containing nativity, language of interview and all covariates were estimated to assess the independent contributions of each on the three outcomes.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	• Authors also analyze key covariates, including demographic variables (age, sex) and socio-economic factors known as predisposing variables (income status, education), enabling factors or those related to health-care access (type of insurance and usual source of care) and health-care need factors (number of chronic diseases), which is a count variable ranging from 0 to 6, of whether the respondent reported having diabetes, hypertension, ulcer, arthritis, any cardiovascular disease and any respiratory illness.
OUTCOME ASSESSMENT:	**Outcome Measures:** • Authors measured acculturation with US nativity and language of interview, and examined three different CRC screening outcomes: fecal occult blood test (FOBT) in the past year, up-to-date endoscopy and any up-to-date CRC screening. • Three CRC screening outcomes, available in the NHIS, were investigated: (1) whether individuals had undergone FOBT in the past year, (2) whether individuals had received a sigmoidoscopy in the last 5 years or colonoscopy in the last 10 years and (3) whether individuals had received any up-to-date CRC screening (or met the criterion for no. 1 or 2).
RESULTS:	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

<table>
<tr><td>STUDY:</td><td>Authors, ref ID: Afable-Munsuz A, Liang SY, Ponce NA, Walsh JME.[1]
Year of publication: 2009
Dates of data collection: 2000-2005
Trial name: NA</td></tr>
<tr><td>KQ2 - What factors influence the use of colorectal cancer screening?</td><td>Outcomes:
<table>
<tr><th></th><th>FOBT in past year</th><th>UTD endoscopy</th><th>Any UTD screening</th></tr>
<tr><td>Mexico</td><td>10.9</td><td>23.6</td><td>29.0</td></tr>
<tr><td>Puerto Rico</td><td>13.9</td><td>28.5</td><td>35.5</td></tr>
<tr><td>Cuba</td><td>11.2</td><td>30.6</td><td>36.8</td></tr>
<tr><td>Non-Hispanic Black</td><td>14.6</td><td>29.3</td><td>36.2</td></tr>
<tr><td>Non-Hispanic White</td><td>16.8</td><td>38.3</td><td>45.3</td></tr>
</table>
Screening outcomes by nativity and language of interview

Results suggest “differential relationships between acculturation and CRC screening by national origin”. Among Mexicans, the authors observed a positive relationship between US nativity and endoscopy and overall UTD status. Among Puerto Ricans, US nativity was associated with a lower likelihood of FOBT use.
Nativity and language of interview were not significant correlates of any up-to-date CRC screening among Puerto Ricans and Cubans. Mexicans born in the U.S. had higher odds of reporting any UTD screening. (OR=1.4, 95% CI 1.0-1.9)
Higher family income (95% CI: 200-399% FPL (1.3, 6.0) and a greater number of chronic conditions (95% CI: 1.3, 2.0) were significantly associated with a higher likelihood of any up-to-date CRC screening among Cubans.
For FOBT, the study’s acculturation measures were only significant among Puerto Ricans.
It is notable that higher educational level (some college 95% CI: 1.6, 5,5) and a greater number of chronic conditions (95% CI: 1.2, 1.6) were also significant and positively related to having received an FOBT in the past year among Puerto Ricans.
Among Mexicans, having a usual source of care (95% CI: 1.4, 3.5) and a greater number of chronic conditions (95% CI: 1.2, 1.4) were significant and positive correlates of FOBT in the past year.
Among Cubans, male gender (95% CI: 1.0, 2.5) was the only significant, positive correlate of the outcome.
English language was positively associated with FOBT in past year (AOR, 2.5; 95% CI, 1.1, 5.4)
US born among Mexicans was positively associated with endoscopy (AOR, 1.5; 95% 1.1, 2.2) and negatively associated with FOBT among Puerto Ricans (AOR, 0.3; 95% CI, 0.2, 0.7)</td></tr>
<tr><td>KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?</td><td>Outcomes:
NA</td></tr>
<tr><td>KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?</td><td>NA</td></tr>
</table>

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Afable-Munsuz A, Liang SY, Ponce NA, Walsh JME.[1] **Year of publication:** 2009 **Dates of data collection:** 2000-2005 **Trial name:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Good

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NR
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Ananthakrishnan, A.N., et al.[2] **Year of publication:** 2007 **Dates of data collection:** 2002-2003 **Trial name:** NA		
OBJECTIVE OR AIM:	To identify sex, age, socioeconomic, and racial/ethnic disparities in colon cancer screening practices in Medicare beneficiaries in Illinois, New York, and Florida since institution of the expanded coverage.		
DESIGN:	**Setting:** Medicare claims data **Study design:** Cross-sectional retrospective **Duration (mean followup):** No follow-up **Overall study size (N enrolled/N analyzed):** 596,470		
	Florida	**Illinois**	**New York**
Sample size:	Sample size: 228,853	Sample size: 161,867	Sample size: 205,750
Describe intervention:	No intervention, Medicare claims data	No intervention, Medicare claims data	No intervention, Medicare claims data
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Claims-based; Medicare physician/supplier file, which is derived from Medicare Part B claims for physician services, and the denominator file; a one-fifth sample of eligible subjects enrolled in both Parts A and B, exclusively receiving their care through the Medicare fee-for-service system in each of the 3 states of New York, Florida, and Illinois during 2002 and 2003, was identified.		
INCLUSION CRITERIA:	Age 65+		
EXCLUSION CRITERIA:	Individuals with a personal history of colon polyps (*ICD-9* codes V12.72, 211.3, and 211.4), colon cancer (*ICD-9* V10.05 and V10.06), or inflammatory bowel disease (*ICD-9* 555.x, 556.x, 558.2, and 558.9); subjects older than 90 years or with missing data on race/ethnicity or sex		
POPULATION CHARACTERISTICS:	**Florida**	**Illinois**	**New York**
Mean age & range (years):	Age: 27.4% 65-69, 27.8% 70-74, 23.4% 75-79, 21.5% 80+	Age: 28.1% 65-69, 27.4% 70-74, 22.9% 75-79, 21.7% 80+	Age: 26.4% 65-69, 27.3% 70-74, 23.3% 75-79, 23% 80+
Sex (% female):	Sex: 58.2% female	Sex: 60.8% female	Sex: 61.2% female
Race:	Race: 90.8% White, 5.4% Black,	Race: 90% White, 7.9% Black, .6%	Race: 87.6% White, 7.9% Black,
Other:	.5% Pacific Islander, .4% Asian, 2.9% Hispanic, .1% Native American	Pacific Islander, .6% Asian, .8% Hispanic, .1% Native American	1.1% Pacific Islander, 1.1% Asian, 2.2% Hispanic, .1% Native American
Attrition/Drop-out (not available for endpoint measurement):	NA		
Adherence:			
Contamination:			
Response Rates (e.g. for surveys):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Ananthakrishnan, A.N., et al.[2] **Year of publication:** 2007 **Dates of data collection:** 2002-2003 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** Authors calculated the percentages of patients who had undergone any colorectal cancer screening procedure, and for each individual test authors analyzed the screening practices by age group, sex, race/ethnicity, educational achievement, per capita income level, and state of residence using univariate analysis. All variables showing a significant association ($P<.05$) with the outcome were included in the final multivariate model to arrive at adjusted estimates. In addition, authors analyzed interactions between the demographic variables (age, sex, and race/ethnicity) and the socioeconomic markers (educational achievement and per capita income level) and between the various demographic variables. Interactions that were statistically significant ($P<.05$) were included in the final model.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** Screening procedures were identified using the following Health Care Financing Administration Common Procedure Coding System and *Current Procedural Terminology* codes: colonoscopy (44388, 44389, 44392, 44393, 44394, 45378, 45380, 45383, 45384, 45385, G0105, and G0121), sigmoidoscopy (45300, 45305, 45308, 45309, 45315, 45320, 45330, 45331, 45333, 45338, 45339, and G0104), DCBE (74270, 74280, G0106, G0120, and G0122), and FOBT (G0107 and G0328). Authors considered the procedures to be screening tests if they were coded using the relevant Health Care Financing Administration Common Procedure Coding System codes or using the appropriate *ICD-9* codes for screening (V76.51 and V76.51).
RESULTS:	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Ananthakrishnan, A.N., et al.[2] **Year of publication:** 2007 **Dates of data collection:** 2002-2003 **Trial name:** NA
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Overall screening for colon cancer varied by race/ethnicity, income level, and educational achievement but not by sex. An equal proportion (18.3%) of men and women had undergone a screening colon test. Blacks (9.7%) and Hispanics (8.1%) had lower rates of colon cancer screening compared with whites (19.3%). Individuals living in ZIP codes with a higher per capita income were more likely to undergo a colon screening test than were those living in ZIP codes with a lower per capita income (21.0% and 14.6% in the highest and lowest tertiles, respectively). Patients 80+ years were less likely to have received any CRC test than other age groups, regardless of income (RR range, 0.84-0.90). There was a significant interaction between age group and sex ($P<.001$) and between income level and sex ($P<.05$) for all screening tests and in an analysis restricted to screening colonoscopy alone. There was also a significant interaction between race/ethnicity and both sex and income level for screening colonoscopy ($P<.05$).
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NR
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NR
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NR
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer prevention: Adherence patterns and correlates of tests done for screening purposes within United States populations	**Authors, ref ID:** Ata et al.[3] **Year of publication:** 2006 **Dates of data collection:** data from NHIS 2000 sample **Trial name:** data from NHIS used for this study
OBJECTIVE OR AIM:	In this study, they estimate the use of the tests recommended for CRC preventive screening using an outcome variable accounting for adherence to: (1) any combination of recommended tests (2) within their respective time guidelines and (3) done specifically for screening purposes. They also examine the effect of race/ethnicity, and other documented and potential predictors, on the test usage based upon our outcome variable. They also compare the influence of predictor variables between and within racial/ethnic groups with a goal of guiding screening adherence improvement strategies.
DESIGN:	**Setting:** United States, NHIS 2000 **Study design:** cross-sectional, modeling (kq2) **Duration (mean follow-up):** no follow-up data reported **Overall study size (N enrolled/N analyzed):**
Sample size: **Describe intervention:** NA	sample of 12,498 people, representing an age-appropriate population of 72.3 million
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population based
INCLUSION CRITERIA:	The study included only those people who were 50 years or more in age.
EXCLUSION CRITERIA:	The study excluded people who reported ever having cancer of the colon or rectum.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	NR
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	NA
Response Rates (e.g. for surveys):	Annual response rate of the NHIS is greater than 90% of the eligible households in the sample

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer prevention: Adherence patterns and correlates of tests done for screening purposes within United States populations	**Authors, ref ID:** Ata et al.[3] **Year of publication:** 2006 **Dates of data collection:** data from NHIS 2000 sample **Trial name:** data from NHIS used for this study
STATISTICAL ANALYSES:	Descriptive statistics and a multiple logistic regression model with all the independent variables was used to estimate the odds of compliance for each of the predictor variables while controlling for the other variables.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	(a) socio-demographics: age, gender, marital status, education, annual family income, region, and size of metropolitan statistical area (MSA) of residence; (b) healthcare access and utilization: having health insurance, a usual source of healthcare, and time since last visit to a doctor; (c) health risk and health status: family history of any cancer, a personal history of other cancers and perceived health status; (d) behavioral/lifestyle: smoking, body mass index (BMI), and exercise.
OUTCOME ASSESSMENT:	(1) any combination of recommended tests (2) done within their respective time guidelines, and (3) specifically for screening purposes.
Results	
KQ2 - What factors influence the use of colorectal cancer screening?	**Hispanics less likely to be adherent for timescreening in unadjusted and adjusted models.**

Table. Comparison of multivariate adjusted OR's and 95% CI for 'time only' and 'time-screening' adherence (NHIS 2000)

Variable	Adherent for time and purpose (n=9575)			
	(%)	(CI for %)	OR	(CI or OR)
Overall population	25.8	(24.9, 26.7)	-	-
Race				
Non-Hispanic White	27.3	(26.3, 28.3)	1.00	Referent
Hispanics	15.8	(13.5, 18.5)	0.73	(0.58, 0.92)
Non-Hispanic Black	22.7	(20.1, 25.6)	1.13	(0.95, 1.35)
Age (y)				
50-54	19.7	(17.9, 21.7)	1.00	Referent
55-59	25.6	(23.3, 27.9)	1.51	(1.24, 1.84)
60-64	26.7	(24.4, 29.1)	1.70	(1.41, 2.05)
65-69	30.9	(28.5, 33.5)	2.14	(1.75, 2.62)
70-74	30.5	(27.9, 33.3)	2.20	(1.80, 2.70)
>=75	26.5	(24.4, 28.6)	2.08	(1.70, 2.53)
Gender				
Female	23.9	(22.8, 25.1)	1.00	Referent

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer prevention: Adherence patterns and correlates of tests done for screening purposes within United States populations	**Authors, ref ID:** Ata et al.[3] **Year of publication:** 2006 **Dates of data collection:** data from NHIS 2000 sample **Trial name:** data from NHIS used for this study				
	Male	28.0	(26.6, 29.5)	1.16	(1.03, 1.31)
	Marital status				
	Married, living with spouse	28.7	(27.4, 30.0)	1.26	(1.11, 1.44)
	Rest of population	20.9	(19.8, 22.1)	1.00	Referent
	A usual place of health care				
	No	9.5	(7.5, 11.9)	1.00	Referent
	Yes	27.1	(26.1, 28.1)	1.61	(1.17, 2.21)
	Time since last doctor visit				
	<= 6 mos	28.9	(27.8, 30.0)	7.59	(4.40, 13.10)
	> 6 mos – 1 yr	22.9	(20.3, 25.8)	5.86	(3.33, 10.3)
	> 1-2 yrs	11.2	(8.4, 14.7)	2.76	(1.48, 5.17)
	> 2 yrs	3.7	(2.3, 5.9)	1.00	Referent
	Family h/o ca				
	No	23.8	(22.4, 25.3)	1.00	Referent
	Yes	30.6	(29.3, 32.0)	1.27	(1.13, 1.43)
	h/o other cancer				
	No	24.9	(24.0, 25.9)	1.00	Referent
	Yes	32.3	(29.6, 35.0)	1.08	(0.93, 1.25)
	Perceived health status				
	Excellent	30.1	(28.1, 32.1)	1.00	Referent
	Very good	27.7	(26.1, 29.4)	0.90	(0.77, 1.04)
	Good	24.6	(23.0, 26.3)	0.83	(0.70, 0.97)
	Fair	21.1	(19.1, 23.4)	0.77	(0.63, 0.94)
	Poor	20.1	(17.2, 23.3)	0.73	(0.56, 0.96)
	Smoking status				
	Non-smoker	25.1	(23.8, 26.5)	1.00	Referent
	Smoker	18.2	(16.3, 20.3)	0.89	(0.73, 1.07)
	Quitter	30.9	(29.3, 32.6)	1.11	(0.98, 1.27)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer prevention: Adherence patterns and correlates of tests done for screening purposes within United States populations	**Authors, ref ID:** Ata et al.[3] **Year of publication:** 2006 **Dates of data collection:** data from NHIS 2000 sample **Trial name:** data from NHIS used for this study				
	BMI				
	Underweight	17.6	(13.3, 22.8)	0.81	(0.55, 1.19)
	Normal	25.5	(24.0, 27.0)	1.00	Referent
	Overweight	27.6	(26.1, 29.2)	1.07	(0.95, 1.21)
	Obese	26.6	(24.7, 28.5)	1.14	(0.99, 1.32)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	NA				
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA				
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA				
QUALITY RATING:	Good				

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		As mentioned, response rate to NHIS > 90%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		Self-report, so may overestimate screening. However, detailed questions about reasons for test make this less likely.
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Atlas[4] **Year of publication:** 2009 **Dates of data collection:** 2003 to 2005 **Trial name:** NR		
OBJECTIVE OR AIM:	To determine whether patient–physician connectedness affects measures of clinical performance		
DESIGN:	**Setting:** Academic network of 4 community health centers and 9 hospital-affiliated primary care practices. Massachusetts General Hospital Primary Care Network **Study design:** Population-based retrospective cohort study **Duration (mean followup):** **Overall study size (N enrolled/N analyzed):** 155,590		
	Physician connected	**Practice connected**	**Unconnected**
Sample size (all patients):	92,315	53,669	9,606
Sample size (colorectal patients only):	31,215	6,453	NA
Describe intervention:	NA		
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic based		
INCLUSION CRITERIA:	All patients with a visit to 1 of these practices from 1/1/03 to 12/31/05 using billing records.		
EXCLUSION CRITERIA:	Younger than 18 years, had died, or were registered as having a PCP outside of the network. CRC screening measure included only patients age 52-69 without total colectomy.		
POPULATION CHARACTERISTICS:	**Physician connected**	**Practice connected**	**Unconnected**
Mean age & range (years):	52 (SD 16.4)	39.9 (15.0)	51.6 (15.1)
Sex (% female):	58.1	56.6	49.4
Race:			
White	81.2	69.5	67.3
Hispanic	7.0	11.2	12.7
Black	4.7	6.5	6.4
Asian	4.1	5.6	3.8
Other	1.8	4.2	4.5
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA		
STATISTICAL ANALYSES:	To account for repeated measures of patients from the same physician, the authors used generalized estimating equations techniques with compound symmetry correlation structure. Because of the variability among practices,		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Atlas[4] **Year of publication:** 2009 **Dates of data collection:** 2003 to 2005 **Trial name:** NR
	practice was included as a fixed effect in each model. The authors compared proportions of completed performance tests among physician-connected and practice-connected patients.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	A validated algorithm was used to connect patients to either 1 of 181 physicians or 1 of 13 practices in which they received most of their care. Patients were classified as "physician-connected", "practice-connected", or "unconnected". Only patients in the first 2 groups were analyzed. The algorithm primarily uses the PCP designee field from the hospital registration system, combined with a logistic regression model that uses patient age, times since most recent visit, in state residency, and physician practice style (categorized as the proportion of all visits by patients registered ot he physician). Confounders included age, sex, race/ethnicity, insurance status, and number of visits over 3 years.
OUTCOME ASSESSMENT:	**Outcome Measures:** colonoscopy within 10 years; FS or BE within 5 years, home FOBT within 1 year for patients age 52-69 years
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Adjusted rates of CRC screening rates:** Physician connected patients: 72.1% (95% CI, 70.5-73.7) Practice connected patients: 58.0% (95% CI, 56.7-59.4) *P* < 0.001
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Good

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?	x		NA
Were intervention/exposure measures valid, reliable, and equally applied?	x		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR
Were outcome measures valid, reliable, and equally applied?	x		
Does the analysis control for baseline differences?	x		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	x		
Were the statistical methods used to assess the abstracted outcomes appropriate?	x		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Berkowitz, Z., et al.[5] **Year of publication:** 2008 **Dates of data collection:** October 2002 to April 2003 **Trial name:** NA
OBJECTIVE OR AIM:	To assess beliefs and perceptions of risk about colorectal cancer (CRC) and gaps in knowledge about screening in adults aged 65 to 89.
DESIGN:	**Setting:** United States **Study design:** Cross-sectional retrospective **Duration (mean followup):** No follow-up **Overall study size (N enrolled/N analyzed):** 1,148
Sample size: **Describe intervention:**	**All** Sample size: 1,148 (583 not up to date with screening) Intervention: Telephone survey
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based
INCLUSION CRITERIA:	No history of CRC, adults aged 65 to 89
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Age range: 65-89
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** response rate for the screening phase of the study was 55% and for the interview phase was 62.8%, resulting in an overall response rate of 34.5%
STATISTICAL ANALYSES:	**Describe:** A separate logistic regression model for each covariate was used to calculate the odds ratios and *P*-values for being up to date with CRC screening, after adjusting for age groups.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Berkowitz, Z., et al.[5] **Year of publication:** 2008 **Dates of data collection:** October 2002 to April 2003 **Trial name:** NA
	Multivariate logistic regression analysis was performed to determine the effect of demographic and healthcare characteristics, selected covariates of beliefs and risk perceptions, and knowledge about CRC screening on being up to date with screening.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	
OUTCOME ASSESSMENT:	**Outcome Measures:** Whether a person had an FOBT in the past year or a colonoscopy/sigmoidoscopy in the past 10 years. **Secondary Outcome:** Reasons for Not Being Up to Date with Colorectal Cancer Screening According to Test Type and Age Group: Health Information National Trends Survey 2003
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** In the multivariate analysis, not being up to date with CRC screening was associated with being aged 65 to 74, not visiting a provider in the previous year, not being able to cite even one test to detect colon cancer, perceiving that arranging to check for colon cancer is difficult or not having an opinion about it, and not having an opinion about the cost of the test ($P < 0.03$ for each covariate). Older patients were more likely than younger patients to be up to date with CRC screening (AOR, 1.92; 95% CI, 1.32-2.79; $P < 0.001$) People who perceived their health to be excellent or very good were no more or less likely to be up-to-date with CRC screening than those who are in fair or poor health ($P = 0.11$) Respondents who believed that it is not easy to arrange to be tested (AOR, 0.47; 95% CI, 0.25-0.91) or that the tests are too expensive (AOR, of disagreeing with test being too expensive = 1.25; 95% CI, 0.80-1.97); or had a lack of knowledge about the number of available tests (AOR, 0.28; 95% CI, 0.19-0.42) were less likely to report being screened (*P* values at 0.03 or better) Reasons for not being screened: No recommendation received for 65-74 year olds: FOBT: 87.5% (95% CI, 76.7–93.7%); FS/colonoscopy: 79.1% (95% CI, 69.3-86.4%) For those 75-89 years: FOBT: 84.4% (95% CI, 70.6-92.3%); FS/colonoscopy: 75.9% (95% CI, 64.1-86.2%)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Berkowitz, Z., et al.[5] **Year of publication:** 2008 **Dates of data collection:** October 2002 to April 2003 **Trial name:** NA
followup?	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Response rate for the screening phase of the study was 55% and for the interview phase was 62.8%, resulting in an overall response rate of 34.5%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Cardarelli, R., and Thomas, J.[6] **Year of publication:** 2009 **Dates of data collection:** 2004 **Trial name:** NA				
OBJECTIVE OR AIM:	To assess the relationship between having a personal health care provider and receiving colorectal cancer testing				
DESIGN:	**Setting:** United States – 2004 Behavioral Risk Factor Surveillance System data **Study design:** secondary analysis of cross-sectional data **Duration (mean followup):** NA **Overall study size (N enrolled/N analyzed):** 144,897 analyzed in descriptive statistics, 120,221 analyzed in multiple regression models				
Sample size: **Describe intervention:**	N = 144,897 (descriptive stats) N = 120, 221 (multiple regression models) NA				
RECRUITMENT: (population-based, clinic-based, volunteer, other)	NA (secondary data analysis; however, the BRFSS participants are a random sample)				
INCLUSION CRITERIA:	BRFSS includes civilian, noninstitutionalized adults (1 per household). The dataset in the current study only includes participants who are 50 years or older.				
EXCLUSION CRITERIA:	NR (no maximum age selected)				
	Variable	**1 PHP N = 116,349**	**>1 PHP n = 15,087**	**No PHP n = 13,461**	**Total n = 144,897**
	Age, mean (SD), y	64.7 (10.5)	66.2 (10.6)	61.6 (9.9)	4.6 (10.5)
	Female, %	55.8	54.3	43.6	54.5
	Non-Hispanic white	80.2	77.3	65.6	78.5
	Non-Hispanic African American	8.0	8.6	10.2	8.3
	Non-Hispanic Other	3.0	3.2	3.9	3.1
	Non-Hispanic multiracial	1.2	1.7	1.5	1.2
	Hispanic	7.6	9.1	18.8	8.8
	Education level, %				
	Not graduate high school	12.4	15.2	21.8	13.5

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Cardarelli, R., and Thomas, J.[6] **Year of publication:** 2009 **Dates of data collection:** 2004 **Trial name:** NA				
	High school graduate or greater	87.6	84.8	78.2	86.5
	Income, %				
	<$25,000	30.6	35.7	47.2	32.7
	≥$25,000	69.4	64.3	52.8	67.3
	Health Insurance, %				
	Yes	94.6	95.2	67.1	92.1
	No	5.4	4.8	32.9	7.9
	Up-to-date CRC testing, %				
	Yes	59.3	62.5	26.9	56.6
	No	40.7	37.5	73.1	43.4
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	BRFSS 2004 mean response rates = 52.7%				
STATISTICAL ANALYSES:	Descriptive statistics calculated using weighted population percentages. $\chi 2$ statistics and analyses of variance tested for differences between having a personal health care provider and categorical and continuous variables. Univariate logistic regression analyses used to determine association between dependent and independent variables. Multiple logistic regression analysis used to control for potentially confounding covariates. Unadjusted and adjusted odds ratios and 95% confidence intervals calculated for the univariate and multiple logistic regression analyses, respectively. Tests for collinearity conducted, and no collinear relationships were identified in the final model.\				
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Multiple logistic regression analysis was used to control for potentially confounding covariates. Covariates: age sex race/ethnicity education level annual household income level having health insurance				

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Cardarelli, R., and Thomas, J.[6] **Year of publication:** 2009 **Dates of data collection:** 2004 **Trial name:** NA
OUTCOME ASSESSMENT:	The outcome of interest was derived from responses to the CRC screening section of the BRFSS. Respondents asked 4 questions and were considered to be up-to-date if they had a FOBT within the previous year or had a sigmoidoscopy or colonoscopy within the previous 10 years. Responses dichotomized as either "testing up-to-date" or "testing not up-to-date."
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	Having at least 1 personal health care provider significantly predicted up-to-date CRC testing in both the univariate (OR = 3.96; 95% CI 3.56-4.41) and multiple regression models (OR = 2.91; 95% CI 2.58-3.28). Age (OR = 1.04, 95% CI, 1.04-1.04), sex (female as referent group, OR = 1.13, 95% CI, 1.06-1.20), race/ethnicity, education (HS+ as referent group, OR = 0.72, 95% CI, 0.65-0.81), income ($25,000+ referent group, OR = 0.69, 95% CI, 0.64-0.74), and health insurance (No health insurance as referent group, OR = 1.84, 95% CI, 1.62-2.08) were also significantly associated with up-to-date CRC testing. Although covariates were significant predictors, having a personal health care provider had the highest odds of predicting being up-to-date for CRC testing.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA - The response rate for the overall BRFSS was 52.7% - but I chose NA because the current study is secondary analyses of the BRFSS data collected in 2004
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Cairns and Viswanath et al.[7] **Year of publication:** 2006 **Dates of data collection:** 2002-2003 **Trial name:** NR
OBJECTIVE OR AIM:	To examine the role of communication factors and insurance, with a specific focus on the uninsured to examine disparities in CRC screening.
DESIGN:	**Setting:** Subgroup analysis of HINTS (a random sample survey of cancer communication behaviors) **Study design:** Retrospective database analysis of HINTS **Duration (mean follow-up):** NR **Overall study size (N enrolled/N analyzed):** 1,253
Sample size: **Describe intervention:**	1,253 NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based
INCLUSION CRITERIA:	Age 50-64
EXCLUSION CRITERIA:	For “ever screened” for CRC (or screening status), respondents (a) who had CRC, and because not all respondents received all survey questions (b) those respondents who did not receive the CRC question set.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	NR
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA NR
STATISTICAL ANALYSES:	**Describe:** Survey was conducted by telephone using a list-assisted random-digit-dial sample.. African Americans and Hispanics were oversampled; therefore screening rates by demographic and health care access characteristics are presented using weighted data that adjusts for this oversampling. All other analyses used unweighted data, because the enormous sample sizes generated by weighting make it difficult to assess statistical significance in small subpopulation analyses, and create difficulty in modeling with logistic regression. All analyses were conducted using SPSS version 12.0.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Cairns and Viswanath et al.[7] **Year of publication:** 2006 **Dates of data collection:** 2002-2003 **Trial name:** NR
	CRC screening status was examined by demographic variables (age, sex, race/ethnicity) and indicators of SES (education, income, employment status and residence in urban or rural counties) that have been identified in the literature as associated with screening behavior in particular and characteristics associated with health services and health access more generally. To provide background on screening rates within subpopulations in the sample, CRC screening status was examined by demographic variables and usual provider status using crosstabulations, chi-square tests, and Kendall's tau-b correlation coefficients. Because age distributions were not normal, they compared age of the screened and never screened using the nonparametric Mann-Whitney test. To answer first research question (Is insurance status associated with CRC screening, both ever having been screened, and with regard to FOBT being on schedule and repeating screening?), examined CRC screening status by insurance status with a cross-tabulation, chi-square test, and a logistic regression model with insurance status (y/n) as the binomial independent predictor and screening status (ever screened = y/n) as the dependent variable. On schedule and repeat screening with FOBT were assessed for the overall sample and by insurance status. On schedule screening was based on the USPSTF recommended time interval of every year for FOBT; the proportion that received FOBT within the year before the survey (among those who received FOBT) was used to assess on schedule screening with FOBT. To assess whether being on schedule for this test was related to insurance status crosstabulations and chi-square tests were used. To assess repeat screening frequencies were produced of when (categorical time intervals) respondents received another FOBT before their most recent. For patterns in screening behavior, they authors produced cross-tabulations and chi-square tests for the timing of the most recent FOBT against the timing of another FOBT before the most recent, overall and by insurance status. To address the 2nd research question (To what extent are communication factors such as attention to health in the media, experiences with providers and cancer information seeking related to CRC screening among the uninsured?), authors assessed the relationship between: media attention measures, information seeking, patient–provider interaction (CAHPS measures), and provider recommendation, and screening status among the uninsured by using cross-tabulations, chi-square tests, and Kendall's tau-b correlation coefficients. To examine the 3rd research question (Is provider recommendation, another measure of communication, associated with screening among the uninsured?), and because the chi-square statistic was significant for provider recommendation, authors generated a logistic regression model with screening status for the uninsured as the dependent variable (ever screened = y/n) and provider recommendation as the independent variable (y/n). The other communication measures were not significant at the bivariate level, and were therefore excluded from the final model. To answer the 4th research question (What are the reasons that deter the uninsured from undergoing CRC

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Cairns and Viswanath et al.[7] **Year of publication:** 2006 **Dates of data collection:** 2002-2003 **Trial name:** NR
	screening?), authors examined the reasons reported by the uninsured for not undergoing screening. For the uninsured never screened, they combined all reported reasons for not receiving any of the tests and determined which accounted for the largest proportion of identified barriers: lack of awareness, provider recommendation, no problems or symptoms, and insurance or cost.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	HINTS survey collected information on: demographic variables, access to health care, health status, health behaviors, knowledge of CRC screening guidelines, beliefs about cancer risk, beliefs about colorectal cancer test use, beliefs about cancer in general, "cancer worry", "degree to which participants paid attention to any health or medical topics via television, radio, newspapers, magazines, or the Internet", trust in information from these sources, trust in healthcare providers/family/friends for cancer information, cancer information seeking behavior For this study: Independent variables of interest for analysis: lack of insurance & communication Dependent variables: (a) ever screened, and for FOBT, (b) on schedule and repeat screening.
OUTCOME ASSESSMENT:	**Outcome Measures: CRC screening**
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** In the sample, 71.2% of respondents reported having undergone at least one kind of CRC screening Proportion of uninsured who have been screened lower than those who were insured (49% vs. 73%) Screening strongly associated with SES; screening rates increased as income and education increased and decreased as county of residence became more rural Whites (74.5%) were most likely to have been screened compared to African Americans (59.6%) and Hispanics (46.6%) Screening rates were higher among insured, and insurance status was a significant predictor in a simple logistic regression model, with the uninsured 64% (95% CI: 0.2451, 0.536) less likely to be screened than the insured No significant association between timing of most recent FOBT and insurance status, but a greater proportion of the uninsured had received only their first FOBT (no prior) compared to the insured More insured respondents repeated FOBT screening (2 consecutive tests), with a 10.7% point disparity between insured and uninsured There was no statistically significant relationship between any of the communication measures (attention to health in the media, cancer information seeking, and patient-provider interactions) and screening status

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Cairns and Viswanath et al.[7] **Year of publication:** 2006 **Dates of data collection:** 2002-2003 **Trial name:** NR
	No communication measures were significantly related to CRC screening status Almost 91% of the uninsured who have received provider recommendation have undergone screening vs. about 13% of those who did not receive a recommendation by their provider In a simple logistic regression model, this parameter was significant ($P < 0.001$) and the uninsured without a recommendation were 98.5% (95% CI: 0.003, 0.083) less likely to have ever received CRC screening than those who did This parameter was also significant ($P < 0.001$) when the model was run for the insured (n = 630), with the insured who did not receive a provider recommendation 92% (95% CI: 0.054, 0.119) less likely to have been screened for CRC Primary reasons reported by the uninsured never screened for not receiving all tests were lack of awareness (35%), lack of provider recommendation (19%), no problems/symptoms (9%), and financial barriers (3%); in 21%, no reason reported 36.1% of uninsured received a recommendation versus 62.5% for the insured
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Good

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			CD
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?		X	
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Carcaise-Edinboro et al.[8] **Year of publication:** 2008 **Dates of data collection:** 2004 **Trial name:** NA
OBJECTIVE OR AIM:	The relationship between patient-provider communication and socioeconomic variables on the receipt of CRC screening using data from the Medical Expenditure Panel Survey.
DESIGN:	**Setting:** 2004 Medical Expenditure Panel Survey (MEPS) **Study design:** Cross-sectional **Duration (mean follow-up):** One-time data collection, no follow-up **Overall study size (N enrolled/N analyzed):** 8,488
	All
Sample size:	Sample size: 8,488
Describe intervention:	Intervention: 2004 Medical Expenditure Panel Survey (MEPS)
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; 2004 Medical Expenditure Panel Survey (MEPS)
INCLUSION CRITERIA:	Age 50+
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS:	**All**
Mean age & range (years):	NR
Sex (% female):	
Race:	
Other:	
	All
Attrition/Drop-out (not available for endpoint measurement):	NR
Adherence:	
Contamination:	
Response Rates (e.g. for surveys):	
STATISTICAL ANALYSES:	**Describe:** • Authors examined CRC screening status by patient-provider communication and demographic variables using cross tabulations and x2 tests. • Using logistic regression models, authors estimated the effects of the patients' primary language and patient-provider communication on 3 CRC screening dependent variables.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Carcaise-Edinboro et al.[8] **Year of publication:** 2008 **Dates of data collection:** 2004 **Trial name:** NA
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** Dependent measures were receipt of CRC screening, fecal occult blood testing, and colonoscopy or sigmoidoscopy.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • For the CAHPS patient-provider communication measures, a response of "sometimes," "usually," or "always" compared with the response of "never" for "adequate time with their healthcare provider" was positively and significantly associated with increased screening by all methods, with the exception of FOBT. • Patients who reported that their provider adequately explained patient healthcare needs as "sometimes," "usually," or "always," relative to patients who reported their provider "never" adequately explained healthcare needs were significantly more likely to receive CRC screening by FOBT. "Adequate provider explanation of patients' healthcare needs" was not independently significantly associated with other forms of CRC screening. • Race or ethnicity was not significantly associated with CRC screening in the final model. CRC screening by any method: • Subjects who reported that they sometimes, usually, or always have enough time with the provider were 2.61 (95% CI, 1.55-4.38) to 2.99 (95% CI, 1.83-4.88) times more likely than those who reported they never have enough time For FOBT: • Subjects who reported that their provider sometimes, usually, or always adequately explains information were 3.67 (95% CI, 1.16-1.6) to 6.42 (95% CI, 2.15-19.1) times more likely than those who reported provider never explains adequately. Logistic regression results for CRC, OR, 95% CI – controlled for age, living area, health status, insurance, income, language, source of care, race, ethnicity, sex: Independent variable — Screened with either c-scope/s-scope or fobt Enough time with provider Never — 1.0 Sometimes — 2.61 (1.55-4.38) Usually — 2.99 (1.83-4.88) always — 2.65 (1.62-4.31) Provider adequately explains — Screened with fobt Never — 1.0 Sometimes — 3.67 (1.16-11.6)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Carcaise-Edinboro et al.[8] **Year of publication:** 2008 **Dates of data collection:** 2004 **Trial name:** NA	
	Usually Always	6.42 (2.16-19.1) 6.09 (2.01-18.4)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA	
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA	
QUALITY RATING:	Fair	

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NR
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Can breast and cervical cancer screening visits be used to enhance colorectal cancer screening?	**Authors, ref ID:** Carlos et al.[9] **Year of publication:** 2004 **Dates of data collection:** 2000 BRFSS data used **Trial name:** NA
OBJECTIVE OR AIM:	Data from the BRFSS were analyzed to identify potential relationships that would allow interventions to enhance colorectal cancer screening
DESIGN:	**Setting:** United States **Study design:** cross-sectional **Duration (mean follow-up):** no f/u data **Overall study size (N enrolled/N analyzed):** 2,788 women aged 50 or older participated in the 2000 BRFSS
	All
Sample size:	1300 respondents, 1488 non-respondents
Describe intervention:	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population based
INCLUSION CRITERIA:	Women 50 years of age or older who participated in the 2000 BRFSS survey and lived in 1 of 5 states that administered the colorectal cancer module (CO, IL, MA, OH, UT)
EXCLUSION CRITERIA:	NA
POPULATION CHARACTERISTICS:	
Mean age & range (years):	Mean age: 64 years
Sex (% female):	Sex: 100% female
Race:	
Other:	Table. Sociodemographic characteristics of women who did and did not respond to colon cancer screening questions

Characteristic	Respondents n (%)	Nonrespondents n (%)
Number	1300 (46.6)	1488 (53.4)
Age (y)	1300	1486
Mean (range)	64 (50-99)	64 (50-97)
≥50 to <60	546 (42.0)	632 (42.5)
≥60 to <70	366 (28.2)	383 (25.8)
≥70 to <80	251 (19.3)	307 (20.7)
≥80 to <90	121 (9.3)	141 (9.5)
≥90	16(1.2)	23 (1.5)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Can breast and cervical cancer screening visits be used to enhance colorectal cancer screening?	**Authors, ref ID:** Carlos et al.[9] **Year of publication:** 2004 **Dates of data collection:** 2000 BRFSS data used **Trial name:** NA		
	Race		
	Nonwhite and non-Hispanic	118(9.1)	160 (10.8)
	Income*	1058	1139
	<$25,000	396 (37.4)	410 (36.0)
	$25,000-$49,999	385 (36.4)	363 (32.9)
	$50,000-$74,999	149 (14.1)	168 (14.7)
	≥$75,000	128 (12.1)	198 (17.4)
	Educational level achieved'	1298	1486
	Attended elementary school or less	48 (3.5)	74 (5.0)
	Attended at least some high school	567 (43.7)	593 (39.9)
	Attended at least some college or technical school	686 (52.9)	819 (55.1)
	Employment status'	1297	1486
	Unemployed	40(3.1)	29 (2.0)
	Employed or self-employed	505 (38.9)	651 (43.8)
	Student or homemaker	171 (13.2)	82 (5.5)
	Retired	522 (40.2)	629 (42.3)
	Unable to work	59 (4.5)	95 (6.4)
	Have health insurance'	1201 (92.4)	1415 (95.1)
	Cancer screening adherence		
	Colorectal cancer	324 (24.9)	
	Cervical cancer	743 (57.2)	829 (55.7)
	Breast cancer'	1022 (78.6)	1261 (84.7)
	*Denotes a statistically significant difference p < 0.05.		
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**		NA	
Response Rates (e.g. for surveys):	47% of women surveyed responded to colorectal cancer items!		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Can breast and cervical cancer screening visits be used to enhance colorectal cancer screening?	**Authors, ref ID:** Carlos et al.[9] **Year of publication:** 2004 **Dates of data collection:** 2000 BRFSS data used **Trial name:** NA
STATISTICAL ANALYSES:	Adherence to the ACS recommendations for CRC screening was considered the primary outcome. Breast and cervical ca screening adherence used as independent predictors of crc screening adherence. First, univariate analysis evaluated using chi-square. Multivariate analysis subsequently performed.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	age, race, educational level, employment status, income, state of origin, health care coverage status obtained through telephone interview as part of fixed component of the BRFSS
OUTCOME ASSESSMENT:	Participants asked if they had ever had FOBT, s-scope, c-scope. Those who had undergone test were asked when their last test was performed Participants also asked about breast and cervical cancer screening
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	Correlates of colon cancer screening adherence

Variable		
Demographics	Unadjusted OR	Adjusted OR
Age (y)	(95% el)	(95% el)
≥50 to <60	0.50 (0.38-0.66)	
≥60 to <70	1.12 (0.85-1.48)	1.81 (1.16-2.83)*
≥70 to <80	2.04 (1.55-2.74)	3.44 (1.73-6.87)*
≥80 to <90	1.09 (0.72-'1.67)	2.12 (0.95-4.74)
≥90	1.82 (0.66-5.05)	3.16 (0.68-14.7)
Nonwhite and non-Hispanic	1.03 (0.67-1.59)	0.93 (0.54-1.61)
Income		
<$25,000	1.06 (0.79-1.41)	
$25,000-$49,999	1.09 (0.82-1.47)	1.14 (0.79-1.66)
$50,000-$74,999	0.83 (0.54-1.26)	1.12 (0.66-1.91)
≥ $75,000	0.89 (0.57-1.39)	1.21 (0.69-2.14)
Educational level achieved		
Attended elementary school or less	1.70 (0.97-3.17)	
Attended at least some high school	1.09 (0.84-1.40)	0.65 (0.29-1.45)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Can breast and cervical cancer screening visits be used to enhance colorectal cancer screening?	**Authors, ref ID:** Carlos et al.[9] **Year of publication:** 2004 **Dates of data collection:** 2000 BRFSS data used **Trial name:** NA		
	Attended at least some college or technical school	0.88 (0.66-1.10)	0.50 (0.22-1.14)
	Employment status		
	Unemployed	0.87 (0.41-1.84)	
	Employed or self-employed	0.60 (0.46-0.79)*	0.63 (0.24-1.69)
	Student or homemaker	0.76 (0.50-1.17)	0.50 (0.17-1.46)
	Retired	1.85 (1.44-2.39)*	0.79 (0.28-2.20)
	Unable to work	1.02 (0.56-1.87)	0.70 (0.21-2.28)
	Have health insurance	3.12 (1.60-6.07)*	2.72 (1.23-6.01)*
	Adherence to non-colorectal cancer-related screening		
	Adherent to Pap smear	0.59 (0.45-0.75)*	2.09 (1.18-3.72)*
	Adherent to mammography	2.37 (1.65-3.41)*	1.89 (1.21-2.92)*
	Note: OR = odds ratio; CI - confidence interval. *P* < 0.01.		
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes:** **NA**		
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** **NA**		
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA		
QUALITY RATING:	Fair		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?	X		Responders, nonresponders similar
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			I don't see the BRFSS response rate, but I think it was relatively low. Also, only 47% of women participating completed the CRC screening items
Were the differential drop-out or response rates acceptable (≤ 15%)?			See above
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		Self report, however
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Carlos, R.C., et al.[10] **Year of publication:** 2005 **Dates of data collection:** 2001 **Trial name:** NA
OBJECTIVE OR AIM:	To better understand screening behaviors among women, data from the Behavioral Risk Factors Surveillance Survey (BRFSS) were analyzed to identify potential relationships that would allow interventions to enhance CRC screening.
DESIGN:	**Setting:** U.S. **Study design:** Cross sectional, secondary data analysis **Duration (mean followup):** No follow-up, 2001 **Overall study size (N enrolled/N analyzed):** 52,478
Sample size: **Describe intervention:**	**All** Sample size: 52,478 No intervention
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; BRFFS
INCLUSION CRITERIA:	Women 50 years and older who participated in the BRFSS 2001 survey
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Mean age: 65 Age range: 50-99 100% female Race: 82% White, Non-Hispanic; 7% Black, non-Hispanic; 6% Hispanic, 1% Multiracial, non-Hispanic, 3% Other
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** 97.6% responded to CRC screening items
STATISTICAL ANALYSES:	**Describe:** • Each potential variable was first screened for its association with cancer screening adherence. • The univariate analysis was evaluated using x^2 test when the variables were categorical variables (e.g.,

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Carlos, R.C., et al.[10] **Year of publication:** 2005 **Dates of data collection:** 2001 **Trial name:** NA
	employment status). • Multivariate analysis was subsequently performed using stepwise regression analysis.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** Participants were asked if they had ever had a fecal occult blood test (FOBT), sigmoidoscopy, or colonoscopy. Considered the patient compliant if she had an FOBT within the past year or sigmoidoscopy or colonoscopy within the past 5 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Significant demographic factors associated with increased adherence to CRC screening included women 60–69 years old (unadjusted OR, 1.50; *P* < .01) and 70–79 years old (unadjusted OR, 1.39; *P* < .01) and being white non-Hispanic (unadjusted OR, 1.34; *P* < .01). As income and level of education achieved increased, the likelihood of CRC screening adherence increased (*P* < .01). Increased screening rates with females who reported adherence to mammograms (AOR, 2.42; *P* < 0.01) and Pap smears (AOR, 1.70; *P* < 0.01) Females who perceived their health as good were less likely to adhere to CRC screening than other females (AOR, 0.79; 95% CI, 0.66-0.93; *P* < 0.01) Women who were Hispanic or of other racial/ethnic descent were less likely to have undergone CRC screening (*P* < .01). Those women who were employed or self-employed were also less likely to have undergone CRC screening, compared with women who were retired (*P* < .01). Having health insurance (unadjusted OR, 2.70; *P* < .01) and the presence of a personal physician (unadjusted OR, 2.89; *P* < .01) significantly increased the probability of CRC screening. Being a current smoker (unadjusted OR, 0.58; *P* < .01) reduced the probability of CRC screening.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Carlos, R.C., et al.[10] **Year of publication:** 2005 **Dates of data collection:** 2001 **Trial name:** NA
followup?	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		Sigmoidoscopy and colonoscopy were grouped, so they used the 5-year window for both… this may underestimate those who had colonoscopies in the past 10 years
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer screening among a sample of community health center attendees	**Authors, ref ID:** Christman et al.[11] **Year of publication:** 2004 **Dates of data collection:** 2002 **Trial name:**
OBJECTIVE OR AIM:	To determine the rate of colorectal cancer screening in patients attending a sample of community health centers, medical records of 1,176 patients from eight community health centers were abstracted.
DESIGN:	**Setting:** community health centers in FL **Study design:** cross-sectional, medical record abstraction **Duration (mean follow-up):** no f/u data **Overall study size (N enrolled/N analyzed):** 1,176 medical records from 8 CHC's
Sample size:	**Overall** 1176
Describe intervention:	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinics were recruited from among the 16 CHCs participating in a county-funded health plan in Hillsborough County, Florida
INCLUSION CRITERIA:	Clinics were eligible if (1) they provided primary medical care 5 days a week, (2) the majority of the clinic staff agreed to participate, and (3) the clinic was expected to continue operating in the same fashion for the following 24 months A patient's records were eligible to be abstracted if both of the following criteria were met: (1) the patient was 50–75 years of age and (2) the patient was established in the clinic (defined as having made at least one visit 12 months or more before the sampled visit)
EXCLUSION CRITERIA:	Refusal to participate, not open 5 days/week, uncertain if they would operate in a continuous fashion over the 2 year period of the grant
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	Table. Clinical characteristics of study sample (n = 1176) **Clinical characteristics** n % Gender Male 251 21.3 Female 925 78.7 Race/ethnicity African American 341 29 White 569 48.4 Hispanic 266 22.6

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer screening among a sample of community health center attendees	**Authors, ref ID:** Christman et al.[11] **Year of publication:** 2004 **Dates of data collection:** 2002 **Trial name:**
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA
STATISTICAL ANALYSES:	The t-test and chi-square test, multivariate predictors of colorectal screening using multiple logistic regression. Logistic regression models examined the log odds of having obtained any one of the three colorectal screening tests within the recommended interval. All abstracted variables, including an indicator variable for primary care clinic attended, were eligible for inclusion in the final logistic regression model. The final logistic model consisted of those variables remaining statistically significant at the 0.05 level using a step-wise variable selection algorithm. For predictors of screening odds ratios and 95% confidence intervals. To determine the effects of gender-specific variables (such as estrogen replacement therapy or having had a PSA screening), logistic models separately by gender.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Date of birth; Gender; Marital status; Race; Insurance status; Primary language; # of visits in the previous 12 months; # of chronic illnesses listed by physician in chart; chronic illness info for the Charlson Comorbidity Index; # of current medications; smoking status; whether pt had a health maintenance visit in the previous 12 months; personal/family h/o breast, cervical, or colorectal cancer screening For women only: h/o hysterectomy, h/o abnormal pap smears, h/o benign breast disease, taking estrogen replacement therapy
OUTCOME ASSESSMENT:	Evidence of the patient having undergone any colorectal screening tests within the recommended interval from the time of their audited visit.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Table.** Logistic regression of colorectal cancer screening predictors (n = 1168)

	Patients screened for colorectal cancer		
Characteristic	n	%	*P*
Gender			0.09
Male	98/251	39	
Female	416/925	45	
Race			0.003
White	228/569	40.1	
African American	175/341	51.3	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer screening among a sample of community health center attendees	**Authors, ref ID:** Christman et al.[11] **Year of publication:** 2004 **Dates of data collection:** 2002 **Trial name:**			
	Hispanic	111/266	41.7	
	Marital status			0.48
	Married	147/324	45.4	
	Unmarried	367/852	43.1	
	Primary language			0.31
	English	414/931	44.5	
	Non-English	100/245	40.8	
	Smoking status			0.4
	Smoker	137/328	41.8	
	Nonsmoker	377/848	44.5	
	Health insurance			0.48
	County program	293/690	42.5	
	Medicaid	86/180	47.8	
	Medicare	104/228	45.6	
	Other	31/78	39.7	
	Family history of colorectal cancer			0.008
	Yes	24/37	64.9	
	No	490/1,139	43	
	Checkup in past year			<0.0001
	Yes	326/627	52	
	No	188/549	34.2	
	Charlson comorbidity index score			0.49
	0	185/423	43.7	
	1	130/275	47.3	
	2	113/266	42.5	
	3+	86/212	40.6	
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes:** **NA**			
KQ4 - What are the current and projected capacities to deliver	**Outcomes:** **NA**			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer screening among a sample of community health center attendees	**Authors, ref ID:** Christman et al.[11] **Year of publication:** 2004 **Dates of data collection:** 2002 **Trial name:**
colorectal cancer screening and surveillance at the population level?	
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** **NA**
QUALITY RATING:	Good

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?		X	
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Coughlin, S. and Thompson, T.[12] **Year of publication:** 2005 **Dates of data collection:** 2000 **Trial name:** NA
OBJECTIVE OR AIM:	The objective was to determine the proportion of persons who had not received a provider recommendation to get a colorectal cancer screening test according to several characteristics related to socioeconomic status and access to health care.
DESIGN:	**Setting:** United States **Study design:** Cross-sectional (National Health Interview Survey) **Duration (mean followup):** One-year data collection **Overall study size (N enrolled/N analyzed):** 12,477/11,480
Sample size: **Describe intervention:**	**All** Sample size: 11,480 Intervention: None, survey
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based
INCLUSION CRITERIA:	Men and women aged 50 years or older who did not have a history of colorectal cancer
EXCLUSION CRITERIA:	Among the persons who did not receive a recent colorectal cancer screening test, a small number of respondents (*n* = 14) were excluded whose race was neither White, African American, American Indian/Alaska Native, nor Asian/Pacific Islander. An additional 89 persons (for fecal occult blood test [FOBT]) or 62 per sons (for endoscopy) were excluded because they had missing information about reason for not having a recent test.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	NR
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** Overall response rate of 72.1%

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Coughlin, S. and Thompson, T.[12] **Year of publication:** 2005 **Dates of data collection:** 2000 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** The descriptive analyses were stratified according to race and ethnicity. A multivariate analysis of predictors of a physician recommendation for each colorectal cancer test was carried out using logistic regression techniques
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** Each adult respondent was asked whether he or she had ever had a sigmoidoscopy, colonoscopy, or proctoscopy and, if so, when they had had their most recent test. For the purposes of this analysis, recent fecal occult blood test use was defined as within the past year and recent flexible sigmoidoscopy or colonoscopy use was defined as within the past 10 years. Lack of doctor recommendation for CRC exams among persons ≥ 50 yrs with no history of CRC, National Health Interview Survey, 2000
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Among the men and women who had not had a recent FOBT, reported reasons for not having had one included "no reason/never thought about it" 51.4% (95% CI 50.0-52.9); "doctor didn't order it" 22.9% (95% CI 21.7-24.1); "didn't need it/didn't know I needed this type of test" 12.3% (95% CI 11.4-13.3); "haven't had any problems" 7.5% (95% CI 6.7-8.3); "put it off" 2.0% (95% CI 1.6-2.4); "too expensive/no insurance" 0.5% (95% CI 0.3-0.6); "too painful, unpleasant, or embarrassing" 0.3% (95% CI 0.2-0.5); and "don't have doctor" 0.4% (95% CI 0.2-0.5). Among the men and women who had a doctor visit in the past year but who had not had a recent FOBT (*n* =8,039), about 94.6% (95% CI 94.0-95.2) reported that their doctor had not recommended the test in the past year. Among the persons who had not had a recent endoscopy, the reported reasons for not having had a sigmoidoscopy or colonoscopy included "no reason/never thought about it" 50.1% (95% CI 48.5-51.7); "doctor didn't order it" 21.6% (95% CI 20.4-22.9); "didn't need it/didn't know I needed this type of test" 12.4% (95% CI 11.4-13.5); "haven't had any problems" 9.9% (95% CI 8.9-10.9); "put it off" 1.7% (95% CI 1.4-2.1); "too expensive/no insurance" 1.0% (95% CI 0.8-1.3); "too painful, unpleasant, or embarrassing" 1.3% (95% CI 1.0-1.6); and "don't have doctor" 0.4% (95% CI 0.3-0.6). Those persons with no insurance were much more likely to report "never thought about it," "too expensive/ no insurance," and "don't have doctor" as the reason for no endoscopy compared to those with health insurance. After adjustment for age, the factors associated with not receiving a doctor recommendation to get a FOBT in this

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Coughlin, S. and Thompson, T.[12] **Year of publication:** 2005 **Dates of data collection:** 2000 **Trial name:** NA
	same sample of men and women included the number of children in the household, having very good health status, having no activity limitations, fewer physician visits in the past year, and residence in the South or outside an MSA. Multivariate Regression: The factors that were positively associated with a doctor recommendation to get a FOBT included female sex, having activity limitations, living in an MSA, or residence outside of the southern United States. Doctor Didn't Recommend FOBT: No., 8,039; %, 94.6; 95% CI, 94.0-95.2; Doctor Didn't Recommend Endoscopy: No., 6,404; %, 93.5; 95% CI, 92.8-94.2; The results continue to describe differences in whether a physician recommendation was based on a number of additional factors. Sample includes persons who had a doctor visit in the past year but who had not had a home FOBT within the past year or endoscopy within the past 10 years.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Overall response rate of 72.1%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Diaz, J.A., Roberts, M.B., Goldman, R.E., Weitzen, S., Eaton, C.B.[13] **Year of publication:** 2008 **Dates of data collection:** 2006 **Trial name:** NA		
OBJECTIVE OR AIM:	To examine the relationship between preferred language use (English versus Spanish) and self-reported receipt of CRC screening tests among Latinos and non-Latinos.		
DESIGN:	**Setting:** Data from the Centers for Disease Control's 2006 Behavioral Risk Factor Surveillance System (BRFSS) **Study design:** Cross-sectional analysis **Duration (mean followup):** NA **Overall study size (N enrolled/N analyzed):** 99,895		
Sample size: **Describe intervention:**	**Non-Latino responding-in-English** Sample size: 94,346 Responded to BRFFS	**Latino responding-in-English** Sample size: 3,660 Responded to BRFFS	**Latino responding-in-Spanish** Sample size: 1,889 Responded to BRFFS
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based		
INCLUSION CRITERIA:	Adults at least age 50 years		
EXCLUSION CRITERIA:	States that had data on fewer than 50 surveys completed in Spanish were excluded and U.S. territories were excluded		
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**Non-Latino responding-in-English** Mean age: 64.2 Sex: 54.1%	**Latino responding-in-English** Mean age: 61.6 Sex: 55.6%	**Latino responding-in-Spanish** Mean age: 61.3 Sex: 54.1%
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NR		
STATISTICAL ANALYSES:	**Describe:** • Respondent characteristics were calculated using standard means for continuous variables and proportions/frequencies for categorical variables.		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Diaz, J.A., Roberts, M.B., Goldman, R.E., Weitzen, S., Eaton, C.B.[13] **Year of publication:** 2008 **Dates of data collection:** 2006 **Trial name:** NA
	• x2 tests were used to examine the relationships between the outcome of interest, receipt of CRC screening tests, and ethnicity/language category as well as each potential confounder. • Logistic regression was used to estimate crude odds ratios (OR) between the three ethnicity/language categories and the receipt of CRC screening tests and to calculate crude ORs between potential confounder variables and receipt of CRC screening tests. • Variables were considered to be confounders and, hence, included in a final multivariable logistic model, if the OR for the ethnicity/ language variable adjusted for each potential confounder resulted in at least a 10% difference from the crude unadjusted OR.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	The presence of an identified health care provider, smoking status, and respondent's perceived general health.
OUTCOME ASSESSMENT:	**Outcome Measures:** Respondents were considered to have been tested for CRC if they reported completing FOBT testing within the past 1 year or lower endoscopy within the past 10 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • There were no significant differences in reported test receipt among groups of non-Hispanic/Latino race/ethnicity subgroups • Overall, 61.6% of non-Latinos versus 43.6% of Latinos reported having received at least one screening test. • In the adjusted model, compared with non-Latinos, Latinos as a group were less likely to report having received CRC screening tests, either FOBT and/or lower endoscopy [adjusted OR, 0.74; 95% confidence interval (CI), 0.65-0.85]. • In the adjusted model, both Latinos responding-in-English (OR, 0.84; 95% CI, 0.73-0.98) and Latinos responding-in-Spanish (OR, 0.57; 95% CI, 0.44-0.74) were less likely to report receiving CRC screening tests compared with non-Latinos. • Latinos responding-in-Spanish were 36% less likely than Latinos responding-in-English to report having been screened (OR, 0.64; 95% CI, 0.48-0.84). • Among those with a health care provider and medical insurance, Latinos responding-in-English (OR, 0.83; 95% CI, 0.71-0.98) and Latinos responding in-Spanish (OR, 0.56; 95% CI, 0.41-0.75) were less likely to report test use compared with non-Latinos. • In the low SES strata, compared with non-Latinos, Latinos responding-in-English (OR, 0.70; 95% CI, 0.54-0.91) and Latinos responding in-Spanish (OR, 0.50; 95% CI, 0.39-0.65) were again less likely to report CRC test use. In the higher SES strata, although no longer statistically significant among Latinos responding-in-English (OR, 0.84; 95% CI, 0.70-1.0), Latinos responding-in-Spanish remained less likely to report screening compared with non-Latinos (OR,0.39; 95% CI, 0.24-0.64)
KQ3 - Which strategies are effective in increasing the appropriate use of	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Diaz, J.A., Roberts, M.B., Goldman, R.E., Weitzen, S., Eaton, C.B.[13] **Year of publication:** 2008 **Dates of data collection:** 2006 **Trial name:** NA
colorectal cancer screening and followup?	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	**Good**

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NR
Were the differential drop-out or response rates acceptable (≤ 15%)?			NR
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		The 5-year flexible sigmoidoscopy was not included
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Etzioni, D., et al.[14] **Year of publication:** 2004 **Dates of data collection:** 2001 **Trial name:** NA
OBJECTIVE OR AIM:	The authors used the 2001 California Health Interview Survey (CHIS 2001) to evaluate 1) rates of CRC test use, 2) predictors of the receipt of tests, and 3) reasons for nonuse of CRC tests.
DESIGN:	**Setting:** California **Study design:** Cross-sectional study **Duration (mean followup):** One year **Overall study size (N enrolled/N analyzed):** 22,343
Sample size: **Describe intervention:**	**All** Sample size: 22,343 Intervention: None, survey (CHIS)
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based, California (California Health Interview Survey)
INCLUSION CRITERIA:	Individuals age 50+ years without a personal history of CRC
EXCLUSION CRITERIA:	Respondents for whom receipt of a colorectal test could not be determined as a result of having responded "refused" or "don't know" to questions concerning testing.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Age: 54.7% 50-64, 45.3% 65+ Sex: 59.9% Female Race: 80.4% White, 6.4% Latino, 4.5% Asian, 4.7% African Americna, 2.6% Other, 1.5% American Indian/Alaska Native
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** NA 63.7%
STATISTICAL ANALYSES:	**Describe:** Weighted multivariate logistic regression was used to analyze each respondent's likelihood of undergoing CRC testing. Two regression models were estimated, 1 for respondents ages 50–64 years and 1 for respondents age >65 years, to account for age-related differences in health insurance coverage.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Etzioni, D., et al.[14] **Year of publication:** 2004 **Dates of data collection:** 2001 **Trial name:** NA
OUTCOME ASSESSMENT:	**Outcome Measures:** Survey respondents were considered tested if an FOBT was performed in the 12 months prior to the interview or if either a flexible sigmoidoscopy or colonoscopy was performed within 5 years prior to the interview.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Men in both age groups were more likely to be tested than women. This effect was greater in respondents ages 50–64 years (RR, 1.28; 95% CI, 1.23–1.32) than in respondents age ≥ 65 years (RR, 1.19; 95% CI, 1.15–1.23). Among respondents age > 65 years, increasing age was associated positively with screening (RR for 5-year interval, 1.49; 95% CI, 1.43–1.57). • In respondents age > 65 years, this effect reversed direction—older respondents were less likely to be screened (RR for 5-year interval, 0.91; 95% CI, 0.88–0.94). • Among adults age ≥ 65 years, Latinos were the only racial/ethnic group that was significantly less likely than whites to have received recent testing (RR, 0.84; 95% CI, 0.77– 0.92 for 50-64 yrs, RR, 0.62; 95% CI 0.37-0.92 for 65+ yrs). • Respondents living below the FPL were significantly less likely to be tested than the highest income group (RR, 0.81; 95% CI, 0.72– 0.91). • Health insurance status was a significant predictor of likelihood of testing in both age groups. Uninsured individuals with a USOC, however, were much less likely to have received testing than individuals who had employer-based insurance with a USOC (RR, 0.61; 95% CI, 0.53– 0.69). Uninsured with no USOC less likely to be screened than any of the other groups of individuals (RR 0.32; 95% CI 0.23-0.43 for 50-64; RR, 0.08; 95% CI, 0.00-1.21 for 65+). • Respondents who reported visiting a physician 1 or more times in past year were more likely to report being current with screening (RR range 1.41-1.77) • Among adults age ≥ 65 years, individuals with fair or poor health status were less likely to be tested than individuals with good, very good, or excellent health status (RR, 0.92; 95% CI, 0.88–0.96). • Individuals age > 65 years who were recent immigrants to the U.S. (0–50% of lifetime in the U.S.) were less likely to be tested than lifetime U.S. residents (RR, 0.86; 95% CI, 0.76–0.97). • Reported reasons for not having endoscopic testing differed by race and ethnicity. Asians and Latinos were significantly more likely than whites to report that they were not tested because of an absence of symptoms or perceived health problems (Asians, 31%; Latinos, 29%; whites, 16%; $P <$ 0.001). The same groups were less likely than whites to report that they were not tested because the endoscopic examination was painful or embarrassing (Asians, 3%; Latinos, 3%; whites, 8%; $P < 0.001$) or because their physician did not tell them the test was needed (Asians, 21%; Latinos, 22%; whites, 28%; $P <$ 0.001). • The reasons reported for not undergoing endoscopic examination also varied by gender. • The reasons identified for not having an FOBT were similar to the reasons for not undergoing endoscopic screening tests, with lack of physician recommendation the most common reason reported by all groups.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Etzioni, D., et al.[14] **Year of publication:** 2004 **Dates of data collection:** 2001 **Trial name:** NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NR
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fenton, J.J., et al.[15] **Year of publication:** 2007 **Dates of data collection:** 2002-2003 **Trial name:** NA	
OBJECTIVE OR AIM:	Determine the association between receipt of a periodic health examination (PHE) and completion of cancer testing in enrollees in a prepaid health plan who were eligible for CRC, breast cancer, or prostate cancer screening.	
DESIGN:	**Setting:** Clinic **Study design:** Retrospective cohort study **Duration (mean followup):** No follow-up, compared 2000-2001 screening rates to those of 2002-2003. **Overall study size (N enrolled/N analyzed):** 64,288 patients	
Sample size: **Describe intervention:**	**PHE** Sample size: 33,708 Intervention: Received a periodic health examination between 2002-2003	**No PHE** Sample size: 30,580
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Participants were enrolled in Group Health Cooperative, a mixed-model health plan that serves approximately 450 000 enrollees in Washington State.	
INCLUSION CRITERIA:	Enrolled in Group Health Cooperative, 52 to 78 years on January 1, 2002, eligible for CRC, breast cancer, or prostate cancer screening in 2002-2003 based on health care data from previous enrollment years, no personal history of CRC , 1 or more primary care visits from 2002-2003	
EXCLUSION CRITERIA:	Received no primary care visits during the study period; Sigmoidoscopy, colonoscopy, or barium enema, 1997-2001; Any positive fecal occult blood test results, 1997-2001; Known indications for surveillance colonoscopy, 1997-2001	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**PHE** Age range: 52-78 60.1% female	**No PHE** Age range: 52-78 47% female
	Group 1	
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA NA	
STATISTICAL ANALYSES:	Describe:	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fenton, J.J., et al.[15] **Year of publication:** 2007 **Dates of data collection:** 2002-2003 **Trial name:** NA
	• Used multivariate logistic regression to estimate adjusted incidence differences and relative incidences of testing in patients who did and did not receive a PHE. • In adjusted models, authors set covariates to sample means to enable model-based equivalents to direct adjustment and estimated confidence intervals (CIs) using bootstrap procedures. • Modeled completion of testing as a function of PHE receipt while adjusting for age (5-year categories), sex (for CRC testing), comorbidity (Charlson comorbidity index score of 0, 1, 2, or >3), number of outpatient visits (quintiles), baseline PHE receipt, baseline number of target organ cancer tests (0, 1, or >2), benign prostatic hyperplasia diagnosis in 2000-2003 (for prostate cancer testing), and significant interactions between PHE receipt and covariates as identified by likelihood ratio tests ($P < 0.05$). • Used the models to estimate adjusted cancer testing incidences among participants who did and did not receive a PHE stratified by age, sex (for CRC testing), and the number of outpatient visits. • Of those who received a PHE, 57.2% received CRC testing vs. 17.2% of those who did not receive a PHE
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	• "If patients often receive opportunistic prevention outside of preventive visits, one might expect the association between PHE receipt and cancer testing to weaken in patients with more outpatient visits." • An association between the PHE and cancer screening could arise if patients schedule PHEs to request the desired screening.
OUTCOME ASSESSMENT:	**Outcome Measures:** • Completion of any colorectal cancer testing in 2002-2003 • A PHE was defined as any outpatient encounter in 2002-2003 having either (1) an evaluation and management code indicating "initial evaluation" (codes 99386-7) or "reevaluation and management of a healthy individual" (codes 99396-7) or (2) an *International Classification of Diseases, Ninth Revision, Clinical Modification*, code signifying either a general medical (code V700 or V708-9) or a gynecologic (code V723) examination.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Of those received a PHE, 57.2% received CRC testing vs. 17.2% of those who did not receive a PHE. • The incidence of CRC testing was more than 3 times higher in patients who received PHEs than in those who did not (adjusted relative incidence, 3.47; 95% CI, 3.34-3.59; $P < 0.001$) • Stratified by the number of outpatient visits, there remained substantial differences in adjusted cancer testing incidences between patients who did and did not receive PHEs, even among those in the highest quintile of visits.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fenton, J.J., et al.[15] **Year of publication:** 2007 **Dates of data collection:** 2002-2003 **Trial name:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			Somewhat
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?		X	
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fenton et al.(#3677} **Year of publication:** 2009 **Dates of data collection:** 1995 - 2003 **Trial name:** Persistent Racial and Ethnic Disparities in Up –to-Date Colorectal Cancer Testing in Medicare Enrollees
OBJECTIVE OR AIM:	To assess whether greater colonoscopy use among white as compared with nonwhite Medicare enrollees since Medicare established coverage for colorectal cancer screening has been associated with a widening in white versus nonwhite disparities in up-to-date CRC testing status
DESIGN:	**Setting:** Medicare claims (Surveillance, Epidemiology, and End Results (SEER) regions in nine states, representing 14% of the US population **Study design:** cross-sectional (serial) **Duration (mean follow up):** NA **Overall study size (N enrolled/N analyzed):** 60,450
Sample size: **Describe intervention:**	Demographics from a single six-month sample (January 1, 2000 to June 30, 2000) N=60,450 Age 70 – 74 years 50.9% Age 75 – 79 years 49.1% Female 58.7% Male 41.3% White 85.8% (n=51,865) Black 6.7% (n=4,042) Asian/Pacific Islander 4.7% (n=2,845) Hispanic 2.8% (n=60,450) Intervention: NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Groups were created every six months from July 1995 to December 2003 from the annual random 5% sample of Medicare enrollees in SEER regions; data were obtained from 12 registries in nine states.
INCLUSION CRITERIA:	Part A and Part B Medicare fee-for-service enrollees aged 70 – 79 years
EXCLUSION CRITERIA:	Age > 80 years; history of colon cancer (excluded only during the year of diagnosis and for subsequent years); “Native American,” “missing,” or “other” designation for race; Medicaid managed care enrollees
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:**	NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fenton et al.(#3677} **Year of publication:** 2009 **Dates of data collection:** 1995 - 2003 **Trial name:** Persistent Racial and Ethnic Disparities in Up –to-Date Colorectal Cancer Testing in Medicare Enrollees
Other:	
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	Groups were identified every six months from July 1995 to December 2003. For each six-month period, more than 104,000 Medicare enrollees between the ages of 70 – 79 were considered for inclusion (range 104,906 to 109,002). For each six-month period, the number included in the analysis fell between 55.7% in late 2002 to 65% in late 1995.
STATISTICAL ANALYSES:	**Describe:** • Conditional prediction was used to estimate and compare race- and ethnicity-specific trends while adjusting for independent variables • To model binary outcome of up-to-date status, generalized estimating equations were used to perform repeated-measures logistic regression in which the referent group was whites during the first observation period. The model included indicator variables for each race and covariates, which were fixed at the mean values observed across the entire sample. • Two sensitivity analyses were conducted to assess the effect of alternate definitions of "up-to-date" status
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NA
OUTCOME ASSESSMENT:	**Outcome Measures:** Overall up-to-date status Up-to-date status per test method
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • The percent of Medicare enrollees who were up to date with CRC testing increased significantly for all racial and ethnic categories from mid-1995 through 2003 • White vs. non-white differences persisted, but did not widen from late 1995 to late 2003. The difference in up-to-date status narrowed for each non-white group. The difference between whites and Hispanics did not change until late 2003 when it dropped from 15.7% to 14.1% • In each racial and ethnic group, the percentage of up-to-date by FOBT and the percentage of up-to-date by sigmoidoscopy declined from mid 1995 through 2003. • The percentage of up-to-date by colonoscopy increased during the study period. • Disparities in the overall up-to-date status changed little during the study period. • Whites exhibited a greater decline in up-to-date status for FOBT and sigmoidoscopy than other racial and ethnic groups. Whites showed a greater increase in up-to-date status for colonoscopy than other racial/ethnic groups.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fenton et al.(#3677} **Year of publication:** 2009 **Dates of data collection:** 1995 - 2003 **Trial name:** Persistent Racial and Ethnic Disparities in Up –to-Date Colorectal Cancer Testing in Medicare Enrollees
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		There is no statement regarding the statistical significance of the changes/differences reported in the results.
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Ferrante et al.[16] **Year of publication:** 2006 **Dates of data collection:** April 2003 - December 2004 **Trial name:** NA		
OBJECTIVE OR AIM:	The objective of this study was to examine whether obesity is associated with lower rates of colorectal cancer screening among patients in primary care practices.		
DESIGN:	**Setting:** 22 family medicine practices (20 group practices; 2 solo practices) located in New Jersey and eastern Pennsylvania **Study design:** Cross-sectional retrospective **(medical record chart abstraction)** **Duration (mean follow-up):** NA **Overall study size (N enrolled/N analyzed):** 1297 patients eligible for colorectal cancer screening from the total patient population of 2034.		
Sample size:	All 1297		
Describe intervention:	Colorectal cancer screening was documented by searching the medical record for any documentation of the tests being done including: progress reports, preventative flow sheets, lab tests, X-rays, and consultant reports. Patients were considered to have been screened according to guidelines (1=yes, 0=no) if they had documentation in the medical record of having received one of the following tests in the recommended time period based on recommendations from the American Cancer Society (ACS): (1) FOBT within 1 year, (2) sigmoidoscopy within 5 years, (3) colonoscopy within 10 years, or (4) double contrast barium enema within 5 years		
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based; Participating practices generated lists of patients seen in the office during the previous 12 months using ICD-9 codes for asthma, coronary heart disease, diabetes, hypertension, and any reason. Within each practice about 100 patients were randomly selected (20 from each list of patients, based on power calculation requirements for ULTRA (Using Learning Teams for Reflective Adaptation)). In practices where there were not 20 patients with a particular ICD-9 code, all patients with the code were used. For all patients, one nurse chart auditor from the research team noted the dates of relevant cancer screenings using a standardized abstraction form.		
INCLUSION CRITERIA:	Patients aged 50 years and over.		
EXCLUSION CRITERIA:	Patients were excluded if they were deceased at the time of the audit, below 18 years of age or no longer a patient of the practice.		
POPULATION CHARACTERISTICS:	**Group 1 (non-obese)**	**Group 2 (obese)**	**Overall**
Mean age & range (years):	68.71 (60.8%)	63.47 (39.2%)	66.65 (100%)
Sex (% female):	60% female	40% female	49.3% female
Race:	NR	NR	80% White, 9% African-American, 3% Pacific Islander, 4% Hispanic, 8% Other
Other:	70.9% colonoscopy, 25% FOBT, 11.1% sigmoidoscopy, 2.9% barium enema	75.2% colonoscopy, 16.8% FOBT, 13.1% sigmoidoscopy, 1.5% barium enema	72.4% colonoscopy, 22.1% FOBT, 11.8% sigmoidoscopy, 2.4% barium enema

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Ferrante et al.[16] **Year of publication:** 2006 **Dates of data collection:** April 2003 - December 2004 **Trial name:** NA		
			64% private insurance, 25% Medicare, 4% Medicaid, 7% uninsured
	Group 1	**Group 2**	Overall
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	NA	NA	NA
Response Rates (e.g. for surveys):			
STATISTICAL ANALYSES:	**Describe:** • Obese and non-obese patients were compared with respect to potential confounding variables by calculating frequencies or means with standard deviations, depending on whether the variable was categorical or continuous, respectively, for each group of patients. • Significant differences between the two groups were determined by Chi square tests or t-tests. • Conducted bivariate analysis to assess the relationship between each of the independent variables with colorectal cancer screening. • Conducted multivariate analysis to control for potential confounders. • Hierarchical logistic regression was used to account for clustering of patients within practices to examine whether obesity status of the patient was associated with differences in CRC screening. • Controlled for effects of age, gender, number of visits in the last 2 years, number of co-morbidities and number of years attending the practice. • Generalized estimating equations were used for estimation, using an exchangeable correlation structure for the working correlation matrix. • Analyzed data separately for men and women to see if obesity-related screening rates differed by gender • Computed adjusted odds ratios and 95% confidence intervals.		
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	• Controlled for effects of age, gender, number of visits in the last 2 years, number of co-morbidities and number of years attending the practice. • Did not have data on SES of patients but used health insurance as a crude indicator. The relatively homogenous population of predominately white suburban patients made it less likely that the associations found in this study would be confounded by SES.		
OUTCOME ASSESSMENT:	**Outcome Measures:** Patients (obese and non-obese) were considered to have been screened according to guidelines (1=yes, 0=no) if they had documentation in the medical record of having received one of the following tests in the recommended time period based on recommendations from the American Cancer Society (ACS): (1) FOBT within 1 year, (2)		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Ferrante et al.[16] **Year of publication:** 2006 **Dates of data collection:** April 2003 - December 2004 **Trial name:** NA
	sigmoidoscopy within 5 years, (3) colonoscopy within 10 years, or (4) double contrast barium enema within 5 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • 31% of non-obese patients were screened for CRC compared with 27% of obese patients (*P* = 0.12). • 34% of male patients were screened for CRC compared with 25% of female patients (*P* = 0.0010). • Patients who were screened for CRC had higher mean number of visits in the past 2 years compared with those who were not screened (*P* = 0.0179). • After controlling for age, gender, total number of comorbidities, number of visits in the past 2 years and number of years attending the practice, obese patients had 25% decreased odds of being screened for CRC compared to non-obese patients (AOR 0.75' 95% CI, 0.62-0.91), *P* = 0.004. • Despite more frequent visits, obese patients were less likely to be screened for CRC. • After control for age, obesity, total number of co-morbidities, and number of visits in the past 2 years, men had 53% increased odds of receiving CRC screening compared to women (*P* = 0.001). • After adjusting for other covariates, each 1-unit increase in number of visits in the past 2 years was associated with a 4% increase in odds of receiving CRC screening (P = 0.006). • Stratified analysis showed no interaction with obesity and gender in CRC screening (P = 0.7922). • Odds of screening when obese versus non-obese for men and women were 0.73 (95% CI: 0.55, 0.97) and 0.77 (95% CI: 0.57, 1.05), respectively.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			they reviewed 1297 or over 2000 eligible charts
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?		X	one nurse reviewed charts and was not blinded
Were outcome measures valid, reliable, and equally applied?	X		Patients (obese and non-obese) were considered to have been screened according to guidelines (1 = yes, 0 = no) if they had documentation in the medical record of having received one of the following tests in the recommended time period based on recommendations from the American Cancer Society (ACS): (1) FOBT within 1 year, (2) sigmoidoscopy within 5 years, (3) colonoscopy within 10 years, or (4) double contrast barium enema within 5 years.
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fisher, D.A., et al.[17] **Year of publication:** 2006 **Dates of data collection:** March 1, 2000 and February 28, 2001 **Trial name:** NA
OBJECTIVE OR AIM:	The primary aim of this study was to explore the factors associated with undergoing a full colon evaluation (FCE) for a positive fecal occult blood test (FOBT) in a single Veterans Affairs center. (of note, the sample size calculation, and primary question, was based on testing for a difference between subjects by race)
DESIGN:	**Setting:** Durham Veterans Affairs Medical Center (Durham, NC) **Study design:** Cross-sectional, retrospective medical record review of patients with + FOBT **Duration (mean followup):** 12 months **Overall study size (N enrolled/N analyzed):** 538
Sample size:	**Overall** Sample size: 538
Describe intervention:	NA (not an intervention study)
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based (Durham Veterans Affairs Medical Center (Durham, NC))
INCLUSION CRITERIA:	Had a positive FOBT that was ordered from a primary care clinic between March 1, 2000 and February 28, 2001 and if they were at least 50 years of age
EXCLUSION CRITERIA:	Patients who had undergone colonoscopy or DCBE within the prior 5 years and those who died within 12 months of the FOBT result date; are other than Caucasian or African American
POPULATION CHARACTERISTICS:	**Overall**
Mean age & range (years): **Sex (% female):** **Race:** **Other:**	Mean Age: 67.2 (range NR) Sex: 1.9% female Race: 58% White, 28.6% Black, 13.4% Missing
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	NA
Response Rates (e.g. for surveys):	NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fisher, D.A., et al.[17] **Year of publication:** 2006 **Dates of data collection:** March 1, 2000 and February 28, 2001 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** • Descriptive statistics were computed for age, gender, race, marital status, appointment adherence, and referral to gastroenterology. • They conducted bivariate analyses of predictor variable with our primary outcome of FCE . • For these unadjusted analyses, they used x2 tests (or exact tests) to examine differences by race, adherence, and referral to gastroenterology in the proportion of patients with FCE within 12 months. • A two-sample t test was used to examine differences in age between those who had a FCE and those that did not. • For the adjusted analysis they used logistic regression models to evaluate factors associated with FCE within 12 months. Factors were included in the logistic regression model if the bivariate association with FCE was significant (P < 0.05).
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Regressions included factors in the model if the bivariate association with FCE was significant (included race, referral for GI, and no show/cancel variables; did not include gender or marital status) SES, education, and whether subjects have other sources of care (besides the VA) were not included To avoid bias resulting from potential seasonal variation in patient evaluation (such as housestaff turnover), they evaluated the medical records of all patients over a 12-month consecutive period who met our inclusion criteria.
OUTCOME ASSESSMENT:	**Outcome Measures:** • The primary outcome, full colon evaluation, was defined as having a colonoscopy or double-contrast barium enema plus flexible sigmoidoscopy completed within 12 months. • As a secondary outcome, FCE was defined as colonoscopy or DCBE alone.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • 77% of subjects were referred to gastroenterology • Ultimately, 44% underwent FCE within 12 months • In the unadjusted analysis, referral to gastroenterology consult was strongly associated with full colon evaluation (FCE) (*P* < 0.001). • 57% (237 of 415) of the subjects referred for gastroenterology consult underwent FCE within 12 months compared with 0% (0 of 123) of the subjects who were not referred for gastroenterology consult. • In both the unadjusted and adjusted analyses, adherence to follow-up appointments was associated with FCE (*P* < 0.001); adjusted OR for no show/cancel 0.06, 95% CI: 0.03, 0.13. • Although the subjects with missing race seemed less likely to undergo FCE than those with a recorded race data, they found no association between Blacks vs. Whites and performance of FCE (adjusted OR 1.14, 95% CI: 0.75, 1.75) • Blacks were as likely to receive full colon examination as whites (AOR, 1.14; 95% CI, 0.57-1.75)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fisher, D.A., et al.[17] **Year of publication:** 2006 **Dates of data collection:** March 1, 2000 and February 28, 2001 **Trial name:** NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:**
QUALITY RATING:	**Fair**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X (some were)	X	Several were not considered: such as SES, education, and whether subjects have other sources of care
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fox et al.[18] **Year of publication:** 2009 **Dates of data collection:** not reported **Trial name:** Cancer screening adherence: Does physician-patient communication matter?
OBJECTIVE OR AIM:	To examine the separate contributions of patients and physicians to their communication regarding cancer screening. To formulate a conceptual framework to explicate whether and how communication between physicians and their patients influenced patient behavior. To test the hypothesis that physician-patient communication regarding cancer screening promoted patient adherence to cancer screening recommendations.
DESIGN:	**Setting:** community-based primary care facilities **Study design:** cross-sectional survey **Duration (mean follow up):** NA **Overall study size (N enrolled/N analyzed):** after a phased identification and selection process, 63 physicians and 904 of their patients were surveyed
Sample size: **Describe intervention:**	63 physicians 904 patients Intervention: NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Physicians: • Phase 1: 1,096 board certified physicians in general internal medicine, family practice, general practice, or obstetrics and gynecology were identified via professional and local telephone directories • Phase 2: All physicians identified in Phase 1 were sent a survey • Phase 3: A portion of survey respondents (n= 81) were randomly selected for a pilot study • Phase 4: Based on pilot study results, OB/GYN physicians were excluded from further participation along with the physicians who responded to the pilot study • Phase 5: A second screening survey was sent to the remaining physicians to obtain more detailed eligibility information • Phase 6 – The remaining physicians (207) were randomly assigned to one of ten “out of area” physicians who asked them to participate in the study. 63 physicians agreed to participate. Patients: • Phase 1: Participating physicians identified female patients between the ages of 50 – 80 years who had been seen by the physician in the past 3 months. (n = 3092) • Phase 2: Each patient received a letter from her physician that included information about the study and a passive consent form. (remaining n = 2103) • Phase 3: Patients were contacted by telephone to determine final eligibility and complete a survey. 904 patients were surveyed. Note: While the initial numbers are large, the final sample sizes are much smaller. It is possible that the participating physicians are a highly select group and may not generally represent their peers. Although, statistical methods were used to account for the distribution of physicians based on certain demographic characteristics, this does not

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fox et al.[18] **Year of publication:** 2009 **Dates of data collection:** not reported **Trial name:** Cancer screening adherence: Does physician-patient communication matter?	
	account for other differences that might have influence. Also, physicians initially identified a group of their own patients who would be contacted to participate in the study. There is no description of the criteria the physicians used other than a time period. In the end, there is no explanation of the distribution of patients among the physicians and if any specific physicians have more patients enrolled in the study than other physicians. A clear description of the inclusion/exclusion criteria is not provided for either group. Statistical methods might limit any of these possible effects, but the authors do not provide a clear explanation in the methodology, so it is difficult to determine if they appropriately adjusted for these. There is one comment about using statistical methods to account for interclass correlation.	
INCLUSION CRITERIA:	Physicians: board certified in general internal medicine, family practice, or general practice; returned a survey; agreed to participate; met "other eligibility criteria." (detailed eligibility criteria were not reported) Patients: female; between the ages of 50 – 80 years; been seen by a physician in the past 3 months; passively consented to participate; met "other eligibility criteria," completed a telephone survey. (detailed eligibility were not reported)	
EXCLUSION CRITERIA:	Not described	
POPULATION CHARACTERISTICS:	Participating female patients	Participating Physicians
Mean age & range (years):	Median age 64 years	Median age 49 years
Sex (% female):	Female 100%	Male 91%
Race:		
Other:	Race/Ethnicity • White: n= 603 (67%) • Asian/Pacific Islander: n= 41 (5%) • African American: n= 101 (11%) • Hispanic: n= 144 (16%) • Other: n=8 (1%) SES • Annual household income >$15,000: n=599 (72%) • Education: high school diploma or more: n= 725 (80%) Health Insurance	Race/Ethnicity • White: n= 41 (65%) • Asian/Pacific Islander: n= 17 (27%) • African American: n= 2 (3%) • Hispanic: n= 1 (2%) • Other: n=2 (3%) Medical Specialty • Family Practice/Gen Med: n=35 (56%) • General Internal Med: n=28 (44%) Practice Setting • Private solo practice: n=35 (56%) • Private group practice: n= 27 (43%) • Public practice: n= 1 (2%)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fox et al.[18] **Year of publication:** 2009 **Dates of data collection:** not reported **Trial name:** Cancer screening adherence: Does physician-patient communication matter?	
	• HMO, IPA: n= 394 (45%) • Other (PPO, Fee-for-service, MediCal, MediCare, other): n= 453 (51%) • No insurance: n= 38 (4%)	
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**Physicians** After initially identifying 1,096 physicians, the researchers ended up with 63 physicians after the final phase of selection and recruitment. The article states that this represents a 44% recruitment rate after accounting for the multi-phase process.	**Patients** After initially identifying 3,092 patients, the researchers ended up with 904 patients. The article states that this represents an estimated 51% recruitment rate across all phases.
STATISTICAL ANALYSES:	**Describe:** • Multilevel logistic regression using SAS GLIMMIX macro to model patient use of mammography and FOBT was used to account for the interclass correlation due to the hierarchical structure of the CMC data. • Sensitivity analyses performed to address issues of comparability for both models • Analyses controlled for a number of physician and patient characteristics	
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	See note above	
OUTCOME ASSESSMENT:	**Outcome Measures:** (Excluding mammography related outcomes) • % of patients reporting some discussion with their physician about FOBT for CRC screening. • Perceived level of physician's enthusiasm • % of patients who received FOBT	
RESULTS:		
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** (Excluding mammography related outcomes) • 42% of patients reported some discussion with their physician about FOBT for CRC screening. • 20% of patients reported their physicians had a high level of enthusiasm about FOBT • 29% of patients received FOBT (compared to 81% receiving a mammography)	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fox et al.[18] **Year of publication:** 2009 **Dates of data collection:** not reported **Trial name:** Cancer screening adherence: Does physician-patient communication matter?
	• Patients who perceived a low level of enthusiasm from provider were more likely to complete FOBT than those who reported no discussion (AOR, 6.426; *P* < 0.0001); no significant relationship to screening for patients who perceived high enthusiasm.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			See note above
Were the differential drop-out or response rates acceptable (≤ 15%)?			See note above
Were intervention/exposure measures valid, reliable, and equally applied?			CD
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			CD
Were the statistical methods used to assess the abstracted outcomes appropriate?			CD
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Garman et al.[19] **Year of publication:** 2006 **Dates of data collection:** 2000-2001 **Trial name:** NR
OBJECTIVE OR AIM:	To examine the relationship between comorbid disease and performance of complete colon examination by colonoscopy or double contrast barium enema (DCBE) after positive screening FOBT in patients ≥ 70 years of age.
DESIGN:	**Setting:** Single VA Center **Study design:** Retrospective medical record review **Duration (mean follow-up):** 12 months **Overall study size (N enrolled/N analyzed):** 266
Sample size: **Describe intervention:**	266
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based (VA)
INCLUSION CRITERIA:	≥ 70 years, positive screening of FOBT, seen at Durham VA
EXCLUSION CRITERIA:	Patients were excluded if they had a FOBT performed for purposes other than screening or if they died within a 1-year follow-up period.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **White** **Black:**	Mean Age: 75 (70 – 87); Sex (% female): 2%; White: 63%; Black: 24% Cardiovascular disease: 14%; Depression: 8%; Pulmonary disease: 24%
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA
STATISTICAL ANALYSES:	**Describe:** For analysis, a Charlson score of 3 was used as a cut-off point, given the known high mortality in those with Charlson scores of 3 to 4.11; data on vision impairment, hearing impairment, hip fracture, and incontinence was also collected as these have been included in prior assessments of function in geriatric patients; a history of deep venous thrombosis and depression were also included, as they have been associated with worse outcomes for patients with CRC.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Garman et al.[19] **Year of publication:** 2006 **Dates of data collection:** 2000-2001 **Trial name:** NR
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Comorbidity (based on Charlson Comorbidity index)
OUTCOME ASSESSMENT:	**Outcome Measures:**
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** 193/266 (73%) referred for evaluation of positive FOBT 109 (41%) underwent a colonoscopy or DCBE w/i 12 months of +FOBTNo relationship between age and completion of full colon exam No association found between Charlson score and referral to gastroenterology for follow-up (P = 0.28) No association found between Charlson score and performance of complete colon exam (P = 0.38) No difference differences within comborbidty groups based on comorbidity Average time to full colon examination: 255 days
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?		X	
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?			
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Gilbert, A., Kanarek, N.[20] **Year of publication:** 2005 **Dates of data collection:** 2002 **Trial name:** NA	
OBJECTIVE OR AIM:	The primary objective of this study was to determine the predictors of colorectal cancer screening use in Maryland.	
DESIGN:	**Setting:** Telephone survey **Study design:** Secondary data analysis of cohort survey study **Duration (mean followup):** One-time data collection **Overall study size (N enrolled/N analyzed):** 2,994 respondents analyzed	
Sample size: **Describe intervention:**	**50-64 Years** Sample size: 1,730 Intervention: None, survey	**65+ Years** Sample size: 1,264 Intervention: None, survey
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; Maryland Cancer Survey	
INCLUSION CRITERIA:	English-speaking Marylanders age 40 and older residing in private residences	
EXCLUSION CRITERIA:	'Don't know' or 'refused' responses for most covariates	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**50-64 Years** Sex: 50.83% female Race: 71.93% White, 22.32% Black, 5.75% Other	**65+ Years** Sex: 58.91% female Race: 80.15% White, 16,56% Black, 3.29% Other
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** Response rate was 38.4%; completion rate was 65.4%	
STATISTICAL ANALYSES:	**Describe:** In initial multivariate analyses, there was a significant interaction for age and health insurance. Thus, age groups were considered in separate models (50–64 years and 65+ years). Unweighted multiple logistic regression analysis was performed by age category (50–64 years and 65+ years) for (1)	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Gilbert, A., Kanarek, N.[20] **Year of publication:** 2005 **Dates of data collection:** 2002 **Trial name:** NA
	FOBT within the past year, (2) sigmoidoscopy within the past 5 years, (3) colonoscopy within the past 10 years, and (4) screening colonoscopy within the past 10 years.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** CRC screening outcomes were defined as (1) FOBT within the past year, (2) sigmoidoscopy within the past 5 years, or (3) colonoscopy within the past 10 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Model results for persons aged 50–64 (FOBT) The only significant predictor of FOBT use was clinician recommendation for the test (OR = 36.89; 95% CI:27.06–50.29; *P* < 0.001). Sigmoidoscopy use was significantly lower among Blacks when compared to Whites (OR = 0.57; 95% CI: 0.35–0.93; *P* = 0.026). Rural residents are less likely have had a timely sigmoidoscopy than urban residents (OR = 0.61; 95% CI: 0.42–0.88; *P* = 0.009). Persons in fair health are less likely to have had a timely sigmoidoscopy than those in excellent, very good, or good health (OR = 0.49; 95% CI: 0.27–0.89; P = 0.019). Current smokers are less likely to have had a timely sigmoidoscopy than non-smokers (OR = 0.39; 95% CI: 0.22–0.69; *P* = 0.001). Reporting a family history of CRC significantly increases the odds of colonoscopy use (OR = 2.56; 95% CI: 1.78–3.68; *P* < 0.001). Independently, reporting having a clinician recommendation for the test raised the odds of colonoscopy by more than 30:1 (OR = 31.76; 95% CI: 21.14–47.73; *P* < 0.001). Usual source of care was also important and positively associated with colonoscopy use (OR = 2.83; 95% CI: 1.52–5.27; P = 0.001). Women have decreased odds of screening colonoscopy use (OR = 0.66; 95% CI: 0.51–0.86; *P* = 0.002). Individuals of Black race or Hispanic ethnicity have increased odds of screening colonoscopy use (OR = 1.87; 95% CI: 1.34–2.62; *P* < 0.001 and OR = 2.26; 95% CI: 1.05–4.88; *P* = 0.038, respectively). Those in annual income brackets of $25,000–49,999 and $75,000+ (compared to b$25,000) have increased odds of screening colonoscopy use (OR = 1.66; 95% CI: 1.01–2.73; *P* = 0.05 and OR = 1.81; 95% CI: 1.09–3.01; *P* = 0.02, respectively). Family history of CRC improves the odds of screening colonoscopy (OR = 2.71; 95% CI: 1.93–3.81; *P* < 0.001). Clinician recommendation significantly raised the odds of screening colonoscopy (OR = 18.26; 95% CI: 11.27–29.57; *P* < 0.001). Usual source of care was also positively associated with screening colonoscopy use (OR = 3.10; 95% CI: 1.41–6.83; *P* = 0.005). Model results for persons aged 65+ Blacks were more likely to have had a timely FOBT than Whites (OR = 2.20; 95% CI: 1.38–3.51; *P* = 0.001). Those

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	Authors, ref ID: Gilbert, A., Kanarek, N.[20] Year of publication: 2005 Dates of data collection: 2002 Trial name: NA
	with poor health status had almost 4 times the odds of FOBT use (OR = 3.75; 95% CI: 1.87–7.52; *P* < 0.001). Those who reported a clinician recommendation for FOBT had over 26 times the odds of use (OR = 26.73; 95% CI: 19.25–37.11; *P* < 0.001). Having a usual source of care improves the odds of having a timely FOBT (OR = 3.28; 95% CI: 1.06–10.17; *P* = 0.039). An annual income of $50,000–$74,999 compared to b$25,000 significantly improves the odds of sigmoidoscopy use (OR = 2.64; 95% CI: 1.30–5.37; *P* = 0.008). Clinician recommendation for the test improves sigmoidoscopy use by more than 11:1 (OR = 11.62; 95% CI: 5.04–26.76; *P* < 0.001). Current smokers have a borderline statistically significant decreased odds of colonoscopy use (OR = 0.59; 95% CI: 0.35–1.01; *P* = 0.055). Current drinkers also have a decreased odds of colonoscopy use (OR = 0.74; 95% CI: 0.55–0.99; *P* = 0.045). Reporting having a family history of CRC improves the odds of colonoscopy (OR = 2.23; 95% CI: 1.48–3.38; *P* < 0.001). Reporting having a clinician recommendation for colonoscopy significantly increases the odds of use by more than 20:1 (OR = 21.71, 95% CI: 14.87–31.72; *P* < 0.001). Family history of CRC increases the odds of screening colonoscopy use (OR = 2.60; 95% CI: 1.83–3.72; *P* < 0.001). Clinician recommendation for colonoscopy significantly improves the odds of screening colonoscopy (OR = 8.70; 95% CI: 5.82–12.99; P < 0.001). Ever had recommendation for FOBT, 50–64 years (N = 1730): Yes, 38.86 [1.37]; No, 61.14 [1.37] Ever had recommendation for FOBT, 65+ years (N = 1264): Yes, 44.64 [1.59]; No, 55.36 [1.59] Ever had recommendation for sigmoidoscopy or colonoscopy, 50–64 years (N = 1730): Yes, 60.00 [1.39]; No, 40.00 [1.39] Ever had recommendation for sigmoidoscopy or colonoscopy, 65+ years (N = 1264): Yes, 70.55 [1.46]; No, 29.55 [1.46] Those who ever had physician recommendation were more likely to have completed the FOBT (AOR, 70.72; 95% CI, 66.56-77.45); FS (AOR 17.41; 95% CI, 14.9-20.25); or colonoscopy (AOR 57.32; 95% CI, 53.82- 60.75).
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Gilbert, A., Kanarek, N.[20] **Year of publication:** 2005 **Dates of data collection:** 2002 **Trial name:** NA
followup?	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Response rate was 38.4%; completion rate was 65.4%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Goel, S.M., Wee, C.C., McCarthy, E.P., Davis, R.B., Ngo-Metzger, Q., Philips, R.S.[21] **Year of publication:** 2003 **Dates of data collection:** 1998 **Trial name:** NA	
OBJECTIVE OR AIM:	To determine whether foreign birthplace explains some racial/ethnic disparities in cancer screening	
DESIGN:	**Setting:** Home-based survey **Study design:** Cross-sectional study **Duration (mean followup):** No follow-up, one-time survey **Overall study size (N enrolled/N analyzed):** 32,440	
Sample size: **Describe intervention:**	**Foreign-born** Sample size: 4,963 No intervention; survey	**U.S. born** Sample size: 27,441 No intervention; survey
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; National Health Interview Survey and Sample Adult and Sample Adult Prevention modules	
INCLUSION CRITERIA:	Non-institutionalized, completed NHIS	
EXCLUSION CRITERIA:	NR	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**Foreign-born** Age: 25% <30, 26% 30-39, 20% 40-49, 13% 50-59, 8% 60-69, 6% 70-79, 3% 80+ Race: 28% White (non-Hispanic), 7% Black, 45% Hispanic, 29% AAPI Sex: 51% female	**U.S.-born** Age: 22% <30, 21% 30-39, 21% 40-49, 14% 50-59, 10% 60-69, 8% 70-79, 4% 80+ Race: 82% White (non-Hispanic), 12% Black, 5% Hispanic, 1% AAPI Sex: 52% female
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**Overall** 74% response rate	
STATISTICAL ANALYSES:	**Describe: independent variables of interest = race/ethnicity and foreign birth** The authors conducted bivariable analyses comparing baseline characteristics between foreign-born and U.S.-born individuals, and compared screening rates across race/ethnicity and birthplace; used x2 statistics for all categorical variables and a *t*-test for continuous variables; described the association between race/ethnicity and cancer screening by fitting multivariable logistic regression models for each outcome of interest.	
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Authors adjusted for potential confounders previously described in the literature, including sociodemographic characteristics (age, marital status, region of residence, education, annual household income) and illness burden	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Goel, S.M., Wee, C.C., McCarthy, E.P., Davis, R.B., Ngo-Metzger, Q., Philips, R.S.[21] **Year of publication:** 2003 **Dates of data collection:** 1998 **Trial name:** NA
	(self-reported health status, smoking status, concurrent illnesses, BMI, and hospitalizations in the past year).
OUTCOME ASSESSMENT:	**Outcome Measures:** The authors considered respondents screened if they reported FOBT in the previous year. An individual was considered screened if proctoscopy (sigmoidoscopy) was completed in the previous 5 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • The authors found significant differences by race/ethnicity and by birthplace in screening for all analyses performed ($P < .05$). • Compared to white respondents, blacks, Hispanics, and AAPIs were generally less likely to undergo FOBTs and sigmoidoscopies. • Similarly, compared with U.S.-born respondents, foreign-born respondents were also less likely to be screened with all forms of cancer screening. • Black respondents were as likely to report FOBT and sigmoidoscopy as whites. Hispanic respondents were significantly less likely to report FOBT or sigmoidoscopy. AAPI respondents were less likely to report all screening outcomes; however, the difference for FOBT was not statistically significant. • After adjusting for sociodemographic characteristics and illness burden, there were no significant differences in cancer screening in U.S.-born nonwhite respondents compared with U.S.-born white respondents. • Foreign-born black respondents were significantly less likely to report FOBT; however, after further adjustment for access to care, this difference was attenuated and no longer significant (AOR, 0.51; 95% CI, 0.21 to 1.21). • Foreign-born Hispanic respondents were significantly less likely to report FOBT and sigmoidoscopy. After further adjustment for access to care, differences were attenuated and were no longer statistically significant for FOBT (AOR, 0.84; 95% CI, 0.60 to 1.18) or sigmoidoscopy (AOR, 0.80; 95% CI, 0.57 to 1.10). • Foreign-born AAPI respondents were significantly less likely to report all screening procedures. However, differences for FOBT (AOR, 0.73; CI, 0.45 to 1.19) and sigmoidoscopy (AOR, 0.74; 95% CI, 0.45 to 1.21) were attenuated and no longer statistically significant. • Before adjustment, foreign-born Hispanic respondents were as likely to report FOBT, but significantly less likely to report sigmoidoscopy compared with U.S.-born Hispanic respondents. Differences for sigmoidoscopy use were substantially attenuated after adjustment and were no longer statistically significant. • Foreign-born AAPI respondents were also significantly less likely to report FOBT than U.S.-born AAPI respondents, before and after adjustment for sociodemographic characteristics and illness burden. After additional adjustment for access to care, the association between foreign birth and FOBT was substantially attenuated, and was no longer statistically significant
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Goel, S.M., Wee, C.C., McCarthy, E.P., Davis, R.B., Ngo-Metzger, Q., Philips, R.S.[21] **Year of publication:** 2003 **Dates of data collection:** 1998 **Trial name:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	**Good**

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?		X	There were several significant differences between sociodemographic categories for U.S.- and foreign-born
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Combined response rate for all portions of the survey was 74%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NR
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID**: Gupta S, et al.[22] **Year of publication:** 2009 **Dates of data collection:** 2002-2006 **Trial name:** Screening for Colorectal Cancer in a Safety Net Health Care System: Access to Care is Critical and Has Implications for Screening Policy
OBJECTIVE OR AIM:	To determine (a) the size of the potential screen-eligible population ages 50 – 75, (b) the rate of screening over 5 years among individuals ages 54 – 75, and (c) the potential predictors of screening including sex, race/ethnicity, insurance status, frequency of out patient visits, and socioeconomic status.
DESIGN:	**Setting:** Electronic administrative records review of patients in a "safety-net" health care system (The Tarrant County Hospital District John Peter Smith Hospital Health Network) **Study design:** cross-sectional (the authors describe it as a cohort study) **Duration (mean followup):** retrospectively reviewed 5 years of electronic administrative records **Overall study size (N enrolled/N analyzed):** • Age-eligible individuals in 2006 = 31,166 • Potential screen-eligible population in 2006 = 28,708 • Number of patients analyzed = 20,416
Sample size:	N = 20,416
Describe intervention:	Intervention: NA Reviewed administrative records for evidence of CRC screening between 2002 - 2006
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Identified potentially eligible patients in the JPS health system database.
INCLUSION CRITERIA:	• Age 50 – 75 (ages 50 – 53 were excluded for the final analysis) • Alive as of 2006
EXCLUSION CRITERIA:	• History of inflammatory bowel disease, polyps, or colon cancer • Age 50 – 53 in 2006
POPULATION CHARACTERISTICS:	N = 20,416
Mean age & range (years):	Median age = 60 years
Sex (% female):	Women = 59%
Race: **Other:** • •	White = 43.7% African-American = 27.7% Hispanic = 23.4% Other = 5.2% Primary Language spoken English = 82% Spanish = 12.5%

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID**: Gupta S, et al.[22] **Year of publication:** 2009 **Dates of data collection:** 2002-2006 **Trial name:** Screening for Colorectal Cancer in a Safety Net Health Care System: Access to Care is Critical and Has Implications for Screening Policy
	Other = 5.6% Insurance status in 2006 None = 20.5% JPS Connection = 39.9% Medicare, Medicaid, private, or other = 39.6% Median household income = $35,419
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	
STATISTICAL ANALYSES:	**Describe**: • Descriptive statistics, including proportions with 95% CIs for estimates of rates of screening • Univariate and multivariate logistic regression to identify any association between potential predictors of screening participation, and the primary outcome, the presence or absence of CRC screening completion. • Cochran-Armitage trend test used to investigate trend between screening and years of insurance coverage.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Model included: age, sex, race/ethnicity, primary language, income, proportion of individuals living in poverty (zip code), insurance, whether seen as an outpt in 2006
OUTCOME ASSESSMENT:	**Outcome Measures:** Size of potential screen-eligible population Rate of screening completion Predictors of screening completion Screening participation defined as: FOBT in 2005 or 2006/any BE, FS or colonscopy from 2002-2006
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • 22% of those screen-eligible individuals aged 54 – 75 years had records of CRC screening completion (defined as FOBT in 2005 or 2006, or any colonoscopy, flexible sigmoidoscopy, or barium enema between 2002 – 2006). • Independent predictors of screening completion used in multiple logistic regression analysis were: age, gender, race/ethnicity, primary language, measures of SES, insurance status, and presence of two or

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID**: Gupta S, et al.[22] **Year of publication:** 2009 **Dates of data collection:** 2002-2006 **Trial name:** Screening for Colorectal Cancer in a Safety Net Health Care System: Access to Care is Critical and Has Implications for Screening Policy
	more outpatient visits. The statistically significant associations were: o Female vs. male, OR = 1.25 (1.16 – 1.35) o Hispanic vs. White, OR = 1.2 (1.07 – 1.34) o Any health insurance vs. none, OR = 2.57 (2.23 – 2.98) o JPS insurance vs. none, OR = 2.55 (2.21 – 2.95) o Two or more outpatient visits in 2006, OR = 3.53 (3.15 – 3.97)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA – cross sectional retrospective records review, no comparison groups
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	x		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR Likely yes as this is administrative record review
Were outcome measures valid, reliable, and equally applied?		x	Screening vs. diagnostic exams were not distinguished. Used ICD9 codes to verify screening status, however the investigators only had access to records of procedures performed within the JPS system, other health records were not available for review.
Does the analysis control for baseline differences?	X		The analysis adjusted for age category, race, primary language, sex, insurance status, presence of two or more out patient visits in 2006, household income, and proportion living in poverty in 5-percentage point increments.
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			Several factors were controlled for in the analysis. There could be some effect from unmeasured confounders such as comorbidity.
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Heo, M., et al.[23] **Year of publication:** 2004 **Dates of data collection:** 2001 **Trial name:** NA
OBJECTIVE OR AIM:	To estimate the association between body-mass index (BMI: kg/m2) and colorectal cancer (CRC) screening among US adults aged ≥ 50 years.
DESIGN:	**Setting:** United States **Study design:** Cross-sectional **Duration (mean followup):** One-time data collection, one year **Overall study size (N enrolled/N analyzed):** 84,284
Sample size:	**All** Sample size: 84,284
Describe intervention:	Intervention: None, survey (BRFFS)
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based (BRFFS)
INCLUSION CRITERIA:	Age 50+
EXCLUSION CRITERIA:	Respondents (n = 250; .3%) with BMI's <18.5 ("underweight") were omitted from the analyses.
POPULATION CHARACTERISTICS:	**All**
Mean age & range (years):	Mean age: 65
Sex (% female):	Sex: 61.8% Female
Race:	Race: 82.3% white, 17.7% Non-white
Other:	
Attrition/Drop-out (not available for endpoint measurement):	NR
Adherence:	
Contamination:	
Response Rates (e.g. for surveys):	
STATISTICAL ANALYSES:	**Describe:** Multivariate logistic regression to estimate BMI screening associations by entering the BMI-defined categories and potential confounders into the model as either continuous (e.g., age [including polynomials up to the third order]) or dichotomous variables (e.g., health insurance).

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Heo, M., et al.[23] **Year of publication:** 2004 **Dates of data collection:** 2001 **Trial name:** NA
	To evaluate whether sex moderated the BMI-screening association, ran adjusted logistic models that also included BMI × sex interaction terms. Finally, because the authors observed a significant BMI × sex interaction, they then analyzed the data for men and women separately.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	This study has limitations including: the BRFSS, a telephone survey, is prone to measurement error; because the BRFSS is an observational study, the BMI-screening associations could be due to residual confounding or confounding from unmeasured variables; the cross-sectional design did not allow testing causal inferences; and people without telephones, approximately 3% of the US population, are not surveyed through BRFSS.
OUTCOME ASSESSMENT:	**Outcome Measures:** BRFSS codes FOBT responses as: 'within past year', 'within past 2 years', 'within past 5 years', '5 or more years ago', 'don't know/not sure', or 'refused'. SIG is coded as: 'within past year', 'within past 2 years', 'within past 5 years', 'within past 10 years', '10 or more years ago', 'don't know/not sure', or 'refused'.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** BMI was not associated with obtaining a FOBT (AOR's ranged from 0.90 to 0.98). Compared to normal weight adults, however, those in the overweight (OR = 1.15, 95%CI 1.02–1.31), obesity class I (1.21, 95%CI 1.09–1.35), II (1.17, 95%CI 1.04–1.44) and III (1.27, 95%CI 1.05–1.58) categories were more likely to have obtained a screening SIG within the previous 5 years (*P*'s < 0.05). The interaction effect between sex and BMI categories on FOBT was not significant ($\chi 2(4) = 8.64$, *P*=.071). However, the interaction effect between sex and BMI categories on SIG screening was significant, ($\chi 2(4) = 114.03$, *P* <.0001). BMI was not associated with obtaining a FOBT for either sex (OR's ranged from 0.87 to 1.05). Compared to normal weight men, men in the overweight (1.25, 95%CI 1.05–1.51) and obesity class I (1.21 95%CI 1.03–1.75) categories were significantly more likely to have obtained a screening SIG. In contrast, obesity class I (0.86 95%CI 0.78–0.94) and II (0.88 95%CI 0.79–0.99) women were less likely to have obtained a screening SIG compared to normal weight women
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Heo, M., et al.[23] **Year of publication:** 2004 **Dates of data collection:** 2001 **Trial name:** NA
colorectal cancer screening?	
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NR
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Honda, K., Kagawa-singer, M.[24] **Year of publication:** 2006 **Dates of data collection:** NR **Trial name:** NA
OBJECTIVE OR AIM:	The study aims are to (1) develop and test a model explaining how socioenvironmental and personal factors are related to colorectal cancer screening adherence, and (2) determine the relative importance of normative (subjective norms) and attitudinal variables (perceived benefits and perceived behavioral control) for explaining colorectal cancer screening adherence for this particular ethnic group.
DESIGN:	**Setting:** US **Study design:** Cross-sectional, retrospective (survey) **Duration (mean followup):** No follow-up **Overall study size (N enrolled/N analyzed):** 341
Sample size: **Describe intervention:**	**All** Sample size: 341 Intervention: None; mailed survey in English and Japanese
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based
INCLUSION CRITERIA:	Japanese names (both first- and surname), age (over 50), and geographic location (NY, NJ, CT)
EXCLUSION CRITERIA:	Did not provide demographic information
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Age range: 50-92 Mean age: 64 Sex: 63% female Ethnicity: Asian (Japanese American)
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	Response rate: 59%

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Honda, K., Kagawa-singer, M.[24] **Year of publication:** 2006 **Dates of data collection:** NR **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** The first step involved using confirmatory factor analysis (CFA) to test an overall measurement model. The second step involved using SEM to test a structural model. The squared multiple correlation (R^2) value was reported for the endogeneous variable to evaluate effectiveness of the model in explaining the variance observed in the sample's screening behavior. Paths with nonsignificant *t* values were removed because no substantively meaningful interpretation can be provided for the parameter estimates
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** (1) never had any of three screening tests, (2) had at least one of three screening tests, but not appropriate frequency, and (3) had any of three screening tests with an appropriate frequency
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Results confirm the existence of a single latent construct underlying each of the measures of emotional family support, emotional friend support, and provider-patient communication in this population. Cronbach's alpha for the latent variables were as follows: Provider-Patient Communication, 0.945; Emotional Support From Family, 0.914; Emotional Support From Friends, 0.883. Five background variables (education, acculturation, marital status, frequency of contact with family, frequency of contact with close friends) were not significant and were dropped from the "full" to the "trimmed" model. The structural equations suggest that not all cognitive factors are significant in colorectal cancer screening adherence. Subjective norms among family and friends (γ = 0.20), perceived benefits (γ = 0.14), but not subjective norms among providers and perceived behavioral control, had significant impacts on colorectal cancer screening adherence. Among sociodemographics and social network variables, regular access (γ = 0.26), emotional friends support (γ = 0.15), income (γ = 0.14), and provider patient communication (γ = 0.12) had direct impacts on adherence, with the indirect effect of provider patient communication via increased perceived benefits leading the total effect of 0.14.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Honda, K., Kagawa-singer, M.[24] **Year of publication:** 2006 **Dates of data collection:** NR **Trial name:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Response rate: 59%--actually only 37.8% once taken into account those that were excluded or were unusable; only 341/900 analyzed
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Hudson, S.V., et al.[25] **Year of publication:** 2007 **Dates of data collection:** April 2003 through December 2004 **Trial name:** NA
OBJECTIVE OR AIM:	This study examines whether primary care practices that involve staff in general forms of health education have higher CRC screening rates than practices that do not.
DESIGN:	**Setting:** Chart audit of practices **Study design:** Cross-sectional retrospective analysis **Duration (mean followup):** No followup, data collected over 20 months, 2003-2004 **Overall study size (N enrolled/N analyzed):** 22 practices, 795 patients
Sample size: **Describe intervention:**	Sample size: 22 practices, 795 patients Charts were audited to extract CRC screening
RECRUITMENT: (population-based, clinic-based, volunteer, other)	No individual recruitment of patients; Within each practice, 20 patients were randomly selected from each list of patients. In cases where there were fewer than 20 patients in the practice with a particular diagnosis code, all patients with the diagnosis code were used.
INCLUSION CRITERIA:	Suburban practices were that had medical records with at least 10 years of data,
EXCLUSION CRITERIA:	If patients were deceased at the time of the audit, below age 18 or no longer a patient of the practice.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**<u>Population</u>** Age range: 50-70 Mean age: 59.3 Sex: 45% female Practices averaged 86% Caucasian patients
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA
STATISTICAL ANALYSES:	**Describe:** Descriptive statistics were used to summarize rates of screening and teamwork indicators as well as other patient and practice-level socio-demographic information. Generalized estimating equations were used to examine the effects of the practice indicators of teamwork, while controlling for additional practice-level covariates and patient-level covariates

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Hudson, S.V., et al.[25] **Year of publication:** 2007 **Dates of data collection:** April 2003 through December 2004 **Trial name:** NA
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Our sample was drawn mainly from a pool of patients with known chronic diseases (i.e., asthma, coronary artery disease, diabetes, hypertension). Though reflective of common diseases that affect many patients eligible for preventive colorectal cancer screening, this sample may over represent patients with chronic disease and under represent others in the general patient population.
OUTCOME ASSESSMENT:	**Outcome Measures:** CRC screening, any procedure (URPSTF)
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Four of the 22 practices indicated that they used Health Risk Assessments (HRA's) for diet, physical activity and tobacco; however, the use of HRA's was not significantly associated with CRC screening (z = -0.44, *P* = 0.6625) Practices using nursing staff for diet, physical activity and tobacco counseling had significantly higher CRC screening rates than those not using nursing or health educator staff for such counseling (z = 7.30, *P* < 0.0001) Practices using patient reminder systems had significantly higher CRC screening rates despite the fact that these systems were not specifically targeting CRC screening (z = 4.96, *P* < 0.0001). CRC screening rates: Use of nonclinician staff for counseling: Yes: 54.1%; No: 27.2% [AOR, 2.96 (95% CI, 2.21-3.96)] Reminder systems: Yes: 39.9%; No: 19.6% [AOR, 2.57 (95% CI, 1.77-3.74)]
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** 31.3% of patients up to date for CRC screening
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?		X	
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		Always concerned about unadjusted confounders
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Janz et al.[26] **Year of publication:** 2003 **Date of data collection:** 2001 **Trial name:**
OBJECTIVE OR AIM:	Assess attitudes and practices regarding CRC screening.
DESIGN:	**Setting:** Telephone survey of general population **Study design:** Cross-sectional, retrospective opulation-based random-digit-dialing telephone survey **Duration (mean followup):** None **Overall study size (N enrolled/N analyzed):** 355
Sample size: **Describe intervention:**	**Population** Sample size: 355
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Population-based; purchased random phone numbers and addresses
INCLUSION CRITERIA:	Age 50-79, residents of Genessee County, Michigan, household telephone number
EXCLUSION CRITERIA:	Prior history of colorectal cancer, colorectal surgery to remove polyp, inflammatory bowel disorder, or familial adenomatous polyposis.
POPULATION CHARACTERISTICS:	**Population**
Mean age & range (years): **Sex (% female):** **Race:** **Other:**	Age range: 50-79 Sex: 55% female Race: 48% Black; 52% White
	Population
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	Response rate = 69%
STATISTICAL ANALYSES:	**Describe:** Demographic variables and variables measuring respondents' familiarity with or use of screening methods were analyzed using two-way contingency tables with accompanying x2 statistics which test the null hypothesis of no difference among race-gender groups. Logistic regression models were used to test whether dimensions represented in the Health Belief Model were significantly related to CRC screening status while controlling for relevant sociodemographic and related factors.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Across all three screening procedures, two consistent barriers were the personal beliefs that the test was "not needed" or would be "embarrassing." Other barriers were unique to a specific screening test; for example, 25%

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Janz et al.[26] **Year of publication:** 2003 **Date of data collection:** 2001 **Trial name:**
	reported that a barrier to FOBT was "not knowing how to perform the self-test," and 11% reported concern with "bleeding or tearing" with colonoscopy. About 30% of participants reported that pain was a barrier to flexible sigmoidoscopy and colonoscopy. Moreover, a cluster of emotional reactions to these tests may also serve as barriers to action. For each test, significant numbers of respondents indicated "anxiety about the procedure" and "fear of the results." Ten percent of the respondents considered cost a barrier to flexible sigmoidoscopy; that number dropped to 7% for colonoscopy.
OUTCOME ASSESSMENT:	**Outcome Measures:** Attitudes and practices related to CRC screening.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Significantly high percentages of white respondents than black respondents were aware of the screening precedures for both endoscopic procedures ($P < 0.05$). • There was considerable attenuation as one move from knowledge of any screening procedure to having had the particular screening test. There was further reduction between having ever been screened and adherence to recommended screening guidelines. • Adherence to the recommended screening interval was lowest in black females for the three procedures: 21.8% for FOBT, 20.5% for flexible sigmoidoscopy, and 12.8% for colonoscopy. • Black males reported greater rates of prior and current screening than white males for both flexible sigmoidoscopy and colonoscopy. • Males reported high screening percentages. • The only significant differences among gender and race subgroups were observed for "having heard of a flexible sigmoidoscopy" ($P = 0.011$); "having heard of a colonoscopy" ($P = 0.001$); and "having ever had a flexible sigmoidoscopy" ($P = 0.037$) • Looking at adherence according to American Cancer Society, the following percentages of groups were adherent: black males (37.8%); white males (24.8%); black females (19.2%); and white females (26.5%) • Between 54 and 65% of respondents indicated that their physician had recommended FOBT, and over 92% of those subjects reported having had the test. (P = NR, OR = NR) • There were no significant differences at the $P < 0.05$ level between race and gender subgroups in either the percentage reporting a physician recommendation or the percentage screened among those reporting such a recommendation. • Increasing age was significantly associated with a greater likelihood of obtaining a flexible sigmoidoscopy or colonoscopy. • A family history of colorectal cancer was significantly associated with an increased odds ratio for having a colonoscopy in the recommended interval (OR= 3.02, 95% CI =1.29, 7.09). • Respondents considering themselves at higher risk for colorectal cancer compared to other persons their age were 1.24 times (95% CI 1.01, 1.52) more likely to have had a flexible sigmoidoscopy in the recommended interval.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Janz et al.[26] **Year of publication:** 2003 **Date of data collection:** 2001 **Trial name:**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**NA**
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Response rate was 69%.
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?		X	People doing interview knew predictive factors and outcome
Were outcome measures valid, reliable, and equally applied?			NA
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Jerant, AF, et al.[27] **Year of publication:** 2008 **Dates of data collection:** 1999-2005 **Trial name:** NR				
OBJECTIVE OR AIM:	To examine factors associated with disparities in CRC screening between whites and Hispanic national origin subgroups.				
DESIGN:	**Setting:** US **Study design:** Cross-sectional, secondary data analysis of survey data **Duration (mean followup):** One-time data collection each year, 1999-2005 **Overall study size (N enrolled/N analyzed):** 22,419				
Sample size:	**All** Sample size: 22,419 (18,733 White, 2,779 Mexican, 336 Cuban, 376 Puerto Rican, 195 Dominican)				
Describe intervention:	Intervention: None; used MEPS data				
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based				
INCLUSION CRITERIA:	Respondents aged >50 years self-identifying as non-Hispanic white or Hispanic				
EXCLUSION CRITERIA:	Individuals not of Mexican, Cuban, Puerto Rican, or Dominican origin				
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**White** Age: 23.1% 50-54, 19.4% 55-59, 14.9% 60-64, 22.6% 65-74, 20% 75+ Sex: 53.8% female	**Mexican** Age: 29.1% 50-54, 21.7% 55-59, 13.5% 60-64, 22.1% 65-74, 13.6% 75+ Sex: 53.8% female	**Cuban** 22.3% 50-54, 13.7% 55-59, 10.4% 60-64, 28.5% 65-74, 25.2% 75+ Sex: 52% female	**Puerto Rican** 23.9% 50-54, 25.3% 55-59, 22.6% 60-64, 18.9% 65-74, 9.2% 75+ Sex: 60.4% female	**Dominican** 30.7% 50-54, 23.4% 55-59, 16.1% 60-64, 19.4% 65-74, 10.4% 75+ Sex: 60.5% female
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** Response rate about 65%				
STATISTICAL ANALYSES:	**Describe:** • Analyses incorporated the longitudinal strata and primary sampling units and were weighted to yield appropriate standard errors and estimates representative of the U.S. civilian, non-institutionalized adult population. (DR note: this was cross sectional study.) • Four main models were constructed to determine the relationship between CRC screening and Hispanic national origin subgroup using a series of logistic regression analyses with CRC screening as the				

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Jerant, AF, et al.[27] **Year of publication:** 2008 **Dates of data collection:** 1999-2005 **Trial name:** NR
	dependent variable in the models. • The modeling sequence was designed to adjust first for relatively fixed demographic characteristics, then basic socioeconomic factors common to all persons, then access factors common to all persons, and, finally, language, a factor of specific relevance to Hispanics in this analysis.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Nonetheless, the data regarding geographic region by ethnicity presented in Table 1 suggest the potential for confounding even by broad geographic region, and our models adjusted for such confounding.
OUTCOME ASSESSMENT:	**Outcome Measures:** Dependent variable: self-report of up to date CRC screening, defined as fecal occult blood testing within 2 years and/or lower endoscopy at any time
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Total unadjusted screening rates: Non-Hispanic whites: 55.9%, Mexican: 35.2%, Cuban: 51.0%, Puerto Rican: 45.7%, Dominican: 28.5% • Adjusted for age, gender, region and year: Mexican: (AOR, 0.46; 95% CI, 0.40-0.53), Puerto Rican: (AOR, 0.65; 95% CI, 0.47-0.91), Dominican: (AOR, 0.30; 95% CI, 0.19-0.45) • Adjusted for above plus income and education: Mexican: (AOR, 0.70; 95% CI, 0.60-0.81), Dominican: (AOR, 0.44; 95% CI, 0.28-0.69) • Adjusted for above plus insurance, usual source of care, health status: Mexican: (AOR, 0.79; 95% CI, 0.69-0.91), Dominican: (AOR, 0.54; 95% CI, 0.32-0.91) • Compared with non-Hispanic whites, all Hispanic national origin subgroups except people of Cuban origin were significantly less likely to report up to date CRC screening, after adjustment for age, sex, region, and year (Mexican: OR .46, 95% CI: .40, .53, *P* = 0.00; Puerto Rican: OR. .65, 95% CI .47, .91, *P* = 0.01; Dominican: OR .30, 95% CI .19, .45, *P* = 0.00) • With additional adjustment for socioeconomics, the effect for people of Puerto Rican origin became non-significant (Mexican: OR .70, 95% CI .60, .81, *P* = 0.00; Dominican: OR .44, 95% CI .28, .69, *P* = 0.00). • With further adjustment for access (insurance status, and availability of a usual source of care, there was a further non-significant attenuation of disparities (Mexican: OR .79, 95% CI .69, .91, *P* = 0.00; Dominican: OR .54, 95% CI .32, .91, *P* = 0.02). • The final model, including language revealed further attenuation of the disparity between non-Hispanic whites and Hispanics (with no remaining statistically significant disparity), while people of Cuban origin had higher adjusted screening rates (Cuban: OR 1.57, 95% CI 1.15, 2.14, *P* = 0.01).
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and	NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Jerant, AF, et al.[27] **Year of publication:** 2008 **Dates of data collection:** 1999-2005 **Trial name:** NR
projected capacities to deliver colorectal cancer screening and surveillance at the population level?	
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Good

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			Population demographics vary based on country of origin.
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Response rate about 65%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Jerant, A.F., et al.[28] **Year of publication:** 2008 **Dates of data collection:** 2001-2005 **Trial name:** NR
OBJECTIVE OR AIM:	To address these limitations in the literature, the authors examined the correlates of CRC screening among all 4 major US racial/ethnic categories (non-Hispanic white, Asian, black, and Hispanic individuals) using linked data from the 2001-2005 Medical Expenditure Panel Survey (MEPS) and the 2000-2004 NHIS.
DESIGN:	**Setting:** USA; Medical Expenditure Panel Survey and the National Health Interview Survey **Study design:** Cross-sectional) **Duration (mean followup):** One-time data analysis **Overall study size (N enrolled/N analyzed):** 22973/21,433
Sample size:	**All** Sample size: 22,973 (no missing data = 21,433)
Describe intervention:	Intervention: None; Medical Expenditure Panel Survey and the National Health Interview Survey
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based survey
INCLUSION CRITERIA:	Civilian, noninstitutionalized population, age 50+
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Age: 23.6% 50-54, 19.7% 55-59, 14.8% 60-64, 22.2%, 65-74, 19.6% 75+ Sex: 54.1% female Race: 68% White (non-Hispanic), 3.4 Asian, 13.7% Black, 14.9% Hispanic
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	MEPS point-in-time response rates for the 5 panels of public use data that the authors used were as follows: 2000, 70.5%; 2001, 71.4%; 2002, 69.2%; 2003, 68.9%; 2004, 68.2%; and 2005, 66.5%.
STATISTICAL ANALYSES:	**Describe:** They constructed 3 sets of analyses with 4 sequential logistic regression models to determine the relationship

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Jerant, A.F., et al.[28] **Year of publication:** 2008 **Dates of data collection:** 2001-2005 **Trial name:** NR
	between CRC screening and race/ethnicity (non-Hispanic white, Asian, black, and Hispanic) using CRC screening as the dependent variable in all the models. Model 1: adjusted only for basic demographics (age, sex, MSA residence, and region of US) Model 2: adjusted for SES (annual income and educ level) Model 3: included also access to care (insurance, USOC) and self-rated health Model 4: incl also language spoken at home and nativity
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Modeling included potential confounders noted above
OUTCOME ASSESSMENT:	**Outcome Measures:** CRC screening; respondents were considered to be up-to-date for screening if they reported FOBT in the previous 2 years or endoscopic testing at any time Combined, FOBT alone, endoscopy alone
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** After adjustment for age, sex, MSA residence, region, and year, (MODEL 1) compared with non-Hispanic whites, all minorities, and especially Asians and Hispanics, were significantly less likely to report up-to-date CRC screening. With additional socioeconomic adjustment (MODEL 2), the disparities in CRC screening were attenuated for Hispanics and blacks (and, for blacks, eliminated for FOBT) relative to non-Hispanic whites, but there was little change in Asian/non-Hispanic white disparities. The gradient in screening was steepest for educational level, with the most educated group (16+ years of schooling) having adjusted odds ratios of greater than 2.00 relative to the least educated group (less than 9 years of schooling) Adjustment for access and self-rated health (MODEL 3) further attenuated Hispanic/non-Hispanic white screening disparities but had little effect on Asian/non-Hispanic white disparities. For FOBT, blacks were more likely to report being up-to-date than were non-Hispanic whites. Those with worse self-rated health, availability of some insurance, and a usual source of care were more likely to report screening. With the inclusion of language and nativity MODEL 4), Hispanic/non-Hispanic white disparities were attenuated such that they were no longer statistically significant, whereas Asian/non-Hispanic white disparities were attenuated but remained significant. Speaking English at home and being born in the continental United States were associated with greater CRC screening. Analyses that included language and nativity separately suggested that language, rather than nativity,

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	Authors, ref ID: Jerant, A.F., et al.[28] Year of publication: 2008 Dates of data collection: 2001-2005 Trial name: NR
	was the main driver of the attenuation in disparities. Absolute rates for screening among blacks were 25.5% for FOBT; 38.3% for endoscopy; and 48.2% for the combined tests; among non-Hispanic whites, rates were 25.8%, 49.0, and 57.2%, respectively Initial analysis (adjusted for demographics) showed blacks to be significantly less likely than non-Hispanic whites to have CRC tests (unadjusted OR 0.72; 95% CI, 0.65-0.80) Further adjustment to the model (i.e., when foreign birth, language spoken at home are taken into account) eliminated these differences. Unadjusted screening rates: Asians: 14.8% FOBT; 27.5% endoscopy; 33.8% combined FOBT and endoscopy Non-Hispanic whites: 25.8% FOBT; 49.0% endoscopy; 57.2% combined FOBT and endoscopy Adjusted for age, gender, region: AOR, 0.41; 95% CI, 0.33-0.50 Adjusted for above plus income and education: AOR, 0.42; 95% CI, 0.34-0.52 Adjusted for above plus insurance, usual source of care, health status: AOR, 0.44; 95% CI, 0.35-0.55 Adjusted for above plus language spoken at home, nativity: AOR, 0.63; 95% CI, 0.49-0.81 Respondents who reported speaking English at home were more likely to report being screened than those who did not (AOR, 1.84; 95% CI, 1.52-1.33 for combined screening with FOBT or endoscopy) Those born in the US were also more likely to be screened than those who were not (AOR, 1.16; 95% CI, 1.01-1.33)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Good

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			MEPS point-in-time response rates for the 5 panels of public use data that we used were as follows: 2000, 70.5%; 2001, 71.4%; 2002, 69.2%; 2003, 68.9%; 2004, 68.2%; and 2005, 66.5%.
Were the differential drop-out or response rates acceptable (≤ 15%)?	X		
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good **Reviewer #1 initials: BLM** **Reviewer #2 initials: DR** **Comments (explain poor quality ratings):**			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Katz, M., et al.[29] **Year of publication:** 2004 **Dates of data collection:** Focus group: 1998; Survey October 1998 to October 1999 **Trial name:** WATCH (Wellness for African Americans Through Churches) Project
OBJECTIVE OR AIM:	The authors sought to determine the relationship between the general quality of self-rated patient-provider communication and the completion of CRC screening.
DESIGN:	**Setting:** Rural churches in North Carolina **Study design:** Cohort survey study **Duration (mean followup):** One-year data collection **Overall study size (N enrolled/N analyzed):** 397 analyzed
Sample size: **Describe intervention:**	**All** Sample size: 397 Intervention: None, focus group and telephone survey of church members
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Church-based
INCLUSION CRITERIA:	Age 50+
EXCLUSION CRITERIA:	Deceased, no longer living in the state, medically incapable, phone number no longer working
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Sex: 73,8% female Race: 98% African American Mean age: 63 years
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** Adjusted response rate: 66%
STATISTICAL ANALYSES:	**Describe:** Analyses of data from this study included factor analysis, analysis of variance, and logistic regression.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Katz, M., et al.[29] **Year of publication:** 2004 **Dates of data collection:** Focus group: 1998; Survey October 1998 to October 1999 **Trial name:** WATCH (Wellness for African Americans Through Churches) Project
	Logistic regression analyses were performed to evaluate whether the level of perceived patient-provider communication was significantly related to CRC screening behavior in this population. Sociodemographic variables were identified as potential covariates if there was plausible theoretical or empirical evidence that the variable might be associated with the communication variable or with CRC screening. Only the sex of the participant, receiving healthcare at a doctor's office versus a clinic/emergency room, and knowledge of CRC risk were significantly associated with communication and only these three covariates were entered into the initial logistic model.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Participants were categorized as having "good" communication if they perceived receiving enough information from their provider, being involved in medical decisions, and thinking that their provider understood their health needs almost all the time or always. This was self-rated
OUTCOME ASSESSMENT:	**Outcome Measures:** Participants were considered to have been screened within the recommended time period if they had a FOBT within the preceding year, and sigmoidscopy within the preceding 5 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** After adjustment for the sex of the participant and source of healthcare, quality of communication (good vs fair/poor as rated by patient) remained significantly associated with completion of a CRC test (OR= 1.95; 95% CI= 1.29, 2.94; *P* = 0.002). CRC screening results by communication:

	CRC screening in recommended time (%)	*P* value
Poor and fair communication		
Inadequate knowledge (n=40)	15.0	0.654
Adequate knowledge (n=54)	18.5	
Good communication		
Inadequate knowledge (n=124)	27.4	0.012
Adequate knowledge (n=173)	41.6	

KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Katz, M., et al.[29] **Year of publication:** 2004 **Dates of data collection:** Focus group: 1998; Survey October 1998 to October 1999 **Trial name:** WATCH (Wellness for African Americans Through Churches) Project
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Adjusted response rate: 66%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: MJG Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Klabunde et al.[30] **Year of publication:** 2005 **Dates of data collection:** 1999-2000 **Trial name:** NA	
OBJECTIVE OR AIM:	The authors sought to compare barriers to CRC screening reported by primary care physicians (PCPs) and by average-risk adults, and to examine characteristics of average-risk adults who identified lack of provider recommendation as a major barrier to CRC screening.	
DESIGN:	**Setting:** Surveys of doctors (PCPs) and patients (from NHIS) **Study design:** Secondary data analysis, comparison study, cross-sectional **Duration (mean follow-up):** No follow-up, data collected 1999-2000 **Overall study size (N enrolled/N analyzed):** 1,235 PCPs, 6,497 adults	
Sample size: **Describe intervention:**	**Primary Care Physicians (PCPs)** Sample size: 1,235 Intervention: Survey of Colorectal Cancer Screening Practices (SCCSP)	**Patients** Sample size: 6,497 Intervention: National Health Interview Survey (NHIS)
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; Survey of Colorectal Cancer Screening Practices (SCCSP) and National Health Interview Survey (NHIS)	
INCLUSION CRITERIA:	NHIS respondents age 50+ at average risk for CRC; SCCSP: PCPs (family/general practitioners, general internists, obstetrician/gynecologists)	
EXCLUSION CRITERIA:	Respondents who reported having a personal or family history (ie, one or more first-degree relatives) of CRC	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	NR	
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** 2 surveys with response rates exceeding 70%	
STATISTICAL ANALYSES:	**Describe:** They used contingency tables with x2 tests to assess sociodemographic and health care access factors associated with average-risk adults not current with CRC screening and reporting lack of physician recommendation as their main reason. They entered variables that showed a statistically significant association in bivariate analyses at a *P* value of, 0.20	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Klabunde et al.[30] **Year of publication:** 2005 **Dates of data collection:** 1999-2000 **Trial name:** NA
	into 2 logistic regression models to further assess potential predictors in multivariate analyses.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	**NR**
OUTCOME ASSESSMENT:	**Outcome Measures:** Measured barriers to CRC screening identified by PCPs and average-risk adults who were not current with screening.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** PCPs more often identified patient-related (80%) than health care system-related (68%) factors as major barriers. Similarly, average-risk adults who were not current with CRC screening more often identified patient-related (77%) than system-related (22%) barriers as the main reason they were not current with testing, for both FOBT and colorectal endoscopy. Although a majority of PCPs (56%) identified patient embarrassment or anxiety about CRC screening tests as a major barrier, #1% of adults indicated this as their main reason for not being current with screening. Of the system-related barriers, PCPs more often identified cost/lack of insurance coverage as a major barrier (46%) than did adults (>1%). 37% of PCPs identified failure of PCPs to actively recommend CRC screening to their patients as a major barrier, compared to approximately 20% of adults. PCPs; N, 1235; %, 67.6; 95% CI, 65.0–70.2; Adults Aged 50 or Older Who had not Been Tested Ever or Recently for FOBT: N, 6497; %, 21.6; 95% CI, 20.2–23.0 or CRE: N, 6497; %, 22.2; 95% CI, 20.9–23.6; 37% of PCPs identified failure of PCPs to actively recommend CRC screening to their patients as a major barrier, compared to approximately 20% of adults.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Klabunde et al.[30] **Year of publication:** 2005 **Dates of data collection:** 1999-2000 **Trial name:** NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, N/A)
Were the groups similar at baseline regarding the most important prognostic indicators?			N/A
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			2 surveys with response rates exceeding 70%
Were the differential drop-out or response rates acceptable (≤ 15%)?			N/A
Were intervention/exposure measures valid, reliable, and equally applied?			N/A
Were the outcome assessors blinded to the intervention or exposure status of subjects?			N/A
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Koroukian, S.M., et al.[31] **Year of publication:** 2005 **Dates of data collection:** 1998-1999 **Trial name:** NA		
OBJECTIVE OR AIM:	The authors sought to study colorectal cancer screening among Medicare FFS beneficiaries in relation to levels of Medicare managed care activity (MCA).		
DESIGN:	**Setting:** US **Study design:** Cross-sectional study **Duration (mean followup):** No follow-up, data from 1998-19999 **Overall study size (N enrolled/N analyzed):** 23 million (2,655 counties)		
	Low MCA	**Moderate MCA**	**High MCA**
Sample size:	Sample size: 2027 counties	Sample size: 449 counties	Sample size: 179 counties
Describe intervention:	No intervention	No intervention	No intervention
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; 1999 population-based Outpatient Standard Analytic File (SAF) and Physician/Supplier Part B (SAF) file, 1999 Denominator file, and 1998 ARF		
INCLUSION CRITERIA:	Medicare beneficiaries age 65+, counties in contiguous states and Hawaii with more than 1000 beneficiaries, or those in which total enrollment in Medicare FFS exceeded 10,000 months		
EXCLUSION CRITERIA:	8 counties without gastroenterologists or primary care physicians, as well as 36 unique area codes found in Medicare files but not in the Area Resource File (ARF); claims that carried—at the procedure level—additional diagnosis codes indicating symptoms (eg, abdominal distension, or anemia) or previous conditions, such as Crohn disease, for which surveillance was indicated; barium enema		
POPULATION CHARACTERISTICS:	**Low MCA**	**Moderate MCA**	**High MCA**
Mean age & range (years):	Age: 27.5% 65-69, 26% 70-74, 21% 75-79, 14% 80-854, 11% 85+	Age: 25% 65-69, 26% 70-74, 22% 75-79, 15% 80-84, 12% 85+	Age: 23% 65-69, 26% 70-74, 23% 75-79, 13% 80-84, 13% 85+
Sex (% female):	Sex: 60% female	Sex: 61% female	Sex: 61% female
Race:	Race: 91% White, 7% Black, 2% Other	Race: 88% White, 9% Black, 3% Other	Race: 85% White, 6% Black, 9% Other
Other:			
	All		
Attrition/Drop-out (not available for endpoint measurement):	NA		
Adherence:			
Contamination:			
Response Rates (e.g. for surveys):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Koroukian, S.M., et al.[31] **Year of publication:** 2005 **Dates of data collection:** 1998-1999 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** Conducted descriptive analyses to study the demographic profile and physician supply by MCA level and tested the presence of bivariate associations between categorical variables using x2 statistics. The authors used the individual as the unit of analysis, and obtained adjusted odds ratios (AORs) by employing multilevel logistic regression models to assess the likelihood of undergoing CRC screening procedure given the MCA level, after controlling for individual- and county-level characteristics.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** Procedure codes for FOBT, sigmoidoscopy, and colonoscopy.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Positive association between CRC screening and greater level of MCA, adjusting for county-level sociodemographic attributes and physician resources. Greater level of MCA associated with CRC screening: High vs. low MCA: • FOBT: AOR, 1.10 (95% CI, 1.04-1.16) • Colonoscopy: AOR, 1.07 (95% CI, 1.03-1.10) • FS: AOR, 0.98 (95% CI, 0.93-1.03) No absolute screening rates given. Moderate MCA was not associated with increased use of FLEX but was positively associated with FOBT and both measures of colonoscopy. No consistent association between CRC screening and level of MCA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Koroukian, S.M., et al.[31] **Year of publication:** 2005 **Dates of data collection:** 1998-1999 **Trial name:** NA
for monitoring the use and quality of colorectal cancer screening?	
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?	X		NA
Were intervention/exposure measures valid, reliable, and equally applied?		X	
Were the outcome assessors blinded to the intervention or exposure status of subjects?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		But probably inadequate
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: RPH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Koroukian, S.M., et al.[32] **Year of publication:** 2006 **Dates of data collection:** 1999 and 1998 **Trial name:** NA	
OBJECTIVE OR AIM:	To assess the disparities in CRC screening between elderly dual Medicare-Medicaid enrollees (duals) and non-duals.	
DESIGN:	**Setting:** 1999 Medicare Denominator File, the Medicare Outpatient Standard Analytic Files, Physician Supplier part B files, 1998 Area resource File. **Study design:** Cross-sectional study **Duration (mean followup):** No follow-up **Overall study size (N enrolled/N analyzed):** 23 million Medicare beneficiaries	
	Duals	**Non-duals**
Sample size:	2.5 million	20.2 million
Describe intervention:	No intervention	
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based	
INCLUSION CRITERIA:	Duals: Age 65+, reside in contiguous states and Hawaii, enrolled in Medicare for the entire calendar year, and receiving care exclusively through the fee-for-service system Non-duals: No history of enrollment in the stat buy-in program for Part A and Part B, reside in county with more than 1,000 beneficiaries or 10,000 FFS months of enrollment in Medicare, whichever is more	
EXCLUSION CRITERIA:	Duals: Not enrolled in the state buy-in program for Part A and Part B for all 12 months of the study year.	
POPULATION CHARACTERISTICS:	**Duals**	**Non-duals**
Mean age & range (years):	Age: 22% 65-69, 23% 70-74, 20% 75-79, 15% 80-84, 19% 85+	Age: 26% 65-69, 27% 70-74, 22% 75-79, 14% 80-84, 11% 85+
Sex (% female):	Sex: 74% female	Sex: 41% female
Race:	Race: 63% Caucasian, 21% African American, 16% Other	Race: 92% Caucasian, 5% African American, 3% Other
Other:		
Attrition/Drop-out (not available for endpoint measurement):	NR	
Adherence:		
Contamination:		
Response Rates (e.g. for surveys):		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Koroukian, S.M., et al.[32] **Year of publication:** 2006 **Dates of data collection:** 1999 and 1998 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** Used x2 statistics to test for statistical significance in bivariate associations. Conducted stratified analyses and compared the proportions of duals and non-duals undergoing various screening modalities with demographic categories. Calculated the age-race-sex adjusted rates of screening for duals and non-duals using the direct adjustment method. Hierarchical logistic regression models Adjusted Ors were used to assess likelihood of undergoing CRC screening after controlling for individual- and county-level characteristics.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** Procedure codes for FOBT, flexible sigmoidoscopy, and colonoscopy.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Duals were significantly less likely to undergo CRC screening ($P < 0.001$) and was consistent across all age, race, and sex strata, and procedural modalities. For all screening modalities, older age and African American race were associated with lower likelihood of undergoing screening Men were less likely to undergo FOBT (OR = 0.72, CI: 0.68, 0.76), more likely to undergo flexible sigmoidoscopy (OR=1.17, CI: 1.12, 1.22) or colonoscopy (OR=1.19, 1.15, 1.23). Use of CRC screening services decrease if dual enrollment in Medicare-Medicaid: FOBT (AOR, 0.48; 95% CI, 0.45-0.51), FS (AOR, 0.55; 95% CI, 0.49-0.61), FS or colonoscopy (AOR, 0.60; 95% CI, 0.54-0.67), colonoscopy (AOR, 0.85; 95% CI, 0.80-0.89
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Koroukian, S.M., et al.[32] **Year of publication:** 2006 **Dates of data collection:** 1999 and 1998 **Trial name:** NA
surveillance at the population level?	
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?	X		NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Lemon, S., et al.[33] **Year of publication:** 2001 **Dates of data collection:** June-August 1998 **Trial name:** NA
OBJECTIVE OR AIM:	The relation of personal characteristics, health and lifestyle behaviors, and cancer screening practices to current colorectal cancer (CRC) screening was assessed and compared with those factors' relation to current mammography screening in women and prostate-specific antigen (PSA) screening in men.
DESIGN:	**Setting:** State **Study design:** Cross-sectional survey **Duration (mean followup):** None **Overall study size (N enrolled/N analyzed):** 954
Sample size: **Describe intervention:**	**All** N = 954 Intervention: None, random digit dial survey
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Population-based; random digit dial
INCLUSION CRITERIA:	Massachusetts residents 50 years and older who were cognitively able, resided in a home with a working telephone number, and had never been diagnosed with CRC
EXCLUSION CRITERIA:	Men ever diagnosed with prostate cancer and women ever diagnosed with breast cancer
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Age: 52.6% 50-64, 27.8% 65-74, 19.6% 75-84 Sex: 56.6% female Race: 91% White, 9% Other
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** Among 1747 eligible persons contacted, 1119 (64%) completed the survey; 954 analyzed
STATISTICAL ANALYSES:	**Describe:** • Univariate analyses were used to describe the study sample and screening prevalence. Both in the total sample and in the analyses stratified by sex, bivariate x^2 statistics and odds ratios, with 95% confidence intervals, were used to document the crude relationship between each independent variable and CRC screening status.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Lemon, S., et al.[33] **Year of publication:** 2001 **Dates of data collection:** June-August 1998 **Trial name:** NA
	• Logistic regression was used to model the association between each outcome measure and health and lifestyle behavior.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Personal characteristics were considered potential confounders if they were marginally associated with the outcome or the exposure variables in bivariate analyses or were strongly associated in prior literature. Variables included: Demos (age, race, ethnicity, gender, marital status, education) Health factors (family history) Access (income, insurance, regular check-ups) Health/risk behavior (vitamin supplement use, screening practices, smoking)
OUTCOME ASSESSMENT:	**Outcome Measures:** • Patient experiences with FOBT, colonoscopy, and sigmoidoscopy • Persons were considered currently screened on the basis of recent guidelines15 if they reported having had 1 or more of the following: (1) a fecal occult blood test within the previous year; (2) flexible sigmoidoscopy within the previous 5 years; (3) colonoscopy within the previous 10 years; (4) a double contrast barium enema within the previous 10 years. This definition included those who received a CRC test for screening as well as for diagnostic reasons.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • While neither sex nor education had an independent effect, an interaction between education and sex emerged. Compared with men with a college degree or higher, those with less than a high school diploma (OR=0.11; 95% CI=0.04, 0.32; p=.001) and men with high school diplomas or some college or trade school (OR=0.31; 95% CI=0.15, 0.64; p=.002) were less likely to be currently screened. • Family history of CRC was an independent predictor of screening (OR=1.98; 95% CI= 1.02, 3.86; *P* = 0.04). • Compared with those with private, non-HMO insurance, members of Medicare HMO plans were significantly more likely to be currently screened (OR=2.25; 95% CI=1.13, 4.46; p=.02). • Men and women who were currently screened for PSA and mammography, respectively, were more likely to be screened for CRC than those who were not (OR=4.40; 95% CI=2.94, 6.58; p<.001). • Those who had a regular checkup (OR=3.07; 95% CI=2.00, 4.71; p<.001) and vitamin supplement users (OR=1.87; 95% CI=1.27, 2.77; p=.02) had higher screening rates.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver	NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Lemon, S., et al. [33] **Year of publication:** 2001 **Dates of data collection:** June-August 1998 **Trial name:** NA
colorectal cancer screening and surveillance at the population level?	
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Among 1747 eligible persons contacted, 1119 (64%) completed the survey
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Levy, B.T., et al.[34] **Year of publication:** 2006 **Dates of data collection:** chart reviews were conducted from May to September 2004 **Trial name:**
OBJECTIVE OR AIM:	The purpose of this study was to examine patient and physician factors associated with documented CRC testing according to national guidelines.
DESIGN:	**Setting:** Cross-sectional study **Study design:** Secondary data analysis **Duration (mean followup):** 2004-2006 **Overall study size (N enrolled/N analyzed):** 511
Sample size:	511
Describe intervention:	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based; Participating physicians provided lists of their patients aged 55 to 80 years.
INCLUSION CRITERIA:	55-80 years
EXCLUSION CRITERIA:	Physicians: Patients primarily below age 50
POPULATION CHARACTERISTICS:	
Mean age & range (years): **Sex (% female):** **Race:**	Age range: 55-80; Mean age: 68.1 NR 99% White
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	Overall: 59% returned study materials

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Levy, B.T., et al.[34] **Year of publication:** 2006 **Dates of data collection:** chart reviews were conducted from May to September 2004 **Trial name:**
STATISTICAL ANALYSES:	**Describe:** The generalized estimating equations (GEE) approach in SAS PROC GENMOD was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for potential predictors of screening, taking into account random effects due to physicians.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	
OUTCOME ASSESSMENT:	**Outcome Measures:** • The main outcome variable was whether a patient was up-to-date with CRC as determined by medical record review. • "Up-to-date" was defined as any of the following within the time interval noted from the initial mailing date: five take-home hemoccult tests within the previous 5.5 years, FS within the previous 5.5 years, barium enema within the previous 5.5 years, or colonoscopy within the previous 10.5 years. • The overall CRC testing rate was defined as (number of patients with up-to-date CRC testing) / (total number of patients).
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Overall, 76% of patients stated that their physician had ever recommended CRC testing, with 71% reporting that they had completed at least one of the CRC tests. • Based on medical record review, 55% of patients had physician documentation of a CRC screening discussion, 64% had completed at least one CRC test ever, 54% had completed at least one CRC test in the past 5.5 years, and 46% were up-to-date with CRC screening. • Not including hemoccults, of the 234 patients up-to-date with screening, 90 (38%) were truly screened and 144 (62%) were tested because of symptoms. • Results, Patient self-report, Hemoccult X 3, Doc ever recommend?, 265 (51.9); Completed Recommended test?, 231 (45.2) vs Medical record review, Hemoccult X 3, MD recommended, 87 (17.0); At least one test ever completed, 183 (35.8); Up-to-date with test, 5 (1.0); Proportion of current tests done for screening, unable to calculate; Patient self-report, FS, Doc ever recommend?, 129 (25.2); Completed Recommended test?, 114 (22.3) vs Medical record review, FS, MD recommended, 61 (11.9); At least one test ever completed, 80 (15.7); Up-to-date with test, 25 (4.9); Proportion of current tests done for screening, 15 (60.0); Patient self-report, Colonoscopy, Doc ever recommend?, 295 (57.7); Completed recommended test?, 263 (51.5) vs Medical record review, Colonoscopy, MD recommended, 220 (43.1); At least one test ever

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Levy, B.T., et al.[34] **Year of publication:** 2006 **Dates of data collection:** chart reviews were conducted from May to September 2004 **Trial name:**
	completed, 225 (44.0); Up-to-date with test, 208 (40.7); Proportion of current tests done for screening, 60 (28.9), Patient self-report, Any colon cancer screening test, Doc ever recommend?, 389 (76.1); Completed recommended test?, 360 (70.5) vs Medical record review, Any colon cancer screening test, MD recommended, 279 (54.6); At least one test ever completed, 328 (64.2); Up-to-date with test, 234 (45.8); Proportion of current tests done for screening, 90 (38.5) (not including hemoccults); Physician Predictors, Patient recalls MD recommendation, No, 218 (20.6); Yes, 283 (64.7); OR (95% CI), 6.4 (4.2–9.6); P <0.001; MD documented CRC discussion, No, 232 (14.7); Yes, 279 (71.7); OR (95% CI), 14.1 (8.5–23.3); P <0.001; Patient Perceptions/Satisfied with: Doctor's discussions of screening importance; Low, 123 (27.6); High, 310 (59.7); OR (95% CI), 3.6 (2.5–5.3); P <0.001; MD Doctor's discussion of screening options; Low, 152 (33.6); High, 266 (60.5); OR (95% CI), 2.8 (1.8–4.5); P <0.001; MD Input into the screening decision; Low, 144 (34.0); High, 261 (61.7) OR (95% CI), 2.9 (2.0–4.3); P <0.001; MD Comfort in asking doctor questions about CRC screening; Low, 76 (26.3); High, 400 (52.5); OR (95% CI), 3.1 (1.7–5.4); P <0.001; MD; Satisfied with doctor's discussions of screening importance: CRC testing (up-to-date), N, 511; OR (95% CI), 3.3 (2.2–4.8); P <0.001; Asymptomatic screening, N, 367; OR (95% CI), 3.0 (1.8–5.1); P <0.001; Diagnostic testing, N, 421; OR (95% CI), 3.8 (2.5–5.7); P <0.001
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			Yes, if you consider the statistic adjustments made
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			59% returned study materials
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		They looked for 5 FOBT within 5.5 years to be up-to-date, rather than 1 in the past 1 year.
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Ling, B.S., et al.[35] **Year of publication:** 2006 **Dates of data collection:** 2002-2003 **Trial name:** Health Information National Trends Survey (HINTS)
OBJECTIVE OR AIM:	Assessed the association between provider–patient interaction with colorectal cancer screening utilization and compared the information seeking patterns, sources of information, trust in cancer information, and Internet usage among respondents who were up to date with colorectal cancer screening with those who were not.
DESIGN:	**Setting:** Telephone survey **Study design:** Cross-sectional, econdary data analysis **Duration (mean followup):** 2002-2003 administration of the HINTS **Overall study size (N enrolled/N analyzed):** 2,670 respondents
Sample size: **Describe intervention:**	2,670 respondents
RECRUITMENT: (population-based, clinic-based, volunteer, other)	List-assisted random digit dialing
INCLUSION CRITERIA:	51 years and greater
EXCLUSION CRITERIA:	Those 50 or younger; prior personal history of CRC
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**Sample** Age: 51+; 39.6% 51-60, 29.3% 61-70, 30.1% 71+ Sex: 63.1% female Race: 80% White, 10.5% African American, 9.5% Other
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	Overall response rate 62.8%
STATISTICAL ANALYSES:	**Describe:** Descriptive statistics were generated for all variables as frequencies or means. Chi-square tests were conducted to assess for significant differences in the primary outcome variable with regard to the categorical variables The association between continuous variables and the primary outcome was assessed using the nonparametric

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Ling, B.S., et al.[35] **Year of publication:** 2006 **Dates of data collection:** 2002-2003 **Trial name:** Health Information National Trends Survey (HINTS)
	Wilcoxon rank-sum test. For those communication=information-related items found significantly associated with colorectal cancer screening behavior, logistic regression models were used to assess for adjusted effect after controlling for all respondent characteristics.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** Provider-patient interaction, information seeking, channel reliance, channel credibility, internet usage, and colon cancer screening behavior measures The primary outcome variable was colorectal cancer screening defined as being up to date or not.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** No statistically significant differences were seen between the up-to-date and not-up-to-date groups for each of the provider–patient interaction items (“the provicer always: listens carefully, explains things, shows respect, spends enough time, involves patients in decisions”. Conversely, for information seeking, the up-to-date group had a statistically significant higher percentage who had sought cancer information (52.9% vs. 36.8%, *P*<.001) and had others do the information search (21.9% vs. 12.5%, *P*<.001). Significant differences were seen in the percentage of respondents between the groups in the desire for cancer information from personalized reading materials (p<.05) and publications (*P*<.001). As for trust in cancer information from specific sources, an overwhelming percentage trusted the doctor in both the up-to-date (95.4%) and not-up-to-date (88.4%) groups, with a significant difference seen between the groups (*P*<.001). When asked about Internet usage, among those who go on-line, 63% in the up-to-date group use it to look up cancer information compared with the 54.8% who are not up to date (*P*<.01). Logistic regression models showed that having trust in cancer information from the doctor was most predictive for being up to date (OR 2.08, 95% CI 1.49–2.94). Other items remaining significantly associated with being up to date included the following: searched for cancer information, had others search for cancer information, desired cancer information from personalized reading materials or a publication, and used the Internet for cancer information. Trust in MD associated with greater screening. Other interaction items not significant.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Ling, B.S., et al.[35] **Year of publication:** 2006 **Dates of data collection:** 2002-2003 **Trial name:** Health Information National Trends Survey (HINTS)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			response rate 62.8%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		

Quality Rating (Good, Fair, or Poor): Fair
Reviewer #1 initials: BLM
Reviewer #2 initials: MJG
Comments (explain poor quality ratings):

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Matthews, B., et al.[36] **Year of publication:** 2007 **Dates of data collection:** Spring 2005 **Trial name:** NA
OBJECTIVE OR AIM:	The purpose of this study was to examine potential indicators of success in a geographic area of the US that has previously shown relatively high CRC screening rates. Our goal was to survey a representative sample of approximately 1050 age-appropriate southeastern Wisconsin residents regarding their health beliefs, behaviors, and current CRC screening status.
DESIGN:	**Setting:** Wisconsin, telephone survey **Study design:** Cohort survey study **Duration (mean followup):** No follow-up **Overall study size (N enrolled/N analyzed):** 1,068 interviews completed/1,033 interviews analyzed
Sample size: **Describe intervention:**	**All** Sample size: 1,033 Intervention: None, survey
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based, random digit dial
INCLUSION CRITERIA:	Age between 50-79, English proficiency, and informed consent for research participation.
EXCLUSION CRITERIA:	Only one person per household, previous diagnosis of CRC
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Age: 52.9% 50-64, 47.1% 65-79 Sex: 56.1% female Race: 9.3% Other, 90.7% White
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** Simple response rate of 88% Using CASRO formula the response rate was 60.7%.
STATISTICAL ANALYSES:	**Describe:** Contingency tables (v2) were used to test bivariate relations; logistic regression was used to generate multivariate models. Because of the large number of potential indicators, authors used bivariate analysis to identify variables to be included in multivariate analyses

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Matthews, B., et al.[36] **Year of publication:** 2007 **Dates of data collection:** Spring 2005 **Trial name:** NA
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Variables included: Demographics (county of residence, age, gender, race, education) Health care (have regular MD, freq of visits, annual physicals, MD recomm for screening) Health factors (screening behavior, family/personal history, exercise, eating) Access (health insurance) Care behavior/pscyho (worries about cancer) KABRs (knowledge of CRC, beliefs, locus of control)
OUTCOME ASSESSMENT:	**Outcome Measures:** FOBT within 12 months preceding the survey, FS within 5 years, or CS within 10 years
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Adults 65 to 79 were more than twice as likely to report up-to-date test use as adults age 50 to 64 (OR = 2.38; 95% CI = 1.76–3.21) Respondents who reported visiting a physician regularly were more likely to report being current with screening (AOR 2.02; 95% CI, 1.49-2.74) Respondents were more likely to be screened if they believed the tests are safe (AOR, 1.39; 95% CI, 1.09-1.78); that it's irresponsible not to get tested (AOR, 2.16; 95% CI, 1.67-2.78); or had a positive attitude about screening in general (AOR, 2.35; 95% CI, 1.76-3.13); *P*-values 0.05 or better Respondents were less likely to be screened if they had anxiety about the tests (AOR, 0.50; 95% CI, 0.49-0.64) or believed that if they are healthy, they don't need to be tested (AOR, 0.58; 95% CI, 0.42-0.79); *P*-values 0.05 or better The odds of up-to-date screening test use increased twofold among individuals who reported visiting their physicians on a regular basis (OR = 2.11; 95% CI = 1.41–3.16), for those at higher risk for CRC because of familial or personal risk factors (OR = 2.26, 95% CI = (1.47–3.49), and among those who reported using their physicians as their primary source of health information (OR = 2.27, 95% CI = 1.33–3.90). The odds of up-to-date screening test use increased about 68% among individuals who participated in other cancer screening tests such as breast or prostate cancer exams (OR = 1.68, 95% CI = (1.20–2.37). Adherence, as reflected by compliant attitudes toward physician recommendation to test for CRC (OR 2.54, 95% CI = 1.75–3.67), and responsibility to test for CRC by age 55 showed the strongest effects, increasing the odds of current testing by about 150% to 140%, respectively, compared to non-current test use. The odds of current testing decreased about 40% among respondents reporting greater anxiety about CRC testing procedures (OR = 1.40 , 95% CI = 1.02–1.92) and about 48% among those who thought there was no reason for

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Matthews, B., et al.[36] **Year of publication:** 2007 **Dates of data collection:** Spring 2005 **Trial name:** NA
	healthy people to test for CRC (OR = 0.52, 95% CI = 0.35–0.77).
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Simple response rate of 88% Using CASRO formula the response rate was 60.7%.
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		

Quality Rating (Good, Fair, or Poor): Fair
Reviewer #1 initials: BLM
Reviewer #2 initials: DJH
Comments (explain poor quality ratings):

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Are there gender differences in colorectal cancer test use prevalence and correlates	**Authors, ref ID:** McQueen, et al.[37] **Year of publication:** 2006 **Dates of data collection:** Data from 2002 to 2003 HINTS used **Trial name:** data from HINTS used
OBJECTIVE OR AIM:	Addressed the following questions: (a) Are prevalence rates for lifetime, recent, and repeat FOBT and endoscopy similar for males and females? (b) Are the demographic, health status, access to health care, and health behavior correlates of FOBT and endoscopy use previously reported in the literature similar for males and females? (c) Are the patterns of these correlates similar to findings from other national surveys? (d) Are psychosocial variables in the HINTS, including knowledge, cancer-related beliefs, and cancer communication, associated with FOBT and endoscopy use, and are the associations similar for males and females?
DESIGN:	**Setting:** US **Study design:** cross sectional; HINTS was a cross-sectional study conducted from 2002 to 2003 using random digit dialing **Duration (mean followup):** data collected for 1 year, no follow-up data reported **Overall study size (N enrolled/N analyzed):** 2686
Sample size: **Describe intervention:** NA	Of the 6,369 telephone surveys completed by adults ages >= 18 years, 2,734 were ages >=50 years. Of those, 2,686 had no personal history of colon or rectal cancer and comprised the sample used in this report NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population based through telephone interviews: random digit dialing
INCLUSION CRITERIA:	One adult (>=18 years) per household was eligible to participate.
EXCLUSION CRITERIA:	Personal history of colon or rectal cancer
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	63% were female and 74% were non-Hispanic White. The average age was 64.4 years old (SD = 10.4 years) and ranged from 50 to 95 years
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	Telephone interviewers were able to reach 19,509 households. The final response rate for an initial screening interview was 55%, calculated according to the guide of Standard Definitions published by the American Association for Public Opinion Research. The final response rate for the full HINTS interview was 62.8%. Full details of the sampling plan are reported elsewhere

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Are there gender differences in colorectal cancer test use prevalence and correlates	**Authors, ref ID:** McQueen, et al.[37] **Year of publication:** 2006 **Dates of data collection:** Data from 2002 to 2003 HINTS used **Trial name:** data from HINTS used
Response Rates (e.g. for surveys):	
STATISTICAL ANALYSES:	Telephone exchanges were geographically stratified to oversample from exchanges estimated to have 15% African American and Hispanic residents. Final data were weighed to be nationally representative. Stratified analyses by gender instead of testing interactions with gender to explore differences in the patterns of associations. Descriptive analyses were conducted using SAS and Survey Data Analysis (SUDAAN) to report both observed sample sizes and weighed percentages. **Prevalence of Colorectal Cancer Test Use:** Examined colorectal cancer test use prevalence rates by gender for lifetime, recent, and repeat use of home FOBT, sigmoidoscopy, and colonoscopy alone and in combination, as well as whether any of the three tests had been completed. Used 95% confidence intervals (95% CI) to compare the rates for males and females. Prevalence estimates were age adjusted. The denominator for repeat colorectal cancer test use was restricted to respondents who would be eligible to complete two screening tests (i.e., two FOBTs within 2 years or two endoscopy tests within 20 years). Conducted analyses using SUDAAN software and a replicate weight jackknife estimate of variance to account for the sampling design and to calculate appropriate population estimates; therefore, the results reflect weighed and design-adjusted data. Additionally, reasons for not completing a colorectal cancer test have been previously reported but have not been examined for gender differences. Identifying gender-specific and test-specific barriers to colorectal cancer test use may be important for future interventions designed to increase colorectal cancer test use. To explore whether reasons for not being tested differed by gender, conducted descriptive analyses with a subset of respondents who had seen a health care provider in the past year but had not had a colorectal cancer test within recommended time intervals. Respondents could give multiple reasons for not having had a FOBT or endoscopy. Categorized responses into patient- or system level factors following Klabunde et al. (25). **Correlates of Colorectal Cancer Test Use**. Used multivariable logistic regression analysis with SUDAAN to examine correlates of colorectal cancer test use by gender and test type (FOBT and endoscopy), thereby creating four regression models (one for each combination). Two dependent variables were home FOBT use in the past year and recent endoscopy (i.e., sigmoidoscopy or colonoscopy in the past 10 years). The reference group for both variables was no colorectal cancer test of any type within recommended intervals. Used ORs and 95% CIs to summarize the results. CIs for males and females that do not overlap may suggest gender differences. **Analysis Strategy**. To facilitate comparison with other national surveys, used a two-step analysis procedure for all four regression models. In step 1, examined variables measuring demographics, access to health care, health status, and health behaviors that have been previously examined with nationally representative samples and explored whether their associations with colorectal cancer test use differed by gender. Correlates that were statistically significant ($P < 0.05$) in at least one of the four models in step 1 were retained in all step 2 regression models. In step 2, added variables from the HINTS that have not been previously examined in national surveys (i.e., knowledge, beliefs, and cancer communication). Family history of cancer has been consistently associated with colorectal cancer test use in the literature and was retained in step 2, although it was not statistically significant in

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Are there gender differences in colorectal cancer test use prevalence and correlates	**Authors, ref ID:** McQueen, et al.[37] **Year of publication:** 2006 **Dates of data collection:** Data from 2002 to 2003 HINTS used **Trial name:** data from HINTS used
	step 1. Because results did not change when this variable was removed from analyses, chose to retain it to enable comparisons with other studies. Effect estimates with cell sizes V 5 were not presented. ''Don't know'' or missing responses were included when the percent of missing data was large and potentially meaningful (e.g., income and perceived risk) or when ''don't know'' was similar in meaningto a valid ''no opinion'' response choice (e.g., cancer beliefs).
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	HINTS survey collected information on: demographic variables, access to health care, health status, health behaviors, knowledge of CRC screening guidelines, beliefs about cancer risk, beliefs about colorectal cancer test use, beliefs about cancer in general, "cancer worry", "degree to which participants paid attention to any health or medical topics via television, radio, newspapers, magazines, or the Internet", trust in information from these sources, trust in healthcare providers/family/friends for cancer information, cancer information seeking behavior
OUTCOME ASSESSMENT:	To assess colorectal cancer test use, individuals were first read a description of one of three test types (home FOBT, sigmoidoscopy, and colonoscopy) and asked whether they had ever heard of the test (no/yes). Respondents who had heard of the test were then asked whether they had ever had the test (lifetime use: no/yes), when the test was completed, and when the next-to-last test was completed. Persons who reported experience with both sigmoidoscopy and colonoscopy were asked to report when their most recent endoscopic test was completed. The survey did not distinguish which endoscopy test was the most recent and so responses reflected either procedure. Individuals were considered currently adherent to guidelines for colorectal cancer testing if they reported having a home FOBT within the past year or endoscopy within the past 10 years. Use of double contrast barium enema was not assessed in the HINTS.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	Females reported slightly higher lifetime (ever) and recent use of FOBT than males (17.1% lifetime and 9.3% recent for female; and 12.1% lifetime and 5.2% recent for male) Males and females who visited a physician 1 or more times in the previous year were more likely to be screened by endoscopy than those with no visits in the prior year (AOR 5.12; 95% CI, 2.54-10.29 and OR 4.89; 95% CI, 1.79-13.37, respectively; $P < 0.05$) "Not having a doctor" was associated with not being screened for CRC in both males (AOR, 0.1; 95% CI, 0.0-0.5 for FOBT and OR, 0.5; 95% CI, 0.1-1.9 for endoscopy) and females (AOR, 0.2; 95% CI, 0.1-0.8 for FOBT and OR, 0.5; 95% CI, 0.2-1.4 for endoscopy) Males and females were more likely to be screened if they understood the appropriate time intervals for FOBT (AOR, 5.42; 95% CI, 2.52-11.66 for males and AOR, 5.25; 95% CI, 3.23-8.52 for female) and endoscopy (AOR, 4.69; 95% CI, 2.55-8.65 and AOR, 3.18; 95% CI, 2.26-4.47, respectively) Females were more likely to be screened if they believed they were more likely than others to be diagnosed with CRC (AOR, 2.53; 95% CI, 1.43-4.46 for endoscopy); if they believed CRC testing leads to early detection (AOR, 3.03; 95% CI, 1.03-8.93 for FOBT); or if they had a fear of finding cancer (AOR, 1.78; 95% CI, 1.18-2.68)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Are there gender differences in colorectal cancer test use prevalence and correlates	**Authors, ref ID:** McQueen, et al.[37] **Year of publication:** 2006 **Dates of data collection:** Data from 2002 to 2003 HINTS used **Trial name:** data from HINTS used
	Males and females were less likely to be screened if they didn't know if the tests were too expensive (0.43; 95% CI, 0.24-0.78 and 0.46; 95% CI, 0.30-0.71 for endoscopy, respectively) Females were also less likely to be screened with FOBT if they believed it was too expensive (AOR, 0.55; 95% CI, 0.32-0.93) or didn't know the costs (AOR, 0.46; 95% CI, 0.27-0.79) All *P* values < 0.05
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Good

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			n/a
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	x		As mentioned, response rate for full HINTS interview as >60%
Were the differential drop-out or response rates acceptable (≤ 15%)?			n/a
Were intervention/exposure measures valid, reliable, and equally applied?	x		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			n/a
Were outcome measures valid, reliable, and equally applied?	x		Self-report may have overestimated screening, but this was equal across all participants
Does the analysis control for baseline differences?	x		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	x		
Were the statistical methods used to assess the abstracted outcomes appropriate?	x		
Quality Rating (Good, Fair, or Poor): good Reviewer #1 initials: MJG Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Messina, CR, et al.[38] **Year of publication:** 2009 **Dates of data collection:** October 2004 – January 2005 (Group 1), April 2004 – July 2004 (Group 2) **Trial name:** NA	
OBJECTIVE OR AIM:	To examine the use of CRC screening exam modalities among county health centers and private physician offices, where both were located in the same geographic area.	
DESIGN:	**Setting:** telephone survey of Suffolk County, New York residents **Study design:** Cross-sectional **Duration (mean follow-up):** NA **Overall study size (N enrolled/N analyzed):** N = 1070 enrolled and analyzed	
Sample size:	**Group 1 (County Health Center Patient)** n = 570	**Group 2 (Private Physician Patient)** n = 570
Describe intervention:	NA (no intervention – cross-sectional telephone survey)	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based – details: Group 1: The authors randomly selected participants from sampling frame of adults who were age-eligible for CRC screening and who received primary care at Suffolk county health centers. They stratified random sample selection by health center to balance proportions of participants from each. Group 2: The authors obtained data for the random population-based private physician patient sample as part of our NCI-funded Reducing Barriers to Colorectal Cancer Screening Project. They oversampled adults aged 65–75 years and conducted random selection in blocks stratified on gender and age group.	
INCLUSION CRITERIA:	Group 1: (1) be without a prior diagnosis of CRC, colonic polyps, or other colorectal diagnoses requiring surveillance rather than screening in the general population (e.g., UC or Crohn's); (2) not be too impaired to answer questions; (3) consent to the telephone survey; (4) speak either English or Spanish; (5) age-eligible for CRC screening; and (6) receive care at the county health centers. Group 2: Same as above but only included English speaking participants	
EXCLUSION CRITERIA:	Group1: none listed Group 2: none listed	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**Group 1** Female: 68% Age 52–64 (vs. 65–75): 76% (n = 382) Race/ethnicity White (non-Hispanic): 47% Hispanic: 29% African American (non-Hispanic):	**Group 2** Female: 59% Age 52–64 (vs. 65–75): 48% (n = 270) Race/ethnicity White (non-Hispanic): 94% Hispanic: <1% African American (non-Hispanic):

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Messina, CR, et al.[38] **Year of publication:** 2009 **Dates of data collection:** October 2004 – January 2005 (Group 1), April 2004 – July 2004 (Group 2) **Trial name:** NA		
	20% Other: 5% Education <HS: 34% HS graduate: 32% Post HS/trade school/technical school/some college: 22% ≥ College degree: 10% Annual household income <$15,000: 50% $15,000–$24,999: 25% $25,000–$44,999: 16% ≥ $45,000: 9% Medical insurance coverage No insurance: 44% Medicare/Medicaid: 49% Other commercial: 6% HMO: 2% Survey language English (vs. Spanish): 80%	4% Other: 2% Education <HS: 4% HS graduate: 29% Post HS/trade school/technical school/some college: 29% ≥ College degree: 38% Annual household income <$15,000: 5% $15,000–$24,999: 7% $25,000–$44,999: 17% ≥ $45,000: 71% Medical insurance coverage No insurance: 3% Medicare/Medicaid: 5% Other commercial: 59% HMO: 33% Survey language English (vs. Spanish): 100%	
	Group 1	**Group 2**	Overall
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	NA	NA	
Response Rates (e.g. for surveys):	Response Rate: 52%	Response Rate: 47%	
STATISTICAL ANALYSES:	**Describe:** Bivariate cross-tabular analyses and Chi-square tests of association were used to examine the relationship between source of primary care, participant characteristics, CRC screening, and barriers to screening. Bivariate analyses stratified by age group identified potential confounders. Logistic regression analyses were used to evaluate the probability of reporting recent screening for each screening modality separately, for the health center and private practice patient samples. All participant characteristics were		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Messina, CR, et al.[38] **Year of publication:** 2009 **Dates of data collection:** October 2004 – January 2005 (Group 1), April 2004 – July 2004 (Group 2) **Trial name:** NA
	included in the multivariate model. They computed odds ratios from maximum-likelihood parameter estimates, and calculated 95% confidence intervals. They reported the Nagelkerke R^2 as an indicator of the usefulness of the explanatory variables to predict CRC screening.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Multivariate logistic regression controlled for potential covariate effects of sociodemographic, health status and screening barrier variables
OUTCOME ASSESSMENT:	**Outcome Measures:** They determined CRC screening exam use by responses to questions asking whether the participant had ever had FOBT, sigmoidoscopy, or colonoscopy, and the date of each most recent exam. They based screening intervals for FOBT and sigmoidoscopy on guidelines from the ACS, the Interdisciplinary Task Force, and the U.S. Preventive Services Task Force
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Overall (considering the three screening modalities), the private physician patient sample reported higher CRC screening than the county health center registrants (70% vs. 55%, *P* < 0.001). While a greater proportion of county health center registrants reported an FOBT in the past year (37% vs. 31%, *P* < 0.042), private patients were more likely to report a recent endoscopy (59% vs. 33%, *P* < 0.001). • For the most part, the authors did not find CRC screening disparities associated with any of the sociodemographic variables or self-reported health status in adjusted analyses. Exceptions to this are as follows: • County health center participants with a college education were significantly more likely to report recent sigmoidoscopy than those with less than a college education (AOR = 3.23, 95% CI (1.08 – 9.64), *P* = 0.04). • Among county health center participants, other commercial/HMO insurance coverage was associated with significantly with lower odds of FOBT (OAR = 0.35, 95% CI (0.14 – 0.91) *P* = 0.02), while Medicare/Medicaid significantly with greater odds of sigmoidoscopy (OAR = 2.72, 95% CI (1.18 – 6.25) *P* = 0.02) or colonoscopy (OAR = 2.11, 95% CI (1.17 – 3.80) *P* =0.01), compared with no coverage. • African American (vs. white) adults (OAR = 0.17, 95% CI (0.05 – 0.52), *P* < 0.001) and those with a high school education (OAR = 0.40, 95% CI (0.21 – 0.73), *P* < 0.001) were significantly less likely to report recent colonoscopy. • No physician recommendation and other perceived barriers to screening contributed to decreased CRC screening among county health center and private physician office participants. • Results of multivariate logistic regression models describing screening barriers associated with recent CRC screening among users of private physician offices • CHC patients less frequently cited no physician recommendation as a barrier to FOBT, but more frequently cited no recommendation as a barrier to FS and colonoscopy, compared with PPO patients (p<0.02)
KQ3 - Which strategies are effective in increasing the appropriate use of	**NA**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Messina, CR, et al.[38] **Year of publication:** 2009 **Dates of data collection:** October 2004 – January 2005 (Group 1), April 2004 – July 2004 (Group 2) **Trial name:** NA
colorectal cancer screening and follow-up?	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**NA**
QUALITY RATING:	**Fair**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			X – The response rates were 47% for private physician participants and 52% for CHC participants, indicating a possibility of selection bias. Those who didn't participate in the survey could differ in a significant way from those who did.
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?			Used validated, NHIS survey items and CRC screening behavior/attitudinal questions piloted prior to this study
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Muus, K, et al.[39] **Year of publication:** 2009 **Dates of data collection:** 2004-2005 **Trial name:** NA	
OBJECTIVE OR AIM:	To describe the prevalence of FOBT testing (and PSA testing for prostate cancer) within the past year by age and rurality and to determine whether or not BMI is associated with receipt of FOBT (and PSA) among American Indian and Alaska Native men.	
DESIGN:	**Setting:** National survey of American Indian and Alaska Native men conducted by the National Resource Center on Native American Aging **Study design:** secondary analysis of cross-sectional data **Duration (mean followup):** NA **Overall study size (N enrolled/N analyzed):** 2447	
Sample size:	N = 2447	
Describe intervention:	No intervention; survey only	
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based convenience sample recruited through tribal service areas	
INCLUSION CRITERIA:	Complete records for all model covariates, self-report of never having been diagnosed with colorectal cancer (or prostate cancer)	
EXCLUSION CRITERIA:	NR	
POPULATION CHARACTERISTICS:	**FOBT in Past Year**	**No FOBT in Past Year**
Mean age & range (years): **Sex (% female):** **Race:** **Other:**	Age 55-64 34% 65-74: 40% ≥75: 27% Male: 100% Race: 100% American Indian or Alaska Native Residence Urban: 20% Large rural: 20% Small rural: 18% Isolated rural: 43%	Age 55-64 42% 65-74: 39% ≥75: 19% Male: 100% Race: 100% American Indian or Alaska Native Residence Urban: 20% Large rural: 17% Small rural: 17% Isolated rural: 46%

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Muus, K, et al.[39] **Year of publication:** 2009 **Dates of data collection:** 2004-2005 **Trial name:** NA
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	**NA**
Response Rates (e.g. for surveys):	**NR**
STATISTICAL ANALYSES:	**Describe:** The authors compared the frequency distributions for all independent variables by screening status, and assessed the association of FOBT testing by creating a logistic regression model that modeled the log-odds of FOBT receipt within the past year as a functional BMI category and the covariates.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Covariates were derived from the literature as potential confounders and included in the logistic regression model. Covariates included were: age, marital status, education, limitations in activities of daily living, smoking status, health insurance coverage, and rurality of residence
OUTCOME ASSESSMENT:	**Outcome Measures:** FOBT assessed through the question, "How long has it been since you had your last blood stool test using a home kit?"
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Having an FOBT was associated with higher age ($P < .001$), being married ($P < .001$), being unemployed during the past year($P < .001$), having a regular health care provider ($P < .001$), having health insurance ($P < .01$), having higher numbers of limitations in activities of daily living ($P < .001$), and being a non-smoker ($P < .001$). • Prevalence of FOBT use in past year in urban areas did not differ by age. In rural regions, men aged 65 and older showed a higher prevalence of recent FOBTs than younger men. • Adjusted screening odds ratios for FOBT screening in past year by BMI category showed that (using underweight, BMI < 18.5, as the reference group in logistic regression models) BMI was not associated with FOBT screening (data below). BMI Category OR 95% CI Underweight 1 Healthy 1 (0.5, 2.0) Overweight (0.5, 2.0) Obese I 1 (0.5, 2.2) Obese II 1 (0.4, 1.9) Obese III 0.9 (0.3, 1.8) 0.8

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Muus, K, et al.[39] **Year of publication:** 2009 **Dates of data collection:** 2004-2005 **Trial name:** NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NR – They report that 94 out of 243 regional tribal service areas agree to participate, but they do not report anything at the individual participant level
Were the differential drop-out or response rates acceptable (≤ 15%)?			NR
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR
Were outcome measures valid, reliable, and equally applied?		X	Self-reported of FOBT status in past year is subject to recall and social desirability bias
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID: Nguyen et al.**[40] **Year of publication:** 2008 **Dates of data collection:** July to October 2004 **Trial name:** NA
OBJECTIVE OR AIM:	Describe the baseline colorectal screening rates among participants in an on-going intervention study designed to increase such screening in Vietnamese Americans aged 50 to 74, identifies factors associated with screening, and recommends educational strategies to increase screening rates in this population.
DESIGN:	**Setting:** Telephone interview **Study design:** Baseline survey **Duration (mean followup):** only a one-time call **Overall study size (N enrolled/N analyzed):** 867
Sample size:	867
Describe intervention:	NA (Telephone survey
RECRUITMENT: (population-based, clinic-based, volunteer, other)	A cross-sectional sample was drawn from a sampling frame consisting of all individuals in the study area telephone directories with Vietnamese surnames previously used in a number of Vietnamese American studies.
INCLUSION CRITERIA:	1) self-identified as Vietnamese or Vietnamese American, 2) aged 50 to 74, 3) lived in Alameda or Santa Clara Counties, California or Harris County, Texas, and intended to stay in this study area for 2 years, and 4) understood either English or Vietnamese.
EXCLUSION CRITERIA:	Anyone not fitting inclusion criteria and those who already completed interviews.
POPULATION CHARACTERISTICS:	**Sample**
Mean age & range (years):	Range: 50-74 [29% 50-54; 22% 55-59; 22% 60-64; 27% 65-74]
Sex (% female):	47%
Race:	100% Vietnamese or Vietnamese American
Attrition/Drop-out (not available for endpoint measurement):	**Sample** The remaining call attempts reached 1,044 eligible respondents, of which 894 agreed to complete the interview for a response rate of 86%.
Adherence:	
Contamination:	
Response Rates (e.g. for surveys):	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID: Nguyen et al.**[40] **Year of publication:** 2008 **Dates of data collection:** July to October 2004 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** Frequency distributions were tabulated for demographics, health care characteristics, knowledge and attitudes, and colorectal screening rates. Multiple logistic regression models were developed to identify factors associated with such screening. The demographics, healthcare characteristics, and knowledge and attitudes were selected to be independent variables in the models because these variables were found to be associated with cancer screening test utilization among Vietnamese Americans in previous studies
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** The dependent variables were colorectal cancer screening test 1) recognition, 2) receipt, 3) currency, and 4) intention.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Factors positively associated with ever having been screened were being in the older age group (65 to 74 years), residing in California, having private or public insurance, having a regular place of care, having a personal doctor, having heard of colon polyps, worrying about colon cancer, thinking might develop colon cancer, thinking need FOBT and sigmoidoscopy/colonoscopy even if feel healthy, and thinking sigmoidoscopy/colonoscopy preparation troublesome. All significant. • Factors negatively associated included having annual household income less than $20,000, being employed, having a Vietnamese doctor, and thinking sigmoidoscopy/colonoscopy painful. All significant • In general, the rates of colorectal screening recognition, receipt, currency, and intention were low. 48% had ever had: FOBT, 20% Sigmoidoscopy, 26% Colonoscopy, 62% any test • 25% were up-to-date on FOBT, 16% were up-to-date on FS, and 23% were up-to-date on colonoscopy
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** O'Malley et al.[41] **Year of publication:** 2002 **Dates of data collection:** January 2000 - March 2000 **Trial name:** NA
OBJECTIVE OR AIM:	Examine the effects of primary care, health insurance, and HMO participation on adherence to regular breast, cervical, and colorectal cancer screening
DESIGN:	**Setting:** low income communities in DC **Study design:** RDD and targeted telephone survey **Duration (mean follow-up):** NA **Overall study size (N enrolled/N analyzed):** 1205 in sample
Sample size:	1205
Describe intervention:	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	List of telephone numbers to obtain a 25% RDD (from phone exchanges in low income census tracts) and 75% targeted listed households
INCLUSION CRITERIA:	female, over 40 years, residing in DC in low income areas
EXCLUSION CRITERIA:	
POPULATION CHARACTERISTICS:	
Mean age & range (years): **Sex (% female):** **Race:**	64.8 years (16.3% 41-49 years) 100% 82.7% Black
Other:	26.5% living as married 84.8% had a regular doctor 13.2% uninsured
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	NA
Response Rates (e.g. for surveys):	85%
STATISTICAL ANALYSES:	**Describe:** chi-square and log reg
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Age, household income, race/ethnicity, education, work status, marital status, family size, health status, cancer knowledge/ attitudes and beliefs, insurance status and plan type, features of primary care and patient-clinician

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** O'Malley et al.[41] **Year of publication:** 2002 **Dates of data collection:** January 2000 - March 2000 **Trial name:** NA
	relationship
OUTCOME ASSESSMENT:	**Outcome Measures:** adherence to FOBT use-- for this, 990 is the sample size since that's only women 52 and older (they say that's to allow those 50-52 time to get one)
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** factors statistically significant with self-reported FOBT in the past 2 years ($P < 0.01$): no regular site of care or regular clinician going to a provider that provides less comprehensive care reported low levels of compassion, trust or communication in the physician/pt relationship all insurance levels
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, N/A)
Were the groups similar at baseline regarding the most important prognostic indicators?			N/A
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		85% response rate
Were the differential drop-out or response rates acceptable (≤ 15%)?			N/A
Were intervention/exposure measures valid, reliable, and equally applied?			N/A
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR
Were outcome measures valid, reliable, and equally applied?			some were used before but it's unclear which and they did little to control for confounders
Does the analysis control for baseline differences?		X	
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			
Were the statistical methods used to assess the abstracted outcomes appropriate?			
Quality Rating (Good, Fair, or Poor): Fair **Reviewer #1 initials:** DJH **Reviewer #2 initials:** LCM **Comments (explain poor quality ratings):**	X X		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** O'Malley AS et al.[42] **Year of publication:** 2005 **Dates of data collection:** Used the year 2000 Medicare Current Beneficiary Survey (MCBS) data **Trial name:** NA		
OBJECTIVE OR AIM:	To (1) quantify the size of any racial differences in the receipt of CRC screening among Medicare beneficiaries and the extent to which racial differences were confounded by socioeconomic status (SES); (2) determine which features of the health care system, in addition to having a usual health care provider, were associated with higher screening rates; and (3) ascertain whether these features differed for socioeconomic and racial groups of beneficiaries.		
DESIGN:	**Setting:** Population-based, Medicare part A and B beneficiaries with a usual physician **Study design:** Cross-sectional **Duration (mean followup):** NA **Overall study size (N enrolled/N analyzed):** N=9985		
Sample size:	N=9985		
Describe intervention:	NA		
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based from the 2000 Medicare enrollment file		
INCLUSION CRITERIA:	• Medicare part A and B beneficiaries • Having a usual physician		
EXCLUSION CRITERIA:	• Racial groups other than "black" or "white" • Persons who were institutionalized • < 65 years • End-stage renal disease • Not having a usual physician • Persons with a prior diagnosis of CRC • Persons with gastrointestinal symptoms • Persons with large amounts of missing data		
POPULATION CHARACTERISTICS:	**Frequency (N=11,154)**	**Weighted % (SE)**	
Mean age & range (years) 65-74 ≥75	4492	44.9 (0.004)	
Sex (% female):	6662	55.1 (0.004)	
Race/ethnicity White Black	6518 10,133 1021	58.6 (0.004) 91.7 (0.005) 8.2 (0.005)	
Other:			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** O'Malley AS et al.[42] **Year of publication:** 2005 **Dates of data collection:** Used the year 2000 Medicare Current Beneficiary Survey (MCBS) data **Trial name:** NA	
Health status		
Excellent–very good	4592	42.1 (0.006)
Good	3704	33.3 (0.005)
Fair-poor	2828	24.5 (0.005)
Education		
≥High school diploma	7423	68.5 (0.009)
No high school diploma	3731	31.5 (0.009)
Income		
>50 000	1205	10.8 (0.003)
20 001-50 000	4618	41.4 (0.004)
≤20 000	5320	47.7 (0.006)
Additional insurance		
Private Medigap policy	7257	67.7 (0.009)
Medicaid (dual eligible)	993	8.2 (0.004)
No other insurance	2618	24.1 (0.008)
Attrition/Drop-out (not available for endpoint measurement):	NA	
Adherence:	NA	
Contamination:	NA	
Response Rates (e.g. for surveys):	84%	
STATISTICAL ANALYSES:	**Describe:** Univariate, bivariate, and stratified analyses were performed, including assessment for interaction. Logistic regression models were then built. First, race (with age and sex) was entered into the model. Then other beneficiary characteristics were added, followed by the health system characteristics. A hierarchical model was then constructed to assess whether there was any significant clustering of MCBS respondents among physicians. Sampling weights accounting for the multistage sample design and non-response were used to obtain national estimates with SAS callable SUDAAN	
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	**Exposure:** Self-reported receipt of recent CRC screening **(**a home fecal occult blood test had been performed in the past 12 months, a flexible sigmoidoscopy was received in the past 5 years, or a colonoscopy was performed in the past 5 years) **Independent Variables:** Beneficiary • Race • SES (income and education) Health care financing • Insurance	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** O'Malley AS et al.[42] **Year of publication:** 2005 **Dates of data collection:** Used the year 2000 Medicare Current Beneficiary Survey (MCBS) data **Trial name:** NA
	Delivery system • Physician specialty • Perceived quality of care • Availability of specialists, • HMO status **Confounders** • Age • ~ Sex • Attitudes toward health care • Health status • Rural V urban residence • Awareness of CRC • Frequency of physician out-patient visits
OUTCOME ASSESSMENT:	**Outcome Measures:** Factors which influence the self-reported receipt of recent CRC screening including: • Home fecal occult blood test had been performed in the past 12 months • Flexible sigmoidoscopy was received in the past 5 years, • Colonoscopy was performed in the past 5 years
KQ2 – What factors influence the use of colorectal cancer screening?	Summary: Unadjusted rates of screening were 48.2% (95% CI 46.4-50.0) for white and 39.1% (95% CI 35.7-46.2) for black beneficiaries ($P < 0.001$). Racial differences in CRC screening receipt were eliminated after adjustment for socioeconomic status as measured by income and education. SES remained significant after adjusting for other personal and health system factors
	Outcomes: Adjusted odds of receiving CRC screening: OR (95% CI)
Race	
• White	1.00 (0.82-1.16)
• Black	1.0 (Reference)
Age, y	
• ≥75	0.86 (0.79-0.93)
• 65-74	1.0 (Reference)
Sex	
• Female	0.87 (0.79-0.97)
• Male	1.0 (Reference)
Education	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** O'Malley AS et al.[42] **Year of publication:** 2005 **Dates of data collection:** Used the year 2000 Medicare Current Beneficiary Survey (MCBS) data **Trial name:** NA
• College degree or higher	1.79 (1.55-2.07)
• Some college	1.51 (1.30-1.76)
• High school/vocational diploma 1	1.23 (1.12-1.36)
• No high school diploma	1.0 (Reference)
Income (annual household), $	
• >50 000	1.53 (1.27-1.85)
• 20 001-50 000 1.	1.30 (1.17-1.45)
• <20 000	1.0 (Reference)
Urban (vs rural reference group)	1.12 (0.97-1.31)
Supplementary insurance	
• Medicaid	0.87 (0.70-1.09)
• Private supplementary policy	1.23 (1.07-1.42)
• No supplementary insurance	1.0 (Reference)
Aware of colorectal cancer	2.76 (2.29-3.33)
Attitudes toward health care	
• More favorable	1.23 (1.14-1.33)
• Less favorable	1.0 (Reference)
Health status	
• Excellent–very good	0.98 (0.87-1.12)
• Good	1.08 (0.95-1.24)
• Fair-poor	1.0 (Reference)
Outpatient physician visits in past year (excludes ED visits)	
• ≥4	1.47 (1.31-1.64)
• ≤3	1.0 (Reference)
Information giving by usual physician	
• Higher rating	1.12 (1.00-1.25)
• Lower rating (poorer)	1.0 (Reference)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** O'Malley AS et al.[42] **Year of publication:** 2005 **Dates of data collection:** Used the year 2000 Medicare Current Beneficiary Survey (MCBS) data **Trial name:** NA
Usual physician type • Primary care generalist • Specialty other than primary care	 1.31 (1.12-1.53) 1.0 (Reference)
HMO (vs fee for service)	1.56 (1.34-1.82)
Availability of specialists • Higher rating • Lower rating	 1.32 (1.16-1.50) 1.0 (Reference)
KQ3 – Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 – What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 – What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NR
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer screening among men and women in the United States	**Authors, ref ID:** Peterson, et al.[43] **Year of publication:** 2007 **Dates of data collection:** 2000 NHIS **Trial name:** NA					
OBJECTIVE OR AIM:	To explore gender differences in use of CRC screening tests and gender-specific correlates of CRC testing					
DESIGN:	**Setting:** United States **Study design:** Cross-sectional **Duration (mean followup):** no f/u data reported **Overall study size (N enrolled/N analyzed):** 32,374 survey, 11,487 met criteria for this study					
Sample size:	11,487					
Describe intervention:						
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population based, national household survey The 2000 supplement (e.g., Cancer Control Module) was administered to 32,374 adults >= 18 years of age; response rate was 72%					
INCLUSION CRITERIA:	Men and women >= 50 years of age without a prior diagnosis of CRC were considered eligible for analysis of CRC screening					
EXCLUSION CRITERIA:						
POPULATION CHARACTERISTICS (stratified by sex):		Men (n=4782)			Women (n=6705)	
		%	(95% CI)		%	(95% CI)
	Age					
	50–64	59.6	(57.8–61.4)			(52.5–55.3)
	65–74	24	(22.5–25.4)			(23.6–25.8)
	75 +	16.5	(15.3–17.7)			(20.3–22.6)
	Race					
	Non-Hispanic white	81.7	(80.4–83.0)		81.7	(80.6–82.9)
	Non-Hispanic black	8.1	(7.2–9.2)		9.4	(8.6–10.3)
	Hispanic	6.8	(6.1–7.7)	53.9	6.6	(6.0–7.3)
	Non-Hispanic other	3.3	(2.7–4.1)	24.7	2.3	(1.8–2.8)
	Education			21.4		
	Less than high school	23.3	(22.0–24.7)		23	(21.6–24.3)
	High school diploma	27.8	(26.3–29.3)		36.9	(35.4–38.3)
	Some college, no degree	15.7	(14.5–16.8)		16	(15.0–17.0)
	College degree or higher	33.3	(31.6–34.9)		24.2	(22.9–25.5)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer screening among men and women in the United States	**Authors, ref ID:** Peterson, et al.[43] **Year of publication:** 2007 **Dates of data collection:** 2000 NHIS **Trial name:** NA				
	Family income				
	<=$20,000	19.8	(18.6–21.2)	30	(28.7–31.3)
	>$20,000	80.2	(78.9–81.4)	70	(68.7–71.3)
	Insurance				
	Private	77.9	(76.5–79.2)	73.7	(72.4–74.9)
	Public	15	(13.9–16.2)	19.5	(18.4–20.6)
	None	7.1	(6.3–8.1)	6.9	(6.2–7.6)
	Reported functional limitation	42.2	(40.5–43.9)	55	(53.5–56.4)
	Reported usual source of care	91.8	(90.9–92.6)	94.8	(94.1–95.4)
	Reported family history of CRC	7.8	(6.9–8.7)	8.3	(7.6–9.0)
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	NA				
Response Rates (e.g. for surveys):	As above, response rate 72% for NHIS				
STATISTICAL ANALYSES:	• Bivariate analysis to characterize factors associated with CRC screening by gender using Wald chi-square statistics. Two-tailed *P* values ≤0.05 were considered statistically significant • Separate multivariable logistic regression models for each gender to explore the relationship between CRC screening testing and factors of interest • The Survey Data Analysis computer package was used to calculate variance estimations • To reflect U.S. population estimates and adjust for nonresponse, the results were weighted using SAS version 9.1				
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Sociodemographic factors included age, gender, ethnicity/ race, education, annual income, and insurance type. Age was categorized as 50–64, 65–74, and >=75. Race/ethnicity categories were non- Hispanic white, Non-Hispanic black, Hispanic, and other. Educational status was categorized as less than high school, high school diploma, some college but no degree, and college degree or higher. Dichotomous group for income (<$20,000 vs. >=$20,000). Insurance type was considered private if respondents reported having a private insurance plan, military plan, CHAMPUS, or Tricare. Public insurance included Medicaid, Medicare without private supplementation, Indian Health Service, or other public assistance, such as a state-sponsored plan. Persons who reported no insurance type or single service plan were classified as having none. Considered the presence of self-reported functional limitation, having a usual place to receive medical care, reported first-degree family history of CRC, and receipt of other preventive care (influenza vaccine in the last year, pneumovax ever, and, for women, current mammography in the last 2 years, Pap smear in the last 3 years, and for men, prostate-specific antigen [PSA] testing in the last 2 years).				
OUTCOME	Participants asked if they ever had a sigmoidoscopy, colonoscopy, or proctoscopy. If they answered affirmatively, they were then asked				

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer screening among men and women in the United States	**Authors, ref ID:** Peterson, et al.[43] **Year of publication:** 2007 **Dates of data collection:** 2000 NHIS **Trial name:** NA
ASSESSMENT:	which test they had received (sigmoidoscopy, colonoscopy, proctoscopy, or something else) and were read definitions of the tests if necessary. Subjects who responded positively that they had previously undergone a screening test were asked when they had their most recent test. Persons who reported that they had never undergone the test or who had not had the test recently (sigmoidoscopy or colonoscopy in the last 10 years or FOBT in the last year) were asked to provide the main reason (no reason, did not need it, doctor did not offer, no problems, put it off, too expensive, too painful, had another examination, no doctor, other). Subjects who had not had recent screening were also asked if a doctor or other health professional had recommended a screening test in the past year.
Results	
KQ2 - What factors influence the use of colorectal cancer screening?	Adjusted Odds Ratios and 95 % CI Predicting Current CRC Testing Among Men and Women

			Men		Women	
Gender	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Male	1	—	NA	NA	NA	NA
Female	0.98	(0.88–1.08)				
Age						
50–64	1	—	1	—	1	—
65–74	1.78	(1.58–2.01)	1.5	(1.25–1.79)	1.82	(1.55–2.14)
75 +	1.4	(1.22–1.61)	1.28	(1.03–1.59)	1.53	(1.27–1.85)
Race						
Non-Hispanic white	1	—	1	—	1	—
Non-Hispanic black	0.92	(0.78–1.07)	0.98	(0.73–1.31)	0.79	(0.65–0.95)
Hispanic	0.79	(0.64–0.96)	0.78	(0.58–1.05)	0.75	(0.56–1.01)
Non-Hispanic other	0.56	(0.39–0.80)	0.72	(0.45–1.14)	0.52	(0.31–0.86)
Education						
Less than high school	1	—	1	—	1	—
High school diploma	1.41	(1.23–1.62)	1.39	(1.12–1.74)	1.22	(1.01–1.47)
Some college, no degree	1.55	(1.32–1.81)	1.36	(1.06–1.75)		(1.16–1.78)
College degree or higher	2.12	(1.84–2.44)	1.93	(1.54–2.41)	1.44	(1.40–2.14)
Family income					1.73	
<=$20,000	0.81	(0.71–0.92)	0.86	(0.70–1.06)		(0.79–1.10)
>$20,000	1	—	1	—	0.93	1 —
Insurance						
Private	1	—	1	—	1	—
All Public	0.77	(0.67–0.88)	0.87	(0.69–1.09)	0.79	(0.66–0.94)
None	0.51	(0.40–0.64)	0.51	(0.35–0.74)	0.71	(0.51–1.00)
Reported functional limitation						

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer screening among men and women in the United States	**Authors, ref ID:** Peterson, et al.[43] **Year of publication:** 2007 **Dates of data collection:** 2000 NHIS **Trial name:** NA						
	No	1	—	1	—	1	—
	Yes	1.41	(1.27–1.55)	1.42	(1.21–1.67)	1.38	(1.21–1.57)
	Reported usual source of care						
	No	0.3	(0.24–0.39)	0.42	(0.28–0.61)	0.47	(0.32–0.69)
	Yes	1	—	1	—	1	—
	Reported first-degree family history of CRC						
	No	1	—	1	—	1	—
	Yes	2.08	(1.77–2.43)	1.96	(1.51–2.54)	2.21	(1.82–2.69)
	Had mammogram in the last 2 years (women only)						
	No	NA	NA	NA	NA	0.25	(0.21–0.29)
	Yes					1	—
	Had PSA testing in the last 2 years (men only)						
	No	NA	NA	0.29	(0.25–0.34)	NA	NA
	Yes			1	—		
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA						
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA						
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA						

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY: Colorectal cancer screening among men and women in the United States	**Authors, ref ID:** Peterson, et al.[43] **Year of publication:** 2007 **Dates of data collection:** 2000 NHIS **Trial name:** NA
QUALITY RATING:	Good

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			n/a
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	x		NHIS RR > 70%, but I don't see mention of response rate for those aged >= 50.
Were the differential drop-out or response rates acceptable (≤ 15%)?			n/a
Were intervention/exposure measures valid, reliable, and equally applied?	x		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			n/a
Were outcome measures valid, reliable, and equally applied?	x		Self-report, but equal across all participants
Does the analysis control for baseline differences?	x		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	x		
Were the statistical methods used to assess the abstracted outcomes appropriate?	x		

Quality Rating (Good, Fair, or Poor): Good
Reviewer #1 initials: MJG
Reviewer #2 initials: DJH
Comments (explain poor quality ratings):

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Pham HH, et al.[44] **Year of publication:** 2005 **Dates of data collection:** 2001 **Trial name:** NA (secondary analysis of CTS)
OBJECTIVE OR AIM:	To identify characteristics of physicians and their practices that are associated with the quality of preventive care their patients receive.
DESIGN:	**Setting:** National primary care physician survey **Study design:** Cross-sectional, retrospective study **Duration (mean follow-up):** NA **Overall study size (N enrolled/N analyzed):** 3,660 physicians, 24, 581 patients
Sample size:	3,660 physicians, 24, 581 patients
Describe intervention:	NA (survey)
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Population-based Data from Community Tracking Study (CTS)
INCLUSION CRITERIA:	Primary care delivered by physicians providing usual care for Medicare beneficiaries ≥ 65 yrs
EXCLUSION CRITERIA:	Cancer diagnosis,ID-9-CM or V codes:153, 154.0, 154.1, V10.05, V10.06
POPULATION CHARACTERISTICS:	
Mean age & range (years):	NR (≥ 65 yrs)
Sex (% female):	NR
Race:	
Other:	
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	NA
Response Rates (e.g. for surveys):	
STATISTICAL ANALYSES:	Individual beneficiaries were the unit of analysis. Each patient was assigned to a single usual-source-of-care physician, but each physician could serve as the usual source of care for multiple beneficiaries. Reported percentages are therefore weighted to represent estimates for the national population of Medicare beneficiaries aged 65 years and older, using CTS survey weights to take into account the complex physician sampling strategy. Authors used logistic regression to analyze the association between physician and practice characteristics and beneficiary delivery of each of the 6 preventive services. We used SUDAAN software to adjust estimates and

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Pham HH, et al.[44] **Year of publication:** 2005 **Dates of data collection:** 2001 **Trial name:** NA (secondary analysis of CTS)
	variances given the complex survey sampling strategy and the clustering of beneficiaries within physicians.25 This study was approved by the institutional review contractor for Mathematica Inc. *P* = .05 was set as significant.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	Proportion of eligible beneficiaries receiving each of 6 preventive services: diabetic monitoring with hemoglobin A_{1c} measurement or eye examinations, screening for colon (colonoscopy/FS) or breast cancer, and vaccination for influenza or pneumococcus (self-report and claims)
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	Association between CRC screening and physician specialty (patients cared for by family physicians 9.9% vs. patients cared for by general internists 7.8%, *P* < 0.001); board certification (board certified 9.5% vs. not board certified 6.5%, *P* < 0.05); and site of medical school graduation (US or Canada 9.3% vs. non-US or Canada 7.7%, *P* < 0.05). No statistically significant association between CRC screening among patients cared for by physicians in different practice types (e.g., medium/large group vs. solo/two-person group: AOR, 1.12 [95% CI, 0.90-1.38]). Patients cared for by physicians with access to reminders were not more likely to have been screened: 5.8% with reminders vs. 5.9% without reminders (adjusted AOR, 0.96 [95% CI, 0.84-1.09])
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, N/A)
Were the groups similar at baseline regarding the most important prognostic indicators?			CD
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NR
Were the outcome assessors blinded to the intervention or exposure status of subjects?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Rosen, A.B., Schneider, E.C.[45] **Year of publication:** 2004 **Dates of data collection:** 1999 **Trial name:** NA			
OBJECTIVE OR AIM:	To evaluate whether there is an association between body mass index (BMI) and rates of colorectal cancer screening. To examine whether BMI-related disparities in colorectal cancer screening differ between men and women.			
DESIGN:	**Setting:** National telephone survey **Study design:** Cross-sectional, Secondary data analysis **Duration (mean follow-up):** No follow-up, one-time data collection **Overall study size (N enrolled/N analyzed):** 52,886 respondents			
Sample size: **Describe intervention:**	**Normal Weight** Sample size: 19,826 No intervention, responded to BRFFS	**Overweight** Sample size: 21,285 No intervention, responded to BRFFS	**Obese** Sample size: 8,315 No intervention, responded to BRFFS	**Morbidly Obese** Sample size: 3,460 No intervention, responded to BRFFS
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based, BRFFS			
INCLUSION CRITERIA:	Age 50 to 80			
EXCLUSION CRITERIA:	Did not know, or refused, to report their CRC screening status, did not report height or weight, BMI<15.5 kg/m^2, older than 80			
POPULATION CHARACTERISTICS:	**Normal Weight**	**Overweight**	**Obese**	**Morbidly Obese**
Mean age & range (years): **Sex (% female):** **Race:**	Age range: 50-80 Age: 53.5% 50-64, 32.1% 65-74, 14.5% 75+ Sex: 61.8% female Race: 83.3% White (non-Hispanic), 5.9% Black (non-Hispanic), 6.7% Hispanic, 4.2% other	Age range: 50-80 Age: 58.4% 50-64, 30.6% 65-74, 11% 75+ Sex: 44.7% female Race: 80.2% White (non-Hispanic), 8.5% Black (non-Hispanic), 8.7% Hispanic, 2.7% other	Age range: 50-80 Age: 78% 50-64, 9.9% 65-74, 10% 75+ Sex: 50.6% female Race: 78% White (non-Hispanic), 9.9% Black (non-Hispanic), 10% Hispanic, 2.2% other	Age range: 50-80 Age: 75.4% 50-64, 13.9% 65-74, 8.3% 75+ Sex: 62% female Race: 75.4% White (non-Hispanic), 13.9% Black (non-Hispanic), 8.3% Hispanic, 2.4% other
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	NA			
Response Rates (e.g. for surveys):	Median response rate = 68.4%			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Rosen, A.B., Schneider, E.C.[45] **Year of publication:** 2004 **Dates of data collection:** 1999 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** • Respondents were stratified based on BMI and tabulated the characteristics of each group • Association between BMI and CRC screening using multiple logistic regression to control for potential confounders was assessed • Examined the results for trends and then separately compared each overweight/obese group to the corresponding group with normal BMI
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	• Examined several factors thought to be potential confounders of the relationship between obesity and screening • Sociodemographic factors included age, gender, ethnicity, education, marital status, income, and census region • Other variables examined as potential confounders included self-reported health status, smoking status, time since last check-up, and lack of insurance coverage for any part of the past year.
OUTCOME ASSESSMENT:	**Outcome Measures:** • Classified an individual as having had colorectal cancer screening if he or she reported undergoing either FOBT within the last year or endoscopic screening within the last 5 years • Each respondent's BMI was calculated as weight in kilograms divided by height in meters squared
Results	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • The rate of screening for morbidly obese respondents was 39.5%, significantly lower than the rate for obese (45.0%), overweight (44.3%), or normal weight (43.5%) groups. • Those who were less than 65 years of age ($P < 0.0001$), female ($P = 0.0018$), Hispanic ($P < 0.0001$), not high school graduates ($P < 0.0001$), widowed, divorced, or separated ($P < .0001$), had low incomes ($P < .0001$), were uninsured for part or all of the past year ($P < .0001$), current smokers ($P < 0.0001$) and those respondents whose last checkups were over 1 year ago ($P < .0001$) were less likely to be screened than their counterparts. • Respondents who reported fair or poor health status were more likely to be screened than others. • Residents of the Northeast were significantly more likely and residents of the South were significantly less likely to be screened than others (data NR) • Morbidly obese females were less likely than females with a normal body mass index to receive CRC screening (AOR, -5.6; 95% CI, -2.6 to -8.5). • There were no obesity-related disparities in screening rates for males.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** **NA**
KQ4 - What are the current and	**Outcomes:**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Rosen, A.B., Schneider, E.C.[45] **Year of publication:** 2004 **Dates of data collection:** 1999 **Trial name:** NA
projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** **NA**
QUALITY RATING:	**Fair**

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?		X	Some characteristics were different between the weight categories, such as age, sex, and ethnicity
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			69% response rate for those reached by phone
Were the differential drop-out or response rates acceptable (≤ 15%)?			NR
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schenck AP, Klabunde CN, Davis WW[46] **Year of publication:** 2006 **Dates of data collection:** 2001 **Trial name:** NA	
OBJECTIVE OR AIM:	In an attempt to increase understanding of predictors of CRC test use and the role of race, an investigation of CRC test use among African Americans and whites enrolled in the Medicare program was initiated.	
DESIGN:	**Setting:** Telephone survey **Study design:** Observational cross-sectional study **Duration (mean followup):** No follow-up, one-year date collection **Overall study size (N enrolled/N analyzed):** 1,321 White; 580 African American	
	All	
Sample size:	**Sample size:** 1,321 White; 580 African American	
Describe intervention:	**Intervention:** Telephone survey designed to assess baseline consumer knowledge, awareness, and use of CRC test	
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based, telephone survey	
INCLUSION CRITERIA:	Age 50-80, no history of CRC	
EXCLUSION CRITERIA:	No personal history of CRC	
POPULATION CHARACTERISTICS:	**Whites**	**African Americans**
Mean age & range (years):	Age: 8.46% age 50-64, 65.23% age 65-74, 26.31% age 75-80	Age: 15.02% age 50-64, 60.9% age 65-74, 24.08% age 75-80
Sex (% female):	Sex: 55.58% Female	Sex: 60.61% Female
Race:		
Other:		
	All	
Attrition/Drop-out (not available for endpoint measurement):		
Adherence:		
Contamination:		
Response Rates (e.g. for surveys):	Cooperation rate = 69%	
STATISTICAL ANALYSES:	**Describe:** • A series of nested multivariate logistic regression analyses were conducted to assess the independent association of race by category of CRC test use.	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schenck AP, Klabunde CN, Davis WW[46] **Year of publication:** 2006 **Dates of data collection:** 2001 **Trial name:** NA
	• Unadjusted models were constructed using a single predictor variable for African American compared with white race.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Additional questions assessed respondents' awareness that CRC risk increases with age, that both genders are at risk for the disease, and their perceived susceptibility to colorectal cancer. Access to medical care was assessed through two survey questions asking whether the respondent had a primary care provider, and had visited a physician for a checkup in the past 12 months. Respondents' history of CRC and chronic health conditions also were assessed in the survey. CRC risk status was determined by three factors: physician counseling that the respondent was at high risk for colorectal cancer, a family member with colorectal cancer, or a history of having polyps removed. Additional demographic information, obtained from the Medicare Enrollment Database, included date of birth, race, gender, and eligibility for Medicaid, which was used as a proxy for low income.
OUTCOME ASSESSMENT:	**Outcome Measures:** • Colorectal cancer test use was determined by describing each test (FOBT, sigmoidoscopy, and colonoscopy) and asking four questions about each test. The questions were: "Before this test was described, had you ever heard of it?"; "Have you ever had (this test)?"; "When did you have your most recent (test)?"; and, "Why did you have your most recent (test)?" • CRC test use was classified into three categories: no CRC test use, some CRC test use but not current with Medicare testing intervals, and current with testing. Respondents were classified as being current with testing if they had had any of the CRC tests at Medicare covered intervals, including FOBT in the past year, sigmoidoscopy within the past 4 years, colonoscopy within the past 10 years, or barium enema within the past 10 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Unadjusted analyses showed that African Americans were significantly less likely to be tested according to Medicare-covered intervals (OR=0.57, 95% CI 0.46–0.71). However, after adjustment for sociodemographic characteristics, healthcare access, and CRC risk status, racial differences were not statistically significant (OR=0.82, 95%, CI 0.63–1.06). • Among those not tested according to Medicare-covered intervals, African Americans were less likely to have been tested at all compared with whites. This difference remained significant after adjustment for sociodemographic characteristics, healthcare access, and CRC risk status (OR=0.48, 95%, CI=0.33–0.70). • African Americans were significantly more likely than whites to have been tested by an endoscopic procedure than by FOBT (OR=3.06, 95% CI=1.70 –5.51). • The strongest predictors identified with adherence to Medicare-covered testing intervals were elevated CRC risk (OR=3.82, 95% CI=2.79 –5.23), having a checkup in the past year (OR 2.80, 95%CI1.75–4.44), and having a usual source of care (OR=2.27, 95% CI=1.10–4.69) • White race and several health services use variables were strong predictors of having some CRC tests compared to having none. Medicare consumers with a usual source of care (OR=6.96, 95% CI=1.80 –

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schenck AP, Klabunde CN, Davis WW[46] **Year of publication:** 2006 **Dates of data collection:** 2001 **Trial name:** NA
	26.91) and those with a checkup in the last year (OR=2.16, 95% CI=1.27–3.67) were much more likely to have had some CRC tests.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?		X	Age difference p<0.001, sex difference p<0.0001
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]		X	69% cooperation rate
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schneider, E.C., Rosenthal, M., Gatsonis, C.G., Zheng, J., Epstein, A.M.[47] **Year of publication:** 2008 **Dates of data collection:** 2000 **Trial name:** NA		
OBJECTIVE OR AIM:	The authors assessed whether beneficiaries in MMC plans were more likely than those in traditional FFS insurance to receive colorectal cancer (CRC) screening and whether type of insurance was associated with use of specific screening strategies.		
DESIGN:	**Setting:** In-person survey **Study design:** Cross-sectional, retrospective secondary data analysis **Duration (mean follow-up):** No follow-up, 2000 survey data **Overall study size (N enrolled/N analyzed):** 10,173		
Sample size: **Describe intervention:**	**MMC** Sample size: 10,173 No intervention, answered Medicare Current Beneficiary Survey	**FFS Supplemental** Sample size: 2,219 No intervention, answered Medicare Current Beneficiary Survey	**FFS No Supplemental** Sample size: 6,167 No intervention, answered Medicare Current Beneficiary Survey
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Medicare population-based		
INCLUSION CRITERIA:	Age 65+, Medicare beneficiary, non-institutionalized		
EXCLUSION CRITERIA:	Institutionalized, from 11 states (and Puerto Rico) that had no MMC plan option, from 12 states that had fewer than 5 MMC enrollees, age 65 and younger, part-year enrollees in MMC, respondents who were not white, African American, or Hispanic, and respondents who reported a personal history of CRC		
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**MMC** Age: 26.1% 65-69, 27.5% 70-74, 22.4% 75-79, 24% 80+ Sex: 58.7% female Race: 90.6% White, 9.4% Black	**FFS Supplemental** Age: 21.6% 65-69, 28.3% 70-74, 24.3% 75-79, 25.7% 80+ Sex: 58% female Race: 95.8% White, 4.2% Black	**FFS No Supplemental** Age: 28.2% 65-69, 25.8% 70-74, 20.4% 75-79, 25.6% 80+ Sex: 59.3% female Race: 79.1% White, 20.9% Black
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**Overall** Response rate was 84.3%		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schneider, E.C., Rosenthal, M., Gatsonis, C.G., Zheng, J., Epstein, A.M.[47] **Year of publication:** 2008 **Dates of data collection:** 2000 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** • The authors calculated the weighted percentage of beneficiaries with each of the sociodemographic and other characteristics of interest overall and for each insurance group. • Using the definitions of CRC screening, they calculated, for each insurance group, the unadjusted percentage of beneficiaries that reported CRC screening strategies. • They compared percentages of beneficiaries who had received CRC screenings across each potential pairing of the insurance groups using a chi-square test or a *t* test as appropriate. • To address potential "selection biases" they used a propensity score model to adjust statistically for the nonrandom distribution of beneficiaries among insurance types. • To calculate propensity scores, they constructed a multinomial logistic regression model that included all of the patient characteristics that could plausibly predict whether or not an enrollee would choose to enroll in managed care.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Variables examined: • Demographics (age, gender, race, Hispanic origin, education, unmarried) • Access (SES, insurance type) • Health status • Care-seeking variables (worry about health, avoid going to a MD, keep to self when sick, visit a MD as soon as feel bad, had a problem and didn't visit a MD, same MD for >5 yr) • Area of residence (non-metro area resident)
OUTCOME ASSESSMENT:	**Outcome Measures:** CRC screening status and type of test received
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Beneficiaries who were age 80 or older, women, black, Hispanic, and who had lower educational attainment and lower income were less likely to receive screening (data not shown). • Beneficiaries were less likely to receive interval-appropriate screening (FOBT in past 2 yrs or invasive screening in past 5 yrs.) if they reported that they avoided going to the physician (41.1% vs. 54.9%), kept to themselves when sick (47.3% vs. 53.4%), failed to visit a physician as soon as they felt bad (55.6% vs. 48.7%), or had a problem and didn't visit the physician (44.6% vs. 51.6%), all at ($P < 0.001$). • Worrying about health more than others was not associated with receiving a screening, nor was having the same physician for 5 years, except for having an invasive screening within the past 5 years (39.6% vs. 37.3%, $P < 0.024$). • MMC (52.9%) was more likely than supplemental insurance groups (FFS SUP) (50.7%, $P = 0.15$) to receive CRC screening, but time-interval appropriateness was similar between groups (no confidence intervals provided) • Beneficiaries in MMC were more likely than those In the FFS SUPP group to receive interval-appropriate FOBT (36.3% vs. 32.1%; $P = 0.013$), but less likely to receive an interval-appropriate

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schneider, E.C., Rosenthal, M., Gatsonis, C.G., Zheng, J., Epstein, A.M.[47] **Year of publication:** 2008 **Dates of data collection:** 2000 **Trial name:** NA
	invasive screening procedure (35.9% vs. 40.8%; *P* < 0.001)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** **NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** **NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	**Fair**

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?		X	The Managed care, FFS, and FFS no supplemental groups had several large differences in the age distribution, race, etc. of their populations.
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schootman, M., Jeffe, D., Baker, E., Walker, M.[48] **Year of publication:** 2006 **Dates of data collection:** 2002 **Trial name:** NA	
OBJECTIVE OR AIM:	To analyze the contextual effect of area poverty rate on never having been screened for breast, cervical, and colorectal cancer by (1) describing the extent of the variation in screening behaviors among 98 US metropolitan areas; (2) determining if the variation in lack of screening can be explained by differences in the characteristics of the persons who resided in these areas; and (3) determining if living in a metropolitan area with a higher poverty rate increased the likelihood of never having been screened for cancer over and above individual characteristics.	
DESIGN:	**Setting:** Cities in the United States **Study design:** Secondary data analysis **Duration (mean follow-up):** No follow-up, data collection for one year **Overall study size (N enrolled/N analyzed):** 118,000 persons residing in 98 areas	
Sample size: **Describe intervention:**	**MMSA poverty rate 5.0-9.9** Sample size: 59,336 Intervention: None, survey (BRFFS)	**MMSA poverty rate 10.0+** Sample size: 59,301 Intervention: None, survey (BRFFS)
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-level	
INCLUSION CRITERIA:	Age 50 or older	
EXCLUSION CRITERIA:	NR	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**MMSA poverty rate 5.0-9.9** Age: 17.8% 50-59, 11% 60-69, 13% 70+ Sex: 58.9% Race: 80.8% White, 7.2% African American, 7.5% Other, 4.6% Hispanic	**MMSA poverty rate 10.0+** Age: 17.4% 50-59, 12.2% 60-69, 14.4% 70+ Sex: 60.4% Race: 73.1% White, 11.1% African American, 7.8% Other, 8% Hispanic
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NR	
STATISTICAL ANALYSES:	**Describe:** The multilevel logistic models reported in this paper were all two level models in which persons (level 1) were nested within MMSAs (level 2). The authors used restricted iterative generalized least squares and second order penalized quasilikelihood estimation in all models.	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schootman, M., Jeffe, D., Baker, E., Walker, M.[48] **Year of publication:** 2006 **Dates of data collection:** 2002 **Trial name:** NA
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Multilevel logistic models to control for income, education, employment, insurance, race, age, sex, self-perceived health, having trouble getting medical care, and smoking status.
OUTCOME ASSESSMENT:	**Outcome Measures:** FOBT and sigmoidoscopy/colonoscopy
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • The variation (ICC) between MMSAs varied by screening test: FOBT: 2.7 and colonoscopy/sigmoidoscopy: 1.2 (P<0.05). • The crude odds ratios per 5% increase in MMSA level poverty rate were attenuated by the inclusion of the individual level factors, but remained associated with never having had an FOBT (adjusted OR=1.19, 95% CI (1.12 – 1.27) • Adding the individual level factors to the model did not affect the crude odds ratios for a 5% increase in MMSA level poverty rate in never having had a colonoscopy. • For all screening tests, significant MMSA level variance remained after including only the individual level factors, and after adding MMSA level poverty rate (all P<0.05).
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** **NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** **NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** **NA**
QUALITY RATING:	**Fair**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NR
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schumacher, M., Slattery, M., Lanier, A., Ma, K., Edwards, S., Ferucci, E., Tom-Orme, L.[49] **Year of publication:** 2008 **Dates of data collection:** 2004-2007 **Trial name:** Education and Research Towards Health (EARTH) Study
OBJECTIVE OR AIM:	The purpose of this study was to examine the prevalence rates for cervical, breast, and colorectal cancer screening among American Indian and Alaska Native people living in Alaska and in the Southwest US, and to investigate predictive factors associated with receiving each of the cancer screening tests.
DESIGN:	**Setting:** Clinic **Study design:** Cross-sectional **Duration (mean followup):** One-time data collection **Overall study size (N enrolled/N analyzed):** 2,779 (participants ≥ 50 yrs with data available on colonoscopy/sigmoidoscopy)/2,745 for whom timing since last procedure was known)
Sample size:	Sample size: 2,745
Describe intervention:	Intervention: Participants completed several surveys: Health, Lifestyle, and Physical Activity Questionnaire; diet history questionnaire
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based
INCLUSION CRITERIA:	Required participants to be American Indian or Alaska Native eligible for Indian Health Services-funded health care; at least 18 years of age (colonoscopy/sigmoidoscopy analyses were restricted to those age 50+), not pregnant, not actively undergoing cancer treatment, and physically and mentally able to read and understand the consent form and to complete survey instruments and medical tests
EXCLUSION CRITERIA:	Individuals with unknown duration between colonoscopy/sigmoidoscopy
POPULATION CHARACTERISTICS:	
Mean age & range (years):	NR
Sex (% female):	NR
Race:	100% American Indian/Alaska native
Other:	
Attrition/Drop-out (not available for endpoint measurement):	NA
Adherence:	
Contamination:	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schumacher, M., Slattery, M., Lanier, A., Ma, K., Edwards, S., Ferucci, E., Tom-Orme, L.[49] **Year of publication:** 2008 **Dates of data collection:** 2004-2007 **Trial name:** Education and Research Towards Health (EARTH) Study
Response Rates (e.g. for surveys):	
STATISTICAL ANALYSES:	**Describe:** • Prevalence odds ratios and their 95% confidence intervals were calculated using unconditional logistic regression models. • Linear tests for trend were done by including the categorical variable as a continuous variable in the logistic regression analysis. • For each of the potential predictors described, they calculated odds ratios and 95% confidence limits controlling for age and location because age and location most often confounded the relationship between the predictor and the screening test. • Multivariate logistic regression was then done including all variables that were statistically significantly related to the screening test (95% confidence limits exclude 1.0) in the analysis controlling for age and location.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	• For each of the potential predictors described, they calculated odds ratios and 95% confidence limits controlling for age and location because age and location most often confounded the relationship between the predictor and the screening test.
OUTCOME ASSESSMENT:	**Outcome Measures:** Analyses classified individuals as having had a colonoscopy/sigmoidoscopy in the past five years, or not
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Individuals in the age group 60+ were somewhat more likely to have received colonoscopy or sigmoidoscopy in the past five years that those aged 50–59 years. • There was a significant difference in the prevalence of screening by location (Alaska 41.9% versus Southwest 11.8%). • There was an increasing trend in screening with increasing level of education (linear test for trend $P<0.01$). • Individuals with a family history of any cancer were more likely to be screened, as were those with a family history of colorectal cancer. Former smokers were more likely to be screened than current or never smokers; those with other medical conditions were more likely to be screened. • Individuals who spoke only English at home versus those who spoke a Native language (either alone or with English) were also more likely to be screened, as were those residing in an urban area, and those with higher incomes. Women who had received other screening tests (Pap test or mammogram) were also more likely to have received a colonoscopy or sigmoidoscopy. • Overall screening rate was 22% (n = 604) • Alaska Natives were more likely to have obtained CRC screening than Southwest American Indians (AOR, 3.86; 95% CI, 2.92-5.10)
KQ3 - Which strategies are effective in	**Outcomes:**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schumacher, M., Slattery, M., Lanier, A., Ma, K., Edwards, S., Ferucci, E., Tom-Orme, L.[49] **Year of publication:** 2008 **Dates of data collection:** 2004-2007 **Trial name:** Education and Research Towards Health (EARTH) Study
increasing the appropriate use of colorectal cancer screening and followup?	**NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** **NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** **NA**
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NR
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Seeff et al.[50] **Year of publication:** 2004 **Dates of data collection:** 2000 **Trial name:** NA
OBJECTIVE OR AIM:	Estimate the most current rates of CRC test use, to evaluate factors previously described in association with CRC test use, and to describe first-time national estimates of barriers to CRC testing from the perspective of the general public.
DESIGN:	**Setting:** In-person interview, National Health Interview Survey (NHIS) **Study design:** Secondary data analysis **Duration (mean follow-up):** No follow-up, analyzed 2000 data **Overall study size (N enrolled/N analyzed):** 11,734 responded to FOBT questions, 11,816 responded to sigmoidoscopy/colonoscopy/proctoscopy questions
Sample size: **Describe intervention:**	**All** Sample size: 11,734 responded to FOBT questions, 11,816 responded to sigmoidoscopy/colonoscopy/proctoscopy questions
RECRUITMENT: (population-based, clinic-based, volunteer, other)	National Health Interview Survey (NHIS)
INCLUSION CRITERIA:	Age 50+
EXCLUSION CRITERIA:	Inadequate responses to questions, history of CRC, or refused or did not know the answer to questions
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** NR
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** Household response rate was 88.9% for the core NHIS survey and 72.1% for the Cancer Control Module
STATISTICAL ANALYSES:	**Describe:** • Multivariate logistic regression was used to determine the independent variables associated with each of the three endpoints. • Additional models were designed to determine whether either mammography or Pap smear tests were

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Seeff et al.[50] **Year of publication:** 2004 **Dates of data collection:** 2000 **Trial name:** NA
	associated with CRC test use among women. • Two additional models compared screening test versus no test and nonscreening test versus no test. • Variables were included in the multivariate models if they have been previously associated with CRC or CRC screening, if they appeared to be associated with test use based on descriptive tables, or if they varied according to test indication.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Variables included: • Demographic (age, gender, race, Hispanic, education, marital status) • Access (insurance status, income, usual source of care, MD visits/year) • Personal/risk factors (general health status, obesity/BMI, history of cancer- personal and family, prior screening, physical activity, fruit/veggies, smoking, alcohol)
OUTCOME ASSESSMENT:	**Outcome Measures:** FOBT within the previous year, endoscopy (sigmoidoscopy/colonoscopy/proctoscopy) within the past 10 years, and either FOBT within the previous year and/or endoscopy within the past 10 years. **Secondary outcome:** Reasons for Never Undergoing Colorectal Examinations or for Undergoing Tests beyond the Recommended Time Interval
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • With regard to FOBT, test rates increased with increasing age until ages 70–79 years and then decreased. • Persons 65+ years old were significantly more likely to report having undergone an FOBT compared with persons 50–64 years old. • White, non-Hispanic, and married persons were more likely to report having undergone a CRC test than Black, Hispanic, or unmarried persons. • Those who had private health insurance, Medicare, Medi-GAP, or a combination of private insurance and Medicare had higher rates of FOBT use than those with other public insurance or no insurance. • Having a usual source of care and the frequency with which the respondent reported seeing a physician were both associated with higher reported test rates. • Patterns of associations for endoscopy were similar to those for FOBT use, with the exception that being male was associated with higher rates of endoscopy. • Those respondents with a personal or family history of cancers other than CRC or a family history of CRC were more likely to report having undergone endoscopy than those without such a history. • Women who underwent a mammogram or Pap smear test within recommended intervals were more likely to report having undergone CRC tests compared with those who did not. • Persons who exercised regularly reported higher rates of test use for all CRC tests evaluated. • Former cigarette smokers reported higher test rates compared with never-smokers or current smokers.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Seeff et al.[50] **Year of publication:** 2004 **Dates of data collection:** 2000 **Trial name:** NA
	• Between 4–7% of respondents who did not undergo CRC testing had been advised by a physician to do so. • MD recommended FOBT (Age 50–64 yrs): 258 (5.9%); 95% CI, (5.1–6.7); MD did not recommend FOBT (Age 50–64 yrs): 4006 (94.1%); 95% CI, (93.3–94.9) • MD recommended FOBT (Age ≥ 65): 162 (4.1%); 95% CI, (3.4–4.9); MD did not recommend FOBT (Age ≥ 65): 3838 (95.9%); 95% CI, (95.1–96.6) • MD recommended Endoscopy (Age 50–64 yrs): 255 (7.2%); 95% CI, (6.3–8.1); MD did not recommend Endoscopy (Age 50–64 yrs): 3318 (92.8%); 95% CI, (91.9–93.7) • MD recommended Endoscopy (Age 50–64 yrs): 135 (4.8%); 95% CI, (3.9–5.6); MD did not recommend FOBT (Age 50–64 yrs): 2907; (95.2%); 95% CI, (94.4–96.1)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, N/A)
Were the groups similar at baseline regarding the most important prognostic indicators?			N/A
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Household response rate was 88.9% for the core NHIS survey and 72.1% for the Cancer Control Module
Were the differential drop-out or response rates acceptable (≤ 15%)?			N/A
Were intervention/exposure measures valid, reliable, and equally applied?			N/A
Were the outcome assessors blinded to the intervention or exposure status of subjects?			N/A
Were outcome measures valid, reliable, and equally applied?	X		The procedures were defined only to those who asked, so this may introduce some bias.
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair **Reviewer #1 initials:** BLM **Reviewer #2 initials:** DJH **Comments (explain poor quality ratings):**			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shah, M, Zhu, K., Potter, J.[51] **Year of publication:** 2006 **Dates of data collection:** 2000 **Trial name:** National Health Interview Survey		
OBJECTIVE OR AIM:	This study aimed to examine whether low acculturation is a risk factor for the underutilization of colorectal cancer screening examinations in the Hispanic population.		
DESIGN:	**Setting:** US **Study design:** Survey study; secondary data analysis **Duration (mean followup):** One-time data collection, no follow-up **Overall study size (N enrolled/N analyzed):** 1163		
	All		
Sample size: **Describe intervention:**	Sample size: 1163 Intervention: None; National Health Interview Survey (NHIS)		
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based		
INCLUSION CRITERIA:	Hispanic men and women between the age of 50 and 80 years who identified themselves as Hispanic and never were diagnosed with colon or rectal cancer		
EXCLUSION CRITERIA:	Respondents that underwent any of tests for diagnostic purposes were excluded from the study.		
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**Low Acculturation** Sex: 58.9% female Age: 38.8% 50-59, 33.6% 60-69, 27.5% 70-80 Race: Hispanic	**Moderate Acculturation** Sex: 54.9% female Age: 47.1% 50-59, 32.1% 60-69, 20.8% 70-70 Race: Hispanic	**High Acculturation** Sex: 55.3% female Age: 50.6% 50-59, 30.8% 60-69, 18.7% 70-80 Race: Hispanic
	All		
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	The total household response rate was approximately 88.9% and the final response rate for the Adult Core component was 72.1%.		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shah, M, Zhu, K., Potter, J.[51] **Year of publication:** 2006 **Dates of data collection:** 2000 **Trial name:** National Health Interview Survey
STATISTICAL ANALYSES:	**Describe:** • Chi-square tests were executed to assess differences in colorectal cancer screening across various levels of acculturation and to evaluate statistical significance among the cross-tabulations. • With the use of multiple logistic regression, odds ratios having a screening procedure were computed for each acculturation level. • The analysis was repeated for each of the outcomes: having a FOBT, or an endoscopy, or both. • Odds ratios and 95% confidence intervals were adjusted for demographic factors that included gender, age, education, marital status, family income, and ratio of family income to poverty threshold. • Other variables that were included in the logistic regression model were selected if they were related to the use of either FOBT in the past year or an endoscopy in the past 5 years and the acculturation levels. • Logistic regression analyses were also performed separately for men and women.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Cross-tabulations were performed to assess relationships among potential confounding variables and the dependent variables.
OUTCOME ASSESSMENT:	**Outcome Measures:** The use of at-home FOBT in the past year, any endoscopy procedures in the past 5 years, or either procedure were the outcomes of the study.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Higher acculturated Hispanics were significantly less likely to not have an endoscopy in the past 5 years or not have either an FOBT in the past year or endoscopy in the past 5 years. When other variables were adjusted for in addition to sociodemographic variables, the confidence intervals for the odds ratio estimates for both moderate and high acculturation included the null and no dose-effect relations appeared (Endoscopy: OR = 0.77; 95% CI (0.49–1.20); p=0.040; FOBT: p=.032) • After adjusting for sociodemographic variables and other factors, the confidence intervals of the odds ratio for males included the null for no endoscopy and no FOBT and for either procedure. Similarly, for Hispanic women, there was no association for any of the three screening variables. (Male: OR = 0.55; 95% CI (0.19–1.58) p=0.046; Female: OR = 0.54; 95% CI (0.22–1.31) p=0.189) • Adjusted rates for not being screening with low English language usage as the referent: Moderate: AOR, 0.92; 95% CI, 0.60-1.42; High: AOR, 0.75; 95% CI, 0.45-1.25
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shah, M, Zhu, K., Potter, J.[51] **Year of publication:** 2006 **Dates of data collection:** 2000 **Trial name:** National Health Interview Survey
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?		X	Higher acculturated individuals had different characteristics than other groups.
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			The total household response rate was approximately 88.9% and the final response rate for the Adult Core component was 72.1%.
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair **Reviewer #1 initials: BLM** **Reviewer #2 initials: DR** **Comments (explain poor quality ratings):**			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shapiro et al.[52] **Year of publication:** 2008 **Dates of data collection:** 2005 **Trial name:** NA
OBJECTIVE OR AIM:	The purpose of this analysis was to determine the prevalence of colorectal cancer test use in the United States by various factors and to examine reasons for not having a colorectal cancer test.
DESIGN:	**Setting:** USA **Study design:** Secondary data analysis **Duration (mean follow-up):** No follow-up **Overall study size (N enrolled/N analyzed):** 30,873
Sample size: **Describe intervention:**	**All** Sample size: 13,480 people > 50 No Intervention
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; National Health Interview Survey
INCLUSION CRITERIA:	Respondents ages 50+, no family history of colorectal cancer or certain other risk factors
EXCLUSION CRITERIA:	Respondents with a personal history of colorectal cancer or missing information on history of colorectal cancer
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** NR
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** NA
STATISTICAL ANALYSES:	**Describe:** To provide national estimates of the prevalence of colorectal cancer test use, responses were weighted to reflect the probability of selection with adjustments for nonresponse and poststratification. Adjusted percentages (predictive margins) were computed from multiple logistic regression models controlling for all of the variables in Table 2

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shapiro et al.[52] **Year of publication:** 2008 **Dates of data collection:** 2005 **Trial name:** NA
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** Rates of CRC screening: FOBT within one year, or endoscopy within 10 years. **Secondary Outcome:** Reasons for not having a FOBT or endoscopy, by colorectal cancer testing history, NHIS 2005
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • For respondents who reported an endoscopy within the past 10 years, 72.8% (95% CI, 71.3-74.3) said that their most recent endoscopy was part of a routine exam, whereas 24.3% (95% CI, 22.9-25.8) said that they had the endoscopy because of a problem. • Among respondents who reported a FOBT within the past year, 91.0% (95% CI, 89.2-92.6) said that their most recent FOBT was part of a routine exam, whereas 7.8% (95% CI, 6.3-9.5) said that they had the FOBT because of a problem. • Among those respondents who had not had a FOBT or endoscopy within the recommended time interval, the most commonly reported reason for not having a colorectal cancer test was ''never thought about it''. Reasons for not having a FOBT and reasons for not having an endoscopy were similar • Significant factors to receiving any CRC screening test are: education ($P < .0001$), annual household income ($P < .0006$), marital status ($P = .01$), health care coverage ($P < .0001$), usual source of health care ($P < .0001$), general health status ($P < .0001$), personal history of noncolorectal cancer ($P < .0001$), physical activity ($P < .0001$), cigarette smoking ($P < .0001$), and alcohol use ($P < .0001$) • Large effect sizes for SES variables and for factors related to healthcare access (insurance and having regular doctor) • Yes, doctor recommended FOBT/Endoscopy to respondents that never had FOBT: 159; %, 3.7; 95% CI, (3.1- 4.4); and never had Endoscopy: 435; %, 10.3; 95% CI, (9.3-11.5); No, doctor did not recommend FOBT/Endoscopy to respondents that never had FOBT: 4,347; %, 96.3; 95% CI, (95.6-96.9); and never had Endoscopy: 4,091; %, 89.7; 95% CI, (88.5-90.7); Yes, doctor recommended FOBT/Endoscopy to respondents that had FOBT but not within the recommended time: 244; %, 4.6; 95% CI, (4.0- 5.3); Yes, doctor recommended FOBT/Endoscopy to respondents that had Endoscopy but not within the recommended time: 635; %, 12.1; 95% CI, (11.1-13.1); No, doctor did not recommend FOBT/Endoscopy to respondents that had FOBT but not within the recommended time: 5,362; %, 95.4; 95% CI, (94.7-96.0)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes:** Black and white about same; Latino much lower

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shapiro et al.[52] **Year of publication:** 2008 **Dates of data collection:** 2005 **Trial name:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Good

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			N/A
Were the differential drop-out or response rates acceptable (≤ 15%)?	X		N/A
Were intervention/exposure measures valid, reliable, and equally applied?			N/A
Were the outcome assessors blinded to the intervention or exposure status of subjects?			N/A
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good **Reviewer #1 initials:** BLM **Reviewer #2 initials:** RPH **Comments (explain poor quality ratings):**			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shih, YT, Zhao, L, Elting, L[53] **Year of publication:** 2006 **Dates of data collection:** 2000 and 2003 NHIS data analyzed (secondary data analysis) **Trial name:** NA	
OBJECTIVE OR AIM:	To examine differences in colonoscopy screening rates between 2000 and 2003 among racial/ethnic groups (the authors are interested in whether Medicare coverage of colonoscopy, beginning July 2001 changed the pattern of use adults 65 years and older).	
DESIGN:	**Setting:** Population-based, nationally representative sample (Cancer Control Module 2000 and Cancer Screening Supplement 2003 of the NHIS) **Study design:** secondary data analysis of cross-sectional data from 2000 and 2003 (comparisons made between the two datasets) **Duration (mean followup):** NA **Overall study size (N enrolled/N analyzed):** 2000, N = 6,180; 2003, N = 5,759	
	2000	**2003**
Sample size:	N = 6,180	N = 5,759
Describe intervention:	NA	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	NHIS recruitment strategy not reported	
INCLUSION CRITERIA:	Civilian, noninstitutionalized U.S. households for NHIS; current analysis restricted to participants ≥ 65 years	
EXCLUSION CRITERIA:	NR	
POPULATION CHARACTERISTICS:	**2000**	**2003**
Mean age & range (years): **Sex (% female):** **Race:** **Other:**	• Age (years) 65-74: 54.62% 75-85: 36.53% 85+: 8.85% • Female: 57.46% • Race/ethnicity Hispanic: 5.85% Non-Hispanic white: 83.85% Non-Hispanic black: 8.17% Non-Hispanic other: 2.13% • Highest education attained <HS: 31.57%	• Age (years) 65-74: 52.83% 75-85: 36.37% 85+: 10.80% • Female: 57.67% • Race/ethnicity Hispanic: 5.89%Non-Hispanic white: 83.41% Non-Hispanic black: 8.21% Non-Hispanic other: 2.49% • Highest education attained <HS: 27.66%

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shih, YT, Zhao, L, Elting, L[53] **Year of publication:** 2006 **Dates of data collection:** 2000 and 2003 NHIS data analyzed (secondary data analysis) **Trial name:** NA
	• HS: 34.02% Some college: 19.18% ≥ College: 15.23% • Income Poor: 28.03% Low income: 13.44% Middle income: 8.13% Upper income: 15.53% Unknown: 34.87% • HS: 34.54% Some college: 20.94% ≥ College: 16.86% • Income Poor: 24.09% Low income: 14.69% Middle income: 8.27% Upper income: 16.39% Unknown: 36.57%
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA (secondary data)
STATISTICAL ANALYSES:	Wald chi-squareWald chi-square statistics were used to compare the differences in CRC screening rates between the 2000 and 2003 samples for the identified racial/ethnic groups. Multivariate logistic regression used to examine differences in the likelihood of screening across racial/ethnic groups.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Potential confounders identified in the literature were controlled for in the multivariate analysis. Variables: • Age • Income • Education • Marital status • Census region • Secondary insurance • Self-perceived health status • History of cancer • Usual source of care
OUTCOME ASSESSMENT:	**Outcome Measures:** Ever screened by colonoscopy: NHIS survey question, “Have you EVER HAD a sigmoidoscopy, colonoscopy, or proctoscopy?” If the respondent answered yes, they considered that respondent screened.
RESULTS:	
KQ2 - What factors influence the use of	• In 2000 blacks were less likely to have had endoscopic CRC screening compared with whites (OR =

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shih, YT, Zhao, L, Elting, L[53] **Year of publication:** 2006 **Dates of data collection:** 2000 and 2003 NHIS data analyzed (secondary data analysis) **Trial name:** NA
colorectal cancer screening?	0.788, 95% CI, 0.630, 0.984). However, the odds of screening increased in 2003, and the disparities between the two groups were no longer significant (OR = 0.909, 95% CI, 0.731, 1.131). • The odds of screening declined for Hispanics between the two study years (0.806 vs. 0.768), and the differences between Hispanics and non-Hispanic whites was not significant in 2000, but became significant in 2003 (95% CI, 0.592, 0.997 (*P* = .048). • No statistically significant differences were found between non-Hispanic whites and non-Hispanic others in either year. • Sex differences were not significant in 2000, but were in 2003 (OR = , 95% CI, 1.115, 1.440) • Having a history of cancer was not significantly associated with screening in 2000 but became significant in 2003 (OR = 1.627, 95% CI, 1.021, 2.591), (*P* = .041). • The positive effect of having a usual source of care was significant in 2000 and 2003, and also became more pronounced over time (OR = 4.68, 1 95% CI, 3.092, 7.085) • Unadjusted screening rates were approximately 30% among Hispanics in 2000, with only a slight increase by 2003. Screening among non-Hispanic whites was approximately 45% in 2000, increasing to 50% in 2003 *(findings presented only in a bar chart)* • . Odds of screening declined for Hispanics between 2000 and 2003 and the differences between Hispanics and non-Hispanic whites became significant in 2003 (AOR; 0.77; 95% CI, 0.59-0.997; *P* = 0.048).
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NR
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		NHIS data
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR
Were outcome measures valid, reliable, and equally applied?	X		They used NHIS survey data; however, screening variable wasn't divided into diagnostic and screening colonoscopy
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shih, Y.T, Elting, L.S, Levin, B.[54] **Year of publication:** 2008 **Dates of data collection:** 2000 **Trial name:** NA	
OBJECTIVE OR AIM:	Examine the disparities in colorectal cancer (CRC) screening between US- and foreign-born groups and explore factors associated with such disparities	
DESIGN:	**Setting:** data from 2000 National Health Interview Survey Cancer Control Module **Study design:** Cross-sectional retrospective **Duration (mean follow-up):** No follow-up **Overall study size (N enrolled/N analyzed):** 12,179	
Sample size: **Describe intervention:**	**US-Born** Sample size: 10,739 Survey gathered information on CRC screening rates	**Foreign-Born** Sample size: 1,440 Survey gathered information on CRC screening rates
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Data from 2000 National Health Interview Survey Cancer Control Module	
INCLUSION CRITERIA:	Men and women aged 40 years and over in 2000 were asked questions related to CRC screening	
EXCLUSION CRITERIA:	NR	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**US-Born** Age: 49.41% 50-64, 35.72% 65-79, 14.87% 80+ Sex: 57.75% Female Race/ethnicity: 2.73% Hispanic, 86.42% Non-Hispanic White, 9.63% Non-Hispanic African American/Black, 1.22% Non-Hispanic other	**Foreign-Born** Age: 52.18% 50-64, 35.13% 65-79, 12.68% 80+ Sex: 56.10% Female Race/ethnicity: 37.14% Hispanic, 40.03% Non-Hispanic African American/Black, 15.47% Non-Hispanic other
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**Sample** A cancer control module in the 2000 NHIS received a household response rate of 72.1%.	
STATISTICAL ANALYSES:	**Describe:** • Descriptive statistics were first presented to depict the differences in demographic and socioeconomic characteristics between the US- and foreign-born groups. Differences were compared using chi-square statistics for categorical variables and *t* tests for continuous variables. The authors employed appropriate weighting procedures to account for the complex sample design of the NHIS using survey-related commands in STATA® 7.0 statistical software.	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shih, Y.T, Elting, L.S, Levin, B.[54] **Year of publication:** 2008 **Dates of data collection:** 2000 **Trial name:** NA
	• Controlling for factors associated with CRC screening in the literature, they modeled differences in the likelihood of CRC screening between the US-born and foreign- born groups using multivariate logistic regression. • The authors then added terms that interact the binary variable indicating foreign-born status with demographic, socioeconomic, or access barrier variables that were shown to differ significantly between the US- and foreign-born groups in their univariate analysis and conducted additional multivariate regression analyses.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	**NR ---** multivariate logistic models
OUTCOME ASSESSMENT:	**Outcome Measures:** • The module included the following 7 sections: Hispanic acculturation, diet and nutrition, physical activity, tobacco use, cancer screening, genetic testing, and family history. • The cancer screening section for adults included skin examinations, Pap smears, mammography, clinical breast examinations, prostate specific antigen tests, and CRC screening using endoscopic procedures and/or FOBT.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • The foreign-born group had a significantly lower rate of CRC screening than US-born group (39.3% vs 54.9%, $P < 0.001$). • Long-time, foreign-born residents of the United States were significantly less likely to be screened than US-born non-Hispanic whites (OR, 0.58; 95% CI, 0.51-0.67). • Among the foreign-born group, the recent immigrants (defined as people who migrated to the United States within the last 10 years) (OR= 0.46, 95% CI, 0.29-0.71, $P = 0.0001$) were significantly less likely to receive CRC screening than those who had a long residency (15 years or more) (OR = 0.58, 95% CI, 0.51-1.37, $P < 0.0001$) in the United States. • Among the US-born individuals, lower rates of CRC screening were found in non-Hispanic African Americans/Blacks (OR=.77, 95% CI, 0.68-0.88, p<.0001) and Hispanics (OR=.65, 95% CI, 0.51-0.82, $P < 0.0001$). • Men were significantly less likely to be screened as were poorer respondents (OR= 0.89, 95% CI, 0.81-0.97, $P = 0.01$). • Factors found to be positively associated with CRC screening were older age; higher educational attainment; being insured; married; living in the West census region (vs Northeast); being in good, fair, or poor health condition (vs in excellent health); and having a usual source of care. • Comparisons of ORs indicated that every foreign-born racial/ethnic subgroup had a lower OR than its US-born counterpart

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Shih, Y.T, Elting, L.S, Levin, B.[54] **Year of publication:** 2008 **Dates of data collection:** 2000 **Trial name:** NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** **NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** **NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** **NA**
QUALITY RATING:	**Good**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			N/A The US-born and Foreign-born groups were similar except for Race/ethnicity.
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		A cancer control module in the 2000 NHIS received a household response rate of 72.1%.
Were the differential drop-out or response rates acceptable (≤ 15%)?			NR
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good Reviewer #1 initials: BLM) Reviewer #2 initials: DR Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Sun, W., Basch, C., Wolf, R., Li, X.[55] **Year of publication:** 2004 **Dates of data collection:** December 1, 1999 to March 15, 2000 **Trial name:** NA		
OBJECTIVE OR AIM:	To investigate factors associated with receipt of colorectal cancer (CRC) screening among urban senior Chinese-Americans		
DESIGN:	**Setting:** Senior centers **Study design:** Cross-sectional **Duration (mean follow-up):** No follow-up **Overall study size (N enrolled/N analyzed):** 203		
Sample size: **Describe intervention:**	**All** Sample size: 203 I ntervention: None, survey		
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; community centers		
INCLUSION CRITERIA:	Age 50+, current New York City resident, free from symptoms of bowel disease		
EXCLUSION CRITERIA:	NR		
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Age: 22.2% 50-59, 39.4% 60-69, 37.4% 70+ Sex: 43.8% female Race: 100% Asian		
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** 89.4% agreed to participate		
STATISTICAL ANALYSES:	**Describe:** Chi-squared tests were used to analyze categorical data. Stepwise logistic regression was used to determine possible predictors that included age, gender, marital status, ownership of dwelling, citizenship, years of residency, education, household income, health insurance, employment, family history of CRC, salience and coherence, self-efficacy, social influence, efficacy of screening, worries or fears, perceived susceptibility, and intention. One-way analysis of variance (ANOVA) was used to compare means for measured variables among subjects who had an FOBT, FOBT plus sigmoidoscopy, or neither.		
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	After excluding confounding factors, senior Chinese who had fewer years of residency, lower levels of worries or fears, and higher levels of perceived susceptibility to CRC tended to have higher rates of FOBT.		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Sun, W., Basch, C., Wolf, R., Li, X.[55] **Year of publication:** 2004 **Dates of data collection:** December 1, 1999 to March 15, 2000 **Trial name:** NA
OUTCOME ASSESSMENT:	**Outcome Measures:** CRC screening with FOBT or FOBT plus sigmoidoscopy
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • In multivariate analysis, years of residency in the US (AOR = 0.64, 95% CI, 0.41-0.99; *P* < 0.05), worries or fears of positive results (OR = 0.82, *P* < 0.05), and perceived susceptibility (OR = 1.14, *P* < 0.05) were significant predictors of participation in FOBT alone. • In addition, years of residency in the US (OR = 0.55, *P* < 0.01), worries or fears of positive results (OR = 0.66, *P* < 0.01), and perceived susceptibility participation in FOBT or FOBT plus sigmoidoscopy. • Family history, social influence, efficacy of screening, and intention to screen were no longer independent predictors once the other variables were in the model. • For subjects who received both FOBT and sigmoidoscopy, level of education (OR = 1.58, *P* = 0.04), worriers or fears of positive results (OR = 0.72, *P* < 0.01), and perceived susceptibility (OR = 1.26, *P* < 0.01) were significant predictors in multivariate analysis. Family history, self-efficacy, social influence, and intention to screen were no longer independent predictors once the other variables were in the model.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** **NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** **NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** **NA**
QUALITY RATING:	**Fair**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Were the differential drop-out or response rates acceptable (≤ 15%)?			
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	NA		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Thompson et al.[56-58] **Year of publication:** 2002, 2004, 2006 **Dates of data collection:** baseline: 1998-1999; "final" survey: 2003 **Trial name:** NR		
OBJECTIVE OR AIM:	2002{#2275): socioeconomic status is explored as a predictor of differences between Hispanics and non-Hispanic whites in cancer prevention behavior 2004{#1219): to compare CRC screening prevalence and the association between reported barriers and screening participation between Hispanics and non-Hispanic whites 2006{#1188): to examine whether a comprehensive intervention influenced cancer screening behaviors and lifestyle practices in rural communities in Eastern WA state		
DESIGN:	**Setting:** 20 communities in Lower Yakima Valley, Washington State **Study design:** randomization of communities; cross sectional community based surveys at baseline{#1219) and post-intervention Also, cohort of 823 individuals aged 50 and older who were non-compliant with CRC screening at baseline and who agreed to be re-interviewed at final surveying **Duration (followup):** 30 months of intervention, > 3 years for follow-up survey **Overall study size (N enrolled/N analyzed):**		
INTERVENTIONS:	**No intervention**	**Intervention**	**At baseline all 20 communities sampled for data in study #1219**
Sample size:	10 communities	10 communities	
Describe intervention:		Community Advisory Board; Focus groups to develop and test interventions; Activities directed at the community, organizational, small group, and individual levels: Health fairs, block parties, festivals and other events where educational presentations were made Multiple interventions through churches, clinical (free colorectal cancer screening), worksites Home health parties Promotoras	

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Thompson et al.[56-58] **Year of publication:** 2002, 2004, 2006 **Dates of data collection:** baseline: 1998-1999; "final" survey: 2003 **Trial name:** NR				
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Recruitment of communities not described				
INCLUSION CRITERIA:	Presumed convenience sample of 20 communities that range in size from very small (300) to medium (7,000) in the Lower Yakima Valley. For 2004 study, subset of the population-based survey (n = 1795) based on eligibility to answer questions about CRC screening (age > =50)				
EXCLUSION CRITERIA:					
POPULATION CHARACTERISTICS: **Age (%)**	2004 Baseline: Non-Hispanic White	2004 Baseline: Hispanic	2004 CRC study Baseline Non-Hispanic White	2004 CRC study Baseline Hispanic	Demographics for intervention vs. control are not presented Total sample for final survey
18-39	29	63			43.4%
40-49	20	1	50-59 34.2	37.2	20.0%
50-64	24	11	60-69 25.1	31.4	19.9%
65+	27	8	≥70 40.7	31.4	16.7%
			58.0	62.0	
Sex (% female):	57	58			55.2%
Race:					Breakdown not presented
Other population qualities:					
Education			12.7	76.6	
8th grade or less	7	54	52.6	16.8	26.1%
9th-12th, no diploma	18	23	19.4	5.8	23.1%
High school or GED	32	13	15.3	<1.0	22.3%
At least some college	43	11			28.5%
Insurance			Have Insurance:	Have Insurance:	
Private	66	24	93.9%	73.0%	45.6%
Medicare	11	7			8.4%
Public	10	26			24.3%
None	1	43			21.7%

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Thompson et al.[56-58] **Year of publication:** 2002, 2004, 2006 **Dates of data collection:** baseline: 1998-1999; "final" survey: 2003 **Trial name:** NR
Attrition/Drop-out (not available for endpoint measurement): **Adherence in control group:** **Contamination in control group:**	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** For persons > 50 years: FOBT screening within the past 2 years Flex sig/colonoscopy within the past 5 years Categorized as "ever screened, but noncompliant"; "never screened"; "compliant". For the 2005{#1219) report, when examining the intervention effect, the community pairing and community level effects were controlled for as random effects. To examine whether the interaction effect differed for Hispanic and non-Hispanic whites, the authors included an interaction between treatment arm status and ethnicity. Respondents{#1219) who reported having had an FOBT within the past 2 years were classified as being "in compliance." Similarly, if residents ≥ 50 years reported having received a sigmoidoscopy within the previous 5 years, they were compliant, but they were not compliant if the sigmoidoscopy was received > 5 years, or if they had never received a sigmoidoscopy. In piloting the instrument, they found that their respondents could not differentiate a sigmoidoscopy from a colonoscopy even when they used a visual of the procedure and described the differences. For that reason, they report sigmoidoscopy/colonoscopy together.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** 2002{#2275): Non significant differences between Non-Hispanic white and Hispanics in rates of FOBT and FS/colonoscopy, when adjusted for age, education, and insurance coverage

	Non Hispanic White	Hispanic	p
FOBT ever screened, but noncompliant	54.1	44.1	0.315
FOBT never screened	47.5	47.4	0.986
FS/Colon screened, but noncompliant	35.1	27.3	0.453
FS/Colon never screened	58.6	63.1	0.458

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Thompson et al.[56-58] **Year of publication:** 2002, 2004, 2006 **Dates of data collection:** baseline: 1998-1999; "final" survey: 2003 **Trial name:** NR

2004{#1219): Table 2

Participation in FOBT and FS/colon screening, by ethnicity (age unadjusted numbers)

	Non-Hispanic White	Hispanic	P
FOBT ever	55.7	40.6	0.003
In last 2years	34.8	25.8	0.32
>2 years ago	20.9	9.9	0.005
FS/colon ever	44.4	26.9	<0.001
In last 5 years	33.7	24.1	<0.05
>5 years ago	10	3.0	0.013

Table 3 Associations of demographic characteristics with compliance with FOBT and sig/colon

	Relative OR (95% CI) of FOBT		Relative OR (95% CI) of FS/Colon	
	Raw	Adjusted	Raw	Adjusted
Race/ethnicity				
Non-Hispanic white	1.0	1.0	1.0	1.0
Hispanic	0.44 (0.27-0.74)	0.63 (0.33-1.24)	0.63 (0.39-1.01)	0.52 (0.28-0.98)

- adjusted for all other demographic and lifestyle variables

In 2004{#1219):

For being current with FOBT, the OR for Hispanic was lower in raw data (0.44). This difference was attenuated (OR 0.63) when adjusting for age, education, gender and insurance, and became not statistically significant (but with a wide CI, raising question of power to detect difference).

For FS/colonoscopy, OR significant in raw (borderline) and actually increased slightly after adjustment for above factors.

In 2002{#2275):

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Thompson et al.[56-58] **Year of publication:** 2002, 2004, 2006 **Dates of data collection:** baseline: 1998-1999; "final" survey: 2003 **Trial name:** NR
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** Final cancer screening practices and cancer prevention lifestyle behaviors of intervention and control, adjusted for community pair and community and ethnic-specific baseline proportions of screening service use A. Community Survey results Hispanic: Intervention 48.1; Control 54.2; p 0.50 Non-Hispanic White: Intervention 57.9; Control 62.9; p 0.43 FOBT ever screened Hispanic: Intervention 70.4; Control 52.8; p 0.09 Non-Hispanic White: Intervention 48.2; Control 48.6; p 0.94 FOBT compliant Hispanic: Intervention 29.1; Control 37.5; p 0.30 Non-Hispanic White: Intervention 44.6; Control 48.7; p 0.47 FS/Colon ever screened Hispanic: Intervention 83.9; Control 69.7; p 0.24 Non-Hispanic White: Intervention 77.4; Control 79.8; p 0.66 FS/Colon compliant with screening B. Cohort results Final use of screening services for CRC among cohort of respondents ages 50 and older who were non-compliant at baseline survey Hispanic: Intervention 78.5; Control 64.0; p 0.53 Non-Hispanic White: Intervention 62.2; Control 47.8; p 0.23 FOBT ever screened , noncompl Hispanic: Intervention 57.1; Control 48.3; p 0.59 Non-Hispanic White: Intervention 47.4; Control 29.0; p 0.03 FOBT never screened Hispanic: Intervention *; Control *; p * Non-Hispanic White: Intervention *; Control *; p 0.21 FS/Colon ever screened, but noncompl Hispanic: Intervention 92.6; Control 86.1; p 0.55 Non-Hispanic White: Intervention 64.8; Control 54.3; p 0.21 FS/Colon never screened
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes: NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes: NA**
QUALITY RATING:	KQ2 fair KQ3 poor

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Controlled Trials; note this is for the RCT study

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	x		
Was the method of randomization adequate?			X possibly, not described
Was the treatment allocation concealed?			
Were the groups similar at baseline regarding the most important prognostic indicators?			X not described!
Was the outcome assessor blinded?			
Was the care provider blinded?			
Was the patient blinded?			
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			
Was the differential drop-out rate acceptable (≤ 15%)?			
Were co-interventions avoided or similar?			unknown
Were outcome measures valid, reliable, and equally applied?	x		
Were all randomized participants analyzed in the group to which they were originally assigned?			
Quality Rating (Good, Fair, or Poor): KQ 3 poor; KQ 2 fair **Reviewer #1 initials:** DSP **Reviewer #2 initials:** DR **Comments:**			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Thorpe, L.E., et al.[59] **Year of publication:** 2005 **Dates of data collection:** 2003 **Trial name:** NA
OBJECTIVE OR AIM:	This detailed analysis of individual- and neighborhood-level factors associated with colon cancer screening practices will guide the NYC campaign to increase colonoscopy screening and will provide baseline measures with which the campaign can be evaluated.
DESIGN:	**Setting:** New York City, NY **Study design:** Secondary data analysis; cross-sectional telephone survey **Duration (mean followup):** No followup, data collection over 3 months **Overall study size (N enrolled/N analyzed):** 9,802 (≥50 yrs = 3,606)
	All
Sample size:	Sample size: 3,606 adults
Describe intervention:	Intervention: No intervention; New York City Community Health Survey (CHS)
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; New York City Community Health Survey (CHS)
INCLUSION CRITERIA:	To be surveyed: age 18+ In analysis: age 50+
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS:	NR
Mean age & range (years):	
Sex (% female):	
Race:	
Other:	
Attrition/Drop-out (not available for endpoint measurement):	
Adherence:	
Contamination:	
Response Rates (e.g. for surveys):	Cooperation rate of 59%, response rate of 26%l

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Thorpe, L.E., et al.[59] **Year of publication:** 2005 **Dates of data collection:** 2003 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** • Descriptive statistics were used to determine prevalence of screening patterns, and 95% confidence intervals for both prevalence and affected population estimates were calculated with the exact binomial distribution. • Univariate associations were tested at the 0.05 significance level with the chi-square statistic, and stratified analyses were used to examine nonhomogeneity of associations across other covariates. • Multiple logistic regression was used to identify independent predictors of colorectal cancer screening and to adjust for confounding.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Multiple logistic regression was used to identify independent predictors of colorectal cancer screening and to adjust for confounding. Variables included: Demographic (age, race, ethnicity, gender) Personal risk behaviors (smoking, physical activity) SES/Access (house income, insurance, regular doctor) Neighborhood/contextual variable (Neighborhood income)
OUTCOME ASSESSMENT:	**Outcome Measures:** Two models were constructed with different dependent outcomes: having undergone any CRC screening test in a recommended time frame (every 10 years for colonoscopy, every year for FOBT, and every 5 years for flexible sigmoidoscopy) and having undergone a colonoscopy within the past 10 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Adults born outside of the U.S. reported significantly lower levels of any colorectal cancer screening than adults born in the U.S. • Reports of FOBT screening during the preceding year were particularly high among non-Hispanic black women (40%, 95% CI, 35%–45%). • Colonoscopy was the most frequently reported screening test in all race and ethnic groups, although non-Hispanic white adults had a significantly higher rate of colonoscopy (and overall colorectal screening) than other groups. Non-Hispanic black adults reported higher levels of FOBT screening than other racial and ethnic groups. • CRC screening was significantly higher among men aged 65+ years compared with men aged 50–64 years (63% vs. 52%, OR = 1.3; 95%CI, 1.0 –1.6), whereas differences in overall CRC screening frequency among older women compared with younger women were more modest (57% vs. 52%; OR= 1.6; 95%CI 1.2–2.0). • Gender differences in colorectal screening were most evident among Asians, with Asian men being twice as likely as Asian women to have received any timely colorectal cancer screening test (50% vs. 23%; OR= 2.9; 95%CI, 1.4–6.3). • Current smokers were less likely to have received a timely screening than nonsmokers (44% vs. 57%; OR= 0.62; 95% CI, 0.50–0.78), and physically inactive adults were less likely to be screened than those reporting some physical activity (50% vs. 59%; OR= 0.75; 95% CI, 0.63– 0.89).

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Thorpe, L.E., et al.[59] **Year of publication:** 2005 **Dates of data collection:** 2003 **Trial name:** NA
	• Adults who did not receive an influenza vaccination in the past 12 months were less likely to have been screened than those who did obtain the vaccination (46% vs. 66%, OR= 0.44; 95% CI, 0.37– 0.53). • Simultaneous adjustment for multiple covariates tended to reduce the magnitude of observed differences in recent colorectal cancer screening by any modality across racial and ethnic groups and among foreign-born persons. • Factors significantly associated with not having a colonoscopy within the past 10 years included age < 65 years (AOR= 0.68; 95%CI, 0.54–0.86), black or Asian ethnicity (black AOR = 0.72, 95%CI, 0.58–0.91; Asian AOR= 0.36, 95%CI, 0.22– 0.58), and female gender (AOR= 0.74, 95% CI, 0.62– 0.89).
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** **NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** **NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** **NA**
QUALITY RATING:	**Fair**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Cooperation rate=58%, response rate=26%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Trivers, K.F., Shaw, K.M., Sabatino, S.A., Shapiro, J.A., Coates, R.J.[60] **Year of publication:** 2008 **Dates of data collection:** 2000 and 2005 **Trial name:** NA	
OBJECTIVE OR AIM:	This study aimed to determine whether progress was made between 2000 and 2005 in reducing CRC screening disparities by race, ethnicity, income, and insurance status.	
DESIGN:	**Setting:** Household survey **Study design:** Longitudinal, cross-sectional study **Duration (mean followup):** 5-year follow-up **Overall study size (N enrolled/N analyzed):** *n*=6020 in 2000, *n*=6706 in 2005	
Sample size:	**2000** Sample size = 6,020	**2005** Sample size = 6,706
Describe intervention:	Intervention: NHIS cancer control supplement	Intervention: NHIS cancer control supplement
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based	
INCLUSION CRITERIA:	Respondents to the 2000 and 2005 NHIS cancer control supplements, age 50-64, civilian, non-institutionalized	
EXCLUSION CRITERIA:	History of CRC	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**2000** Age: 41.9% 50-54, 32% 55-59, 26.1% 60-64 Sex: 51.9% Race: 84.8% White, 9.8% Black, 2.9% Asian, .7% AI/AN, 1.7% Other	**2005** Age: 39.9% 50-54, 33.6% 55-59, 26.5% 60-64 Sex: 51.8% female Race: 85% White, 10.7% Black, 3.2% Asian, .8% AI/AN, .2% Other
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**2000** 72.1% response rate for cancer control supplements	**2005** 69.0% response rate for cancer control supplements

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Trivers, K.F., Shaw, K.M., Sabatino, S.A., Shapiro, J.A., Coates, R.J.[60] **Year of publication:** 2008 **Dates of data collection:** 2000 and 2005 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** • For each group of interest, the percentages of respondents reporting screening within the defined time frame and 95% CIs were calculated, stratified by gender, and age-adjusted within the survey year. • Changes in disparities over time (from 2000 to 2005) were present if CIs for the differences in percentages did not overlap or exhibited only minimal overlap. • Multivariate logistic regression analysis, stratified by gender, was used to estimate screening disparities adjusted for age, race, ethnicity, poverty ratio, insurance status, education, region, and duration of U.S. residence
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** Up-to-date with CRC screening
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Among men, the percentages screened in 2005 were higher than those in 2000 for white men, non-Hispanic men, those with middle or high incomes, and those with private insurance. The largest significant increase in screening over time was among middle-income men (7.4 percentage points, CI=1.8, 12.9). The uninsured made the least progress over time and had the lowest screening rates in both years (e.g., 19.1%, CI=14.6, 24.5 in 2005). • In 2005, Asian men continued to report the lowest screening of any racial group examined, with 33.2% reporting screening, a 12.0 percentage-point difference compared to white men. In both years, Hispanic men reported less screening than non-Hispanic men, as did men with lower compared to higher incomes. • The largest disparity was associated with being uninsured, and no reduction in the disparity occurred over time. • Screening did not increase among Hispanic women or uninsured women (27.1%, CI=22.0, 32.8; and 19.3%, CI=15.7, 23.4 in 2005, respectively). Asian women had the largest gain in screening (in 2005, 38.5%, CI=27.6, 50.7); however, they had the lowest observed screening rate of any racial group examined among women. • In 2005, uninsured women were least likely to be screened. • Disparities associated with Hispanic ethnicity, low income, and being uninsured were larger in 2005 versus 2000. The difference between Hispanic and non-Hispanic women in 2000 was 8.8 percentage points (CI=3.0, 14.6). This gap rose to 19.3 percentage points (CI=13.6, 25.0) in 2005.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Trivers, K.F., Shaw, K.M., Sabatino, S.A., Shapiro, J.A., Coates, R.J.[60] **Year of publication:** 2008 **Dates of data collection:** 2000 and 2005 **Trial name:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	**Fair**

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			72.1% response rate for cancer control supplements in 2000, 69% in 2005
Were the differential drop-out or response rates acceptable (≤ 15%)?	X		
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DJH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Walsh JME et al.[61] **Year of publication:** 2004 **Dates of data collection:** November 2001 to June 2002 **Trial name:** NA		
OBJECTIVE OR AIM:	To identify current colorectal cancer screening practices and barriers and facilitators to colorectal cancer screening in Latino, Vietnamese, and non-Latino white populations in San Jose, California		
DESIGN:	**Setting:** Telephone survey amongst Latino, Vietnamese, and non-Latino whites aged 50 to 79 years residing in San Jose (Santa Clara County), California **Study design:** Cross-sectional **Duration (mean followup):** NA **Overall study size (N enrolled/N analyzed):** 1,559 contacted, 775 enrolled (50%)		
	White	**Latino**	**Vietnamese**
Sample size:	N=310	N=226	N=239
Describe intervention:	NA	NA	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Community-based		
INCLUSION CRITERIA:	• 50 to 79 years old • Self identified as white, Latino, or Vietnamese. • Able to communicate in either English, Spanish, or Vietnamese		
EXCLUSION CRITERIA:	• Those not within the target age group and population		
POPULATION CHARACTERISTICS:	Total: Educational level, insurance status, median income, employment status, marital status, having a regular physician, and having been to the doctor in past 12 months were significantly different ($P < 0.05$) between ethnic groups		
Mean age & range (years): **Sex (% female):**	• 61 (±8) • 50.5%F		
Race:	• 40% white • 29.2% Latino • 30.8% Vietnamese		
Other: • Education • Insurance (%) • Income (median) • Acculturation (%) • Marital status • Having a regular	• 42.4% ≤ High School education • 6.7% Uninsured • $50,000 • 48% low • 69.9% married • 87.1%		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Walsh JME et al.[61] **Year of publication:** 2004 **Dates of data collection:** November 2001 to June 2002 **Trial name:** NA
physician	
	Overall
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	50% of those contacted and eligible refused to participate
Response Rates (e.g. for surveys):	• 40% white • 29.2% Latino • 30.8% Vietnamese
STATISTICAL ANALYSES:	• Descriptive statistics for demographic and dependent variables • Univariate analysis (Student's t test and logistic regression) to determine association between predictor variables (age, gender, ethnicity, acculturation, education, income and insurance) and dependent variables (bring up-to-date for screening and intention to be screened) • Multivariate analysis: Multivariate regression analysis to determine which predictors remained significant when correcting for other variables
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Multivariate regression analysis to account for age, gender, ethnicity, acculturation, education, insurance, and income
OUTCOME ASSESSMENT:	**Outcome Measures:** • Unadjusted Screening rates for FOBT in the past year or sigmoidoscopy in the past 5 years or colonoscopy in the past 10 years or receipt of any of the tests in the recommended time interval • Predictors of being up-to-date with colon screening: FOBT in the past year or sigmoidoscopy in the past 5 years or colonoscopy in the past 10 years or receipt of any of the tests in the recommended time interval • Predictors of intention to be screened: Plan to have FOBT in next year or sigmoidoscopy in the next 5 years or colonoscopy in the next 10 years or planning to have any of the tests in the recommended time interval
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	The biggest predictor of having had a sigmoidoscopy or colonoscopy was physician recommendation (OR, 6.50; 95 CI, 2.34-18.08). Because this was such a strong factor, excluding it from the analysis allowed other important variables to be explored.

Outcomes:	FOBT in past yr	SIG in past 5 yrs	COL in past 10 yrs	Any
Unadjusted screening rates:				
• White	19%	35.5%	30.6%	41.9%
• Latino	18.1%	29.2%	27%	37.2%

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Walsh JME et al.[61] **Year of publication:** 2004 **Dates of data collection:** November 2001 to June 2002 **Trial name:** NA				
	• Vietnamese	31.4%	18.4%	21.8%	45.2%
	Adjusted predictors of being up-to-date (OR, 95% CI)	**(OR, 95% CI)**	**(OR, 95% CI)**	**(OR, 95% CI)**	**(OR, 95% CI)**
	• Age (per 5 yrs)	1.22 (1.04-1.44)	1.22 (1.05-1.43)	1.19 (1.02-1.39)	1.24 (1.03-1.50)
	• Gender (male)	0.89 (0.60-1.31)	1.44 (0.96-2.16)	1.36 (0.91-2.03)	1.50 (1.00-2.25)
	Ethnicity (compared with white)				
	• Latino	1.01 (0.52-1.94)	0.90 (0.52-1.56)	1.27 (0.73-2.22)	0.55 (0.30-1.02)
	• Vietnamese	1.37 (0.49-3.86)	0.26 (0.09 -0.72)	0.65 (0.30-1.44)	0.37 (0.12-1.08)
	• Acculturation (low)	0.87 (0.38-1.99)	1.71 (0.84-3.48)	0.96 (0.49-1.88)	2.10 (0.84-5.26)
	• Education	0.89 (0.73-1.09)	1.51 (0.86-1.27)	1.01 (0.83-.23)	1.04 (0.84-1.28)
	• Income	1.05 (0.90 -1.23)	0.99 (0.87-1.14)	1.02 (0.90-1.17)	1.01 (0.89 -1.15)
	• No Insurance (compared with medicare)	0.97 (0.38- 2.50)	0.44 (0.15-1.34)	0.31 (0.10-0.94)	0.57 (0.22 -1.50)
		1.12 (0.95-1.32)	0.97 (0.84-1.14)	0.92 (0.78-1.08)	1.28 (1.07-1.52
		1.09 (0.76-1.56)	1.29 (0.91-1.83)	1.05 (0.71-1.54)	1.20 (0.79-1.84)
	Adjusted Predictors of intention to be screened				
	• Age (per 5 yrs)		1.41 (0.79-2.52)	2.04 (1.07-3.88)	1.31 (0.70-2.44)
	• Gender	1.18 (0.66-2.12)	1.52 (0.70-3.29)	1.19 (0.50-2.84)	0.73 (0.31-1.74)
	Ethnicity (compared with white)	1.70 (0.71-4.05)			
	• Latino		2.19 (1.12-4.28	1.86 (0.90-3.83)	2.07 (1.00-4.30)
	• Vietnamese	1.81 (0.91-3.58)	1.07 (0.89-1.29)	1.06 (0.87-1.29)	0.98 (0.78-1.22)
	• Acculturation (low)	0.96 (0.79-1.16)	1.03 (0.87-1.23)	1.01 (0.88-1.16)	1.06 (0.88-1.27)
	• Education	0.96 (0.84-1.08)	0.43 (0.18-1.01)	0.95 (0.38-2.37)	1.18 (0.44-3.14)
	• Income	0.56 (0.23-1.34)			
	• No Insurance (compared with Medicare)				
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and	NA				

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Walsh JME et al.[61] **Year of publication:** 2004 **Dates of data collection:** November 2001 to June 2002 **Trial name:** NA
followup?	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?		X	
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			
Were the differential drop-out or response rates acceptable (≤ 15%)?			NR
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NR
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Wee, C.C., McCarthy, E.P., Philips, R.S.[62] **Year of publication:** 2004 **Dates of data collection:** 2000 **Trial name:** NA
OBJECTIVE OR AIM:	Understand the relative contribution of patient factors and physician counseling patterns to the low prevalence of screening.
DESIGN:	**Setting:** Home; telephone survey: 2000 National Health Interview Survey with the Cancer Control Module **Study design:** Secondary data analysis **Duration (mean followup):** One-time survey collection during 2000 **Overall study size (N enrolled/N analyzed):** 11,427
Sample size: **Describe intervention:**	**All** Sample Size: 11,427 No intervention, telephone survey
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based
INCLUSION CRITERIA:	Age 50-75, completed the national Health Interview Survey
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**All** Age range: 50-75 Mean age: 64
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**All** Combined response of 72% to the supplement and core surveys
STATISTICAL ANALYSES:	**Describe:** • Used descriptive statistics and bivariate analyses to characterize the sample. • Used multivariable logistic regression to examine the correlates of the colon cancer screening outcomes
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	• Exposures, i.e. factors of interest were cited reasons for not having screening, with specific inquiry about physician counseling. Participants asked what was the most important reason for not having

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Wee, C.C., McCarthy, E.P., Philips, R.S.[62] **Year of publication:** 2004 **Dates of data collection:** 2000 **Trial name:** NA
	FOBT. • Other demographic factors were age, race/ethnicity, education, region of US, BMI. • Potential confounders included family history of CRC, healthcare access, smoking status, and illness burden.
OUTCOME ASSESSMENT:	**Outcome Measures:** Respondents were asked if and when they ever have had FOBT, sigmoidoscopy, or colonoscopy. **Secondary Outcome:** Reasons respondents did not have FOBT or sigmoidoscopy or colonoscopy
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Sex, race/ethnicity, region, and health status were significant at the level of *P*<.001 for FOBT screening. • BMI was significant at the level of *P*<.001 for simoidoscopy/colonoscopy. • Education, insurance coverage, and usual source of care were significant at the level of *P*<.0001 for FOBT and sigmoidoscopy/colonoscopy. • Nonwhites less likely to have FOBT in unadjusted analysis. After adjustment, race/ethnicity, access, and education were associated with screening. Hispanics and low SES were less likely to be screened than their counterparts. • Hispanics and "other" (non-black, non white) less likely to report physician counseling. This was true even when adjusted for other factors in the table (e.g. USOC). • Reasons that respondents did not have an FOBT (of 9017): 22% reported their physician not recommending it. Among respondents who gave a reason other than lack of physician recommendation for not completing FOBT, 5793 respondents had a provider visit in the previous year; of these, 94% reported that their doctor had not discussed FOBT with them. • Reasons that respondents did not have a sigmoidoscopy or colonoscopy (of 7863): 21% reported their physician not recommending it. Among the subset of respondents who gave a reason other than lack of physician advice, 5096 had a provider visit in the previous year; of these, 92% reported that their doctor did not recommend sigmoidoscopy or colonoscopy.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Wee, C.C., McCarthy, E.P., Philips, R.S.[62] **Year of publication:** 2004 **Dates of data collection:** 2000 **Trial name:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]		X	combined response of 72% to the supplement and core surveys
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: DR Comments (explain poor quality ratings):.			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Wong et al.[63] **Year of publication:** 2005 **Dates of data collection:** 2001 **Trial name:** NA						
OBJECTIVE OR AIM:	To examine CRC screening rates among different Asian-American groups compared with non-Latino whites, and factors related to CRC screening						
DESIGN:	**Setting:** California **Study design:** population-based telephone survey **Duration (mean follow-up):** NA **Overall study size (N enrolled/N analyzed):** 19,489						
	Asian Americans			**Non-Latino whites**			
Sample size:	1, 771			17,718			
Describe intervention:	NA			NA			
RECRUITMENT: (population-based, clinic-based, volunteer, other)	random digit dialing, list samples						
INCLUSION CRITERIA:	Asian-Americans, non-Latino whites, 50 years and older						
EXCLUSION CRITERIA:	Individuals who had CRC (n = 162); Cambodians were excluded from analysis because of small number who met age criteria						
POPULATION CHARACTERISTICS:	Chinese	Fillipino	South Asian	Japanese	Korean	Vietnamese	Non-Latino whites
Mean age & range (years):	62.56	61.58	56.77	65.97	62.21	61.27	64.97
Sex (% female):	54	56	42	58	56	51	54
Education (%)							
Grade lt 12	22	9	2	2	21	39	6
HS grad, some college	39	43	22	59	35	43	55
College graduate or more	39	48	76	39	44	18	39
Married	78	71	83	70	79	73	62
Born in US (%)	14	6	2	82	2	0	83
Uninsured (%)	9	10	10	1	32	14	4
0-99% FPL	24	80	7	4	19	55	6
100-199% FPL	20	26	4	18	30	24	17
≥ 300% FPL	44	48	77	63	36	15	62

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Wong et al.[63] **Year of publication:** 2005 **Dates of data collection:** 2001 **Trial name:** NA
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA
STATISTICAL ANALYSES:	**Describe:** Descriptive statistics were computed for all sociodemographic and dependent variables, including means and standard errors for continuous data and frequency distributions for each categorical variable. In the bivariate analyses, chi-square tests and *t* tests were used to determine any significant ethnic differences in sociodemographics and CRC screening outcomes. Six multivariate logistic regression models were used to assess the extent to which ethnic group differences in CRC screening were explained by predisposing, enabling, and need factors. All reported ORs were considered statistically significant at the $P < 0.05$ level.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Predisposing variables that were controlled for included ethnic group (Chinese, Filipino, South Asian, Japanese, Korean, Vietnamese, and non-Latino white), age, gender, educational attainment (≤ Grade 12, some college, undergraduate degree or greater), marital status, household size (1, 2, or ≥ 3 individuals), years in the United States (< 15 yrs, ≥ 15 yrs), English-language proficiency, income (0%-99% of the FPL, 100%-199% of the FPL, 200%-299% of the FPL, and ≥ 300% of the FPL), comorbid conditions (diabetes or cardiovascular disease), and a family history of CRC. Enabling variables that were controlled for included insurance status (public, private, or uninsured), a usual source of care (yes or no), and the number of physician visits in the last year. Need variables that were controlled for included both physical and mental health, which were scored from 0 to 100 (higher score = better health), general health status, and limitation of activities. They also included a variable that accounted for the data collection method (RDD sample or list sample).
OUTCOME ASSESSMENT:	**Outcome Measures:** Whether individuals ever had CRC screening; whether individuals were up to date for CRC screening. A respondent was considered up to date if she/he had undergone either FOBT in past yr or endoscopy in past 10 yrs or both
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** **<u>Bivariate</u>** • Receipt of CRC screening low for all groups • Asian Americans had lower rates compared with non-Latino whites ($P < 0.001$) • Non-Latino whites had highest rate of undergoing FOBT (58%), endoscopy (57%), and any CRC

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Wong et al.[63] **Year of publication:** 2005 **Dates of data collection:** 2001 **Trial name:** NA
	screening (75%) • Asian American rates were 38% for FOBT, 42% for endoscopy and 58% for any screening • Koreans had lowest rate of undergoing FOBT (23%) and any screening (49%) • Vietnamese had lowest rate of undergoing endoscopy (36%) • Japanese rates for all three CRC screening outcomes similar to non-Latino white rates **Multivariate** • After controlling for predisposing, enabling and need variables, the only ethnic group less likely than non-Latino whites to have undergone FOBT was Koreans (OR 0.40; 95% CI: 0.25, 0.62) • Other predisposing factors associated with significantly lower receipt of FOBT included male gender (OR 0.90; 95% CI: 0.83, 0.97), those who lived in households with ≥ 3 individuals (OR 0.80; 95% CI: 0.74, 0.87), those who lived in US for < 15 yrs (OR 0.56; 95% CI: 0.38, 0.83), and those with family income < 300% of FPL • Individuals more likely to have undergone FOBT included those who were older (OR 1.02; 95% CI: 1.01, 1.03), college graduates (OR 1.70; 95% CI: 1.42, 2.03), and those with family history of colon cancer (OR 1.77; 95% CI: 1.43, 2.19) • Significant enabling factors for FOBT receipt were having either public insurance (OR 2.00; 95% CI: 1.53, 2.61), or private insurance (OR 1.59; 95% CI: 1.30, 1.95), having a usual source of care (OR 2.49; 95% CI: 1.97, 3.14) • Need factors associated with undergoing FOBT included more physician visits (OR 1.04; 95% CI: 1.02, 1.05) • All Asian-American ethnic groups had similar rates of being up to date with FOBT compared with non-Latino whites • One predisposing factor was associated with individuals who were significantly less likely to be up to date with FOBT: living in households with ≥ 3 individuals (OR 0.68; 95% CI: 0.58, 0.79) • Individuals more likely to be up to date with FOBT screening if they were married (OR 1.41; 95% CI: 1.24, 1.62), if they had a family history of colon cancer (OR 1.77; 95% CI: 1.43, 2.19), if they had either public health insurance (OR 2.00; 95% CI: 1.53, 2.61), or private health insurance (OR 1.59; 95% CI: 1.30 , 1.95), if they had more physician visits (OR 1.04; 95% CI: 1.02, 1.05), if they had a usual source of care (OR 2.49; 95% CI: 1.97, 3.14), and if they had better physical health (OR 1.00; 95% CI: 1.00, 1.01) or better mental health (OR 1.00; 95% CI: 1.00, 1.01) • Filipinos were less likely to be up to date with endoscopy (OR 0.68; 95% CI: 0.48, 0.97) • Individuals significantly less likely to be up to date with endoscopy if they lived in a household of ≥ 3 individuals (OR 0.79; 95% CI: 0.69, 0.90), if they had lived in US for < 15 yrs (OR 0.50; 95% CI: 0.37, 0.69), or if they had a family income < 200% of FPL • Additional predisposing factors associated significantly with being up to date with endoscopy included male gender (OR 1.54; 95% CI: 1.44, 1.65), and having a greater educational attainment (high school graduate: OR 1.34; 95% CI: 1.13, 1.57; college graduate: OR 1.85; 95% CI: 1.57, 2.18)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Wong et al.[63] **Year of publication:** 2005 **Dates of data collection:** 2001 **Trial name:** NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, N/A)
Were the groups similar at baseline regarding the most important prognostic indicators?		X	Significant differences in sociodemographics by ethnic group
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			N/A
Were the differential drop-out or response rates acceptable (≤ 15%)?			N/A
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	**X**		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair **Reviewer #1 initials:** LCM **Reviewer #2 initials:** DJH **Comments (explain poor quality ratings):**			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Yano, E., Soban, L., Parkerton, P., Etzioni, D.[64] **Year of publication:** 2006 **Dates of data collection:** 1999-2001 **Trial name:** NA
OBJECTIVE OR AIM:	To identify primary care practice characteristics associated with colorectal cancer (CRC) screening performance, controlling for patient-level factors.
DESIGN:	**Setting:** VA Primary care clinics **Study design:** Cross-sectional **Duration (mean followup):** No follow-up, data duration of 2 years **Overall study size (N enrolled/N analyzed):** 155 facilities; 38.818 patients
	Patients **Group 2**
Sample size:	Sample Size: 38,818
Describe intervention:	Intervention: none, data collected on CRC screening
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based; VA Survey of Primary Care Practices
INCLUSION CRITERIA:	Physician chiefs at all VA facilities serving 4,000 or more outpatients and providing 20,000 or more outpatient visits in FY98
EXCLUSION CRITERIA:	Patients over age 86; patients with a prior history of CRC, inflammatory bowel disease, or colorectal polyps
POPULATION CHARACTERISTICS:	**Patients**
Mean age & range (years):	Age: 31.3% 52-64, 36.3% 65-74, 32.4% 75-85
Sex (% female):	Sex: 10.8% female
Race:	Race: 86.2% White, 11.1% Black, 2.8% Other
Other:	
	All
Attrition/Drop-out (not available for endpoint measurement):	VA Survey of Primary Care Practices 93% response rate
Adherence:	
Contamination:	
Response Rates (e.g. for surveys):	
STATISTICAL ANALYSES:	**Describe:** • Linked organizational data (n=155 primary care clinics) with the patient-level data (n=38,818) using station identifiers from which each patient was sampled, confirmed through evaluation of each patient's visit patterns. • Evaluated relationships between hypothesized organizational predictors and facility-level CRC

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Yano, E., Soban, L., Parkerton, P., Etzioni, D.[64] **Year of publication:** 2006 **Dates of data collection:** 1999-2001 **Trial name:** NA
	screening rates using correlation coefficients for continuous variables and ANOVA for categorical variables, applying a cutpoint of *P* <= .10 as inclusion criterion. • Included these organizational measures in logistic regression to estimate the influence of specific organizational characteristics on a patient's probability of receipt of CRC screening, adjusting for cluster effects and patient-level covariates associated with screening.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** CRC screening is documented as evidence of (1) three returned FOBT cards in the prior 12 months, (2) performance of a flexible sigmoidoscopy in the last 5 years, or (3) performance of a colonoscopy in the last 10 years, among patients 52 years and older.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Authority over the internal structure and operations of the practice was significantly correlated with CRC screening (r=0.18; *P*<.01) (centralization), as was the sufficiency of clinical support arrangements (r=0.22; *P*<.001) (resources). • Facility size was significantly, negatively correlated with CRC screening (r= -0.16; *P*<.05) (complexity). • After adjusting for region and individual patient characteristics, patients who received their care from a primary care practice characterized by higher centralization (as measured by primary care practice autonomy) (*P*<.04) and resources (as measured by sufficiency of clinical support arrangements) (*P*<.03) were significantly more likely to receive CRC screening. • Overall screening rate 62.2%. No other absolute screening rates reported
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	**Fair**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		VA Survey of Primary Care Practices 93% response rate
Were the differential drop-out or response rates acceptable (≤ 15%)?	X		
Were exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		Probably others not adjusted for
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			uncertain
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair Reviewer #1 initials: BLM Reviewer #2 initials: RPH Comments (explain poor quality ratings):			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Yip et al.[65] **Year of publication:** 2006 **Dates of data collection:** July 2003- Sept 2004 **Trial name:** Part of a Randomized trial (Tu et al., 2006- included under KQ3)		
OBJECTIVE OR AIM:	To describe CRC screening among less acculturated Chinese Americans and to identify factors associated with CRC screening		
DESIGN:	**Setting:** Primary care clinic **Study design:** retrospective chart review **Duration (mean follow-up):** NA **Overall study size (N enrolled/N analyzed):** 383		
Sample size:	**Group 1** 383	**Group 2**	
Describe intervention:	NA		
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Chinese patients seen at a community clinic providing primary medical services to Asian and Pacific Islanders in Seattle		
INCLUSION CRITERIA:	none were given other than they had to be of Chinese decent and patients of the clinic		
EXCLUSION CRITERIA:	greater acculturation (fluent in English, n = 3)		
POPULATION CHARACTERISTICS:	**Group 1**	**Group 2**	
Mean age & range (years):	50-64, n=193 (50%) 65+, n=191 (50%)		
Sex (% female):	63.2% female		
Race:	100% Asian/Chinese 5.2% uninsured		
Other:	100% used an Asian language as their primary language		
	Group 1	**Group 2**	Overall
Attrition/Drop-out (not available for endpoint measurement):	NA		
Adherence:			
Contamination:			
Response Rates (e.g. for surveys):			
STATISTICAL ANALYSES:	**Describe:** descriptive statistics and then Chi-square		
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Age, gender, insurance status, language		

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Yip et al.[65] **Year of publication:** 2006 **Dates of data collection:** July 2003- Sept 2004 **Trial name:** Part of a Randomized trial (Tu et al., 2006- included under KQ3)
OUTCOME ASSESSMENT:	**Outcome Measures:** Whether patients had received screening per USPSTF guidelines
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Overall, 39.7% were assessed as being screened for CRC according to guidelines. Of these, 18.9% had completed FOBT in past year, 2.9% completed FS in past 5 years, and 21.3% completed colonoscopy in past 10 years. There was no significant differences for users and non-users of any of the CRC tests (FOBT, sig, colonoscopy) based on age, gender, insurance status, or language were found.
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**Outcomes: NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes: NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes: NA**
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NR
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			N/A
Were the differential drop-out or response rates acceptable (≤ 15%)?			N/A
Were intervention/exposure measures valid, reliable, and equally applied?			NR
Were the outcome assessors blinded to the intervention or exposure status of subjects?		X	health educator, who is the same person providing the intervention in the Tu paper is the one who reviewed the charts
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?			N/A
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?		X	as an example, they wanted to see about language differences but then only included patients who use an Asian language as their primary language (i.e., no comparison group)
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair **Reviewer #1 initials:** DJH **Reviewer #2 initials:** LCM **Comments (explain poor quality ratings):**			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Young, W.F., McGloin, J., Zittleman, L., West, D.R., Westfall, J.M.[66] **Year of publication:** 2007 **Dates of data collection:** Spring 2005, for 2 weeks **Trial name:** *Testing to Prevent Colon Cancer in Rural Colorado*
OBJECTIVE OR AIM:	To establish baseline attitudinal, knowledge, belief, and behavior measures on colorectal cancer screening and to identify barriers to or predictors of colorectal cancer screening.
DESIGN:	**Setting:** High Plains Research Network (HPRN), a practice-based research network in 9 rural and frontier counties in northeast Colorado **Study design:** Baseline telephone survey **Duration (mean followup):** NA, no follow-up **Overall study size (N enrolled/N analyzed):** 1,050 respondents
Sample size: **Describe intervention:**	**Sample** Sample size: 1,050 respondents The authors conducted a baseline random-digit dialing telephone survey to assess colon cancer knowledge and screening behaviors among people 50 years old and older.
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Random-digit dialing telephone survey
INCLUSION CRITERIA:	Age 50+
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:**	**Sample** Mean age: 65.3 67.1% female 88.4% Caucasia, .2% African American, .4% Asian, .5% Native Hawaiian/Pacific Islander, 1.5% American Indian/Alaskan Native, 7.6% Other 9.6% Hispanic
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	51.6% response rate
STATISTICAL ANALYSES:	**Describe:** • Used *t* tests for continuous variables and chi-square tests for categorical variables. • Performed logistic regression modeling • To test the hypothesis that the geographic distance to colorectal cancer screening services might be related to screening rates, the authors conducted 2 geographical information system (GIS) analyses.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Young, W.F., McGloin, J., Zittleman, L., West, D.R., Westfall, J.M.[66] **Year of publication:** 2007 **Dates of data collection:** Spring 2005, for 2 weeks **Trial name:** *Testing to Prevent Colon Cancer in Rural Colorado*
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Logistic regression modeling. Covariates included: age, gender, race/ethnicity, marital status, educational level, employment status, and household income, when the respondent had last seen a doctor or other health care practitioner for a checkup, requesting a colorectal cancer test at last visit, whether they thought colorectal cancer ranked as a cause of death, level of agreement with the statement "Testing can identify problems in the colon before colorectal cancer can start," family and personal history of colorectal cancer, personal history of polyp removal, perceived chances of getting colorectal cancer, the likelihood of preventing and curing colorectal cancer, and residence in a ZIP code with a hospital.
OUTCOME ASSESSMENT:	**Outcome Measures:** • Compared colorectal cancer knowledge and screening behavior between major demographic variables. • Used the standard American Cancer Society guidelines to define up-to-date on colorectal cancer screening (yearly FOBT, flexible sigmoidoscopy every 5 years, barium enema every 5 years, or colonoscopy every 10 years).
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** • Sixty-three percent reported they ever had an FOBT, but only 50% of those (32%) were up-to-date. • Participants who were of 65 years or older, married, Hispanic, or had an income more than $35,000 were more likely to be up-to-date. • Being up-to-date on this test was also associated with seeing a doctor or other health care practitioner in the past year (O.R. = 1.2, 95% C.I.1.16-1.27) or having asked for a screening test (O.R. = 2.44, 95% C.I. 2.08-2.86). • Thirty-four percent had ever had sigmoidoscopy, with 28% up-to-date. • Persons 50-64 years old were more than twice as likely as those 65 years old or older to report "financial reasons" (23.0% vs 10.3%, $P < .001$) as a reason for not having this test. • Nearly half (48.3%) of the Hispanic study participants reported that they "never heard of the test" compared to 35.7% of non-Hispanics ($P < .05$). • Hispanics were also more likely to report "financial reasons" for not having had a flexible sigmoidoscopy (24.1% vs 17.2%, $P < .05$). • Forty-three percent reported they ever had a colonoscopy and 38% were up-to-date. • Being up-to-date on colonoscopy was associated with having seen a doctor or health care practitioner in the past year, asking for a colon cancer test from their doctor, believing that their chances of getting colorectal cancer were greater than average and having a family history of colon cancer. • Participants who were Hispanic, unemployed, low income or were 50-64 years old were more likely to cite financial reasons for not having this test ($P < .001$ for all). Hispanics were also more likely to report that they never heard of this test (28.0% vs 14.8% all others, $P = .02$). • Only 29% had *ever had* a barium enema and only 13% were up-to-date. • Thirteen percent reported they *ever had* a virtual colonoscopy and only 2% of participants who never had this test planned to have it in the next year.

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Young, W.F., McGloin, J., Zittleman, L., West, D.R., Westfall, J.M.[66] **Year of publication:** 2007 **Dates of data collection:** Spring 2005, for 2 weeks **Trial name:** *Testing to Prevent Colon Cancer in Rural Colorado*
	• Up-to-date screening rates for participants residing in ZIP codes with a health facility were no different than those without a health facility: clinic (59.6% with clinic vs 58.2% without clinic, *P* = .78), hospital (59.4% with hospital vs 57.3% without hospital, *P* = .49), hospital or clinic (59.5% with facility vs 56.7% without a facility, *P* = 0.38). • Demographic predictors of being up-to-date on at least 1 colorectal cancer test were being 65 years or older (OR = 1.40; 95% CI = 1.22-1.61) or married (OR = 1.14; 95% CI = 1.02-1.27)
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	**Fair**

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?	X		NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair **Reviewer #1 initials: BLM** **Reviewer #2 initials: DR; LCM** **Comments (explain poor quality ratings):**			

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Zapka et al.[67] **Year of publication: Dates of data collection:** 2002 **Trial name:** NA
OBJECTIVE OR AIM:	Assess the role of insurance status, type of plan, frequency of preventive health visits, and provider recommendation on utilization of CRC screening tests.
DESIGN:	**Setting:** Telephone survey **Study design:** Cross-sectional, random-digit-dial survey **Duration (mean followup):** June to August 1998 **Overall study size (N enrolled/N analyzed):** 1,002
Sample size: **Describe intervention:**	**Population** Sample Size = 1,002
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; A random-digit-dial telephone survey; Three samples—a basic random sample, a male oversample, and a racial/ethnic minority oversample targeting African Americans and Hispanics—were drawn using the Kish sampling method
INCLUSION CRITERIA:	Participants were Massachusetts residents, aged ≥ 50, who had a working residential telephone number and had never been diagnosed with CRC.
EXCLUSION CRITERIA:	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**Population** Age 50+ Sex: 57% Race: 90.1% White, 4% African American/other; 4.9% Hispanic
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	**Population** Response rate = 64%

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Zapka et al.[67] **Year of publication: Dates of data collection:** 2002 **Trial name:** NA
STATISTICAL ANALYSES:	**Describe:** • Data were standardized for gender, race, and education level to represent the overall Massachusetts population. Analyses were performed separately by age group because of inherent differences in insurance coverage based on Medicare eligibility. Statistical significance was set at < 0.05. • Contingency tables and single-predictor, logistic regression models assessed the bivariate association between the dependent variable, current CRC screening status, and each potential independent variable. • For each age group, a multiple logistic regression model was fit using independent variables that demonstrated a bivariate association of *P* < 0.10.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	**Variables included:** • Demographic (gender, race, education, ethnicity – Hispanic only, employment status, marital status) • Health factors (family history of CRC, health status) • Access (income, insurance, regular MD, gets regular checkups, frequency of checkups, ever given FOBT card, MD recommendation)
OUTCOME ASSESSMENT:	**Outcome Measures:** • Items asked about testing for FSIG, colonoscopy, BE, and FOBT, including those done at home and returned (FOBT) and those done in a physician's office (FOBT/MD). • A broad definition of CRC screening status included colonoscopy or BE (screening or diagnostic) within 10 years, FSIG within 5 years, and FOBT in the past year as options **Secondary Outcomes:** Insurance and health service characteristics by age and CRC screening.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** Significant predictors of CRC screening for younger group (age 50-64): marital status (*P* = 0.02), family history of CRC (*P* = 0.032), perceived health status (*P* = 0.015); for older group (age 65+): income (*P* = 0.03) Among the younger group, those in plans that subjects believed did not cover CRC screening had the lowest rates and those with Medicare or Medicaid had the highest (*P* < 0.0001). Among participants with private insurance, those with HMO coverage had a slightly higher rate (59.1%) than non-HMO respondents (55.3%). Screening status in the older group also varied substantially by insurance coverage, but did not reach statistical significance. Medicare HMO members were most likely to be currently tested. Respondents who reported that their plans covered FOBT, FSIG, and/or colonoscopy were significantly related to being currently tested (*P* < 0.0001). Having a regular physician and receiving a regular checkup were significantly related to current testing (*P* = 0.0001)

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Zapka et al.[67] **Year of publication: Dates of data collection:** 2002 **Trial name:** NA
	Provider recommendations ($P < 0.0001$) and getting a regular checkup ($P < 0.0001$) were significantly related to screening status. M.D. ever rec. Sigmoidoscopy, Age 50-64 from total sample: NO: N, 175; %, 33.8; YES: N, 342; %, 66.2; Age 50-64 from *currently tested sample: NO: N, 151; %, 86.3; YES: N, 118; %, 34.5 P <0.0001 Age ≥ 65from total sample: NO: N, 203; %, 42.5; YES: N, 274; %, 57.5; Age ≥ 65from currently tested sample: NO: N, 181; %, 89.5; YES: N, 111; %, 40.5 P <0.0001 **Currently tested: up to date*
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 1. KQ 2: What factors influence the use of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?		X (Different age groups had different characteristics)	
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			64%, this was a telephone survey, so seems reasonable
Were the differential drop-out or response rates acceptable (≤ 15%)?			N/A
Were intervention/exposure measures valid, reliable, and equally applied?			N/A
Were the outcome assessors blinded to the intervention or exposure status of subjects?			N/A
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair **Reviewer #1 initials:** BLM **Reviewer #2 initials:** **Comments (explain poor quality ratings):**			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance?

STUDY:	**Authors, ref ID:** Ayanian, J.Z., Sequist, T.D., Zaslavsky, A.M., Johannes R.S.[68] **Year of publication:** 2008 **Dates of data collection:** May 1 – October 31, 2006 **Trial name:**	
OBJECTIVE OR AIM:	To determine whether surveillance colonoscopy can be increased among overdue patients by reminders to primary physicians.	
DESIGN:	**Setting:** Clinics in Massachusetts primary care networks **Study design:** Randomized controlled trial **Duration (mean followup):** 6 months **Overall study size (N enrolled/N analyzed):**	
INTERVENTIONS:	**Intervention**	**Control**
Sample size:	Sample size = 358	Sample size = 359
Describe intervention:	Intervention: Sent letter to physicians to notify them about potential need for colonoscopy among their patients in intervention group. Included a personally addressed letter to each patient recommending colonoscopy and encouraging them to call their physician's office to schedule procedure. If physicians felt colonoscopy was clinically indicated they could send these letters. Physicians who did not respond to initial letter within 1 month were sent a second cover letter, response form, and reminder letters addressed to their patients.	Intervention: After 6-month observation period, an identical mailing was sent to physicians of patients in control group to ensure their physicians were aware of potential need for colonoscopy if clinically appropriate.
RECRUITMENT: (population-based, clinic-based, volunteer, other)	• Clinic-based; Physicians from 2 Massachusetts primary care networks were informed that their participation in study was voluntary and confidential. • Patients who had colorectal polyps removed via flexible sigmoidoscopy or colonoscopy during 1995 through 2000 were ascertained from electronic endoscopy database maintained by hospital's gastroenterology division.	
INCLUSION CRITERIA:	Patients had 1 or more adenomas detected by colonoscopy at Brigham and Women's Hospital from 1995 through 2000, did not have a follow-up colonoscopy documented in electronic clinical data during 2001 through March 2006, and had an active attending physician in a primary care practice affiliated with Brigham and Women's Hospital or Harvard Vanguard Medical Associates.	
EXCLUSION CRITERIA:	Did not have an adenoma on pathology report from initial colonoscopy, had subsequent colonoscopy noted in electronic records of integrated practice, patient who did not have an active primary physician listed in electronic records.	
POPULATION CHARACTERISTICS:	**Group 1**	**Group 2**
Mean age & range (years):	Mean age: 69.2 62.3% 65 years or older	Mean age: 69.2 63% 65 years or older
Sex (% female):	45% female	47.6% female
Race:	Mean years since colonoscopy: 6.7	Mean years since colonoscopy: 6.6
Other population qualities:		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Ayanian, J.Z., Sequist, T.D., Zaslavsky, A.M., Johannes R.S.[68] **Year of publication:** 2008 **Dates of data collection:** May 1 – October 31, 2006 **Trial name:**		
	Group 1	**Group 2**	**Overall**
Attrition/Drop-out (not available for endpoint measurement): **Adherence in control group:** **Contamination in control group:**	NA		
OUTCOME ASSESSMENT:	**Outcome Measures:** The primary study outcome was proportion of patients receiving colonoscopy during 6-month observation period in intervention and control groups A response form was included in mailings to physicians, asking them to report whether they intended to send a reminder letter or call each of their patients in intervention group to recommend colonoscopy. They were also asked for reasons a patient should not have this procedure (deceased, severe comorbid illness, advanced age, had follow-up colonoscopy since 2000, or no longer active in physician's practice).		
RESULTS:			
KQ2 - What factors influence use of colorectal cancer screening?	**Outcomes:** NA		
KQ3 - Which strategies are effective in increasing appropriate use of colorectal cancer screening and followup?	**Outcomes:** Patients whose physicians received reminders 9.2% patients underwent colonoscopy within 6 months, compared with 4.5% of patients whose physicians did not receive reminders ($P = 0.009$). In prespecified subgroups, this effect did not differ statistically between 2 primary care networks, elderly and nonelderly patients, or women and men (all $P > 0.60$ by Breslow–Day test).		
KQ4 - What are current and projected capacities to deliver colorectal cancer screening and surveillance at population level?	**Outcomes:** NA		
KQ5 - What are effective approaches for monitoring use and quality of colorectal cancer screening?	**Outcomes:** NA		
QUALITY RATING:	Good		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was study described as randomized?	X		
Was method of randomization adequate?	X		
Was treatment allocation concealed?			
Were groups similar at baseline regarding most important prognostic indicators?	X		
Was outcome assessor blinded?	X		
Was care provider blinded?	X		
Was patient blinded?	X X		The patient did not know they were in a study, so I consider that blinded.
Was drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Was differential drop-out rate acceptable (≤ 15%)?			NA
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Evidence Table XX Title

STUDY:	**Authors, ref ID:** Basch, CE, Wolf, RL, Brouse, CH, Shmukier, C, Neugut, A, DeCarlo, LT, & Shea, S {#1175) **Year of publication**: 2006 **Dates of data collection: 2000 - 2003** **Trial name: NA**	
OBJECTIVE OR AIM:	• Authors compared effectiveness of a telephone outreach approach versus a direct mail approach in improving rates of colorectal cancer (CRC) screening in a predominantly Black population	
DESIGN:	**Setting:** New York City. Sampling frame from membership lists of a health benefit fund compromising approximately 250,000 members. Through this benefit fund, all individuals had health insurance coverage that included coverage for CRC screening. **Study design:** RCT **Duration (mean followup):** Medical records reviewed 6 months after randomization **Overall study size (N enrolled/N analyzed):** 456/456	
INTERVENTIONS:	**Intervention (telephone)**	**Control (mailing)**
Sample size:	N=226	**N=230**
Describe intervention:	Tailored telephone outreach by a health educator to include establishing a positive and trusting rapport with recipient; reinforcing accurate knowledge and healthful beliefs, correcting misconceptions, and bolstering self-efficacy to obtain a CRC screening on basis of participant's readiness and individual cognitive factors; addressing identified barriers (e.g., fear, transportation) and skill deficits that could impede CRC screening; providing social and emotional support for obtaining CRC screening; and eliciting a verbal commitment to obtain CRC screening. Median number of intervention calls was 5, and median number of total telephone minutes spent per participant was 23.5.	Printed materials of cover letter welcoming participants into study and educational brochure.
RECRUITMENT: (population-based, clinic-based, volunteer, or)	Telephone recruitment among those in health plan, eligibility assessed by telephone.	
INCLUSION CRITERIA:	Inclusion criteria were age greater than 52 years, no self-report of a recent CRC screening (defined as a home stool test within past 2 years, a flexible sigmoidoscopy within past 5 years, or colonoscopy or barium enema within past 10 years), no scheduled appointment for a CRC screening test, accessibility by telephone, ability to identify a current primary care physician (PCP), and consent to participate	
EXCLUSION CRITERIA:	Exclusion criteria included self-report of prior diagnosis of colorectal polyps, inflammatory bowel disease, CRC, or other cancer that had been treated within past 5 years; stated intention to travel or to move away from region within subsequent 6 months; unemployed, retired, or unable to work due to disability; enrollment of someone else in household into study; or another medical condition that precluded meaningful participation in study	

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Basch, CE, Wolf, RL, Brouse, CH, Shmukier, C, Neugut, A, DeCarlo, LT, & Shea, S {#1175) **Year of publication**: 2006 **Dates of data collection: 2000 - 2003** **Trial name: NA**			
POPULATION CHARACTERISTICS:	**Intervention (n=226)**	**Control (n=230)**	Screened (n=61)	Not screened (n=61)
Mean Age			57.5y (sd 3.4)	57.5y (s.d. 3.1)
Age 52-54	19.5% (n=44)	25.7% (n=59)		
55-59	47.8% (n=108)	43.5% (n=100)		
>=60	32.7% (n=74)	30.9% (n=71)		
Sex (% female):	69.9% (n=158)	72.2% (n=166)	67.2% (n=41)	65.6% (n=40)
Race: Black	67.7% (n=153)	58.7% (n=135)	72.1% (n=44)	62.7% (n=37)
White	13.7% (n=31)	18.7% (n=43)	11.5% (n=7)	20.3% (n=12)
Or	17.7% (n=40)	21.7% (n=50)	15.4% (n=10)	17.0% (n=10)
Refused	0.9% (n=2)	0.9% (n=2)		
Education: < H.S.	11.9% (n=27)	7.8% (n=18)	11.5% (n=7)	18.3% (n=11)
H.S. grad	46.0% (n=104)	40.4% (n=93)	42.6% (n=26)	46.7% (n=28)
Some college/tech school	31.9% (n=72)	38.7% (n=89)	34.4% (n=21)	26.7% (n=16)
College or beyond	10.2% (n=23)	12.6% (n=29)	11.5% (n=7)	8.3% (n=5)
	Intervention	**Group 2**	**Overall**	
Attrition/Drop-out (not available for endpoint measurement): **Adherence in control group:** **Contamination in control group:**	Telephone intervention was implemented (1 or more calls completed) in 216 of 226 (95.6%) of those assigned to intervention. 10 intervention participants refused participation after randomization			
OUTCOME ASSESSMENT:	Primary outcome was receipt of CRC screening within 6 months of randomization. Outcome criteria were met by receipt of a 3-day fecal occult blood test (defined as 2 samples from each of 3 consecutive bowel movements), sigmoidoscopy, colonoscopy, or a barium enema. A single stool test (defined as a single sample of stool obtained and tested for occult blood during a medical examination) was not considered an acceptable CRC screening outcome.			
Results				
KQ2 - What factors influence use of colorectal cancer screening?	NA			
KQ3 - Which strategies are effective in increasing appropriate use of colorectal cancer screening and followup?	CRC screening was documented in 61 of 226 (27%) in G1 and 14 of 230 (6.1%) in G2 (20.9 percentage point difference). Compared with G2, those in G1 were 4.4 times more likely to receive CRC screening within 6 months of randomization (AOR, 6.38; 95% CI: 3.44-11.85).			
QUALITY RATING:	Good			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity (for RCT)

	Yes	No	Or (CD, NR, NA)
Was study described as randomized?	x		
Was method of randomization adequate?	x		
Was treatment allocation concealed?	x		
Were groups similar at baseline regarding most important prognostic indicators?	x		
Was outcome assessor blinded?	x		
Was care provider blinded?	x		
Was patient blinded?			
Was drop-out rate acceptable?	x		
Was differential drop-out rate acceptable?	x		
Were co-interventions avoided or similar?	x		
Were outcome measures valid, reliable, and equally applied?	x		
Were all randomized participants analyzed in group to which y were originally assigned?	x		
Quality Rating: Good			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Braun, K.L., Fong, M., Kaanoi, M.E., Kamaka, M.L., Gotay, C.C.[69] **Year of publication:** 2005 **Dates of data collection:** January 2003 to May 2003 **Trial name:** NA	
OBJECTIVE OR AIM:	Test CRC screening interventions for Native Hawaiians.	
DESIGN:	**Setting:** Hawaiian civic clubs **Study design:** Randomized trial **Duration (mean followup):** No results were collected after 16 weeks post-intervention. **Overall study size (N enrolled/N analyzed):** 121 people	
INTERVENTIONS:	**Experimental**	**Control**
Sample size:	Sample size: 69	Sample size: 52
Describe intervention:	Intervention: Native Hawaiian physician delivered the targeted educational Presentation; Native Hawaiian CRC survivor told his personal story, addressing myths and feelings of embarrassment related to CRC screening and communicating positive feelings associated with self-care and survivorship; free FOBT kits, Native Hawaiian physician provided instructions on testing and demonstrated how to use the FOBT kit to collect stool samples. Multiple telephone calls were placed to those who did not complete their FOBT 4 to 16 weeks post intervention	Intervention: Targeted educational workshop by non-Hawaiian nurse; brochure on CRC that featured Native Hawaiian nurse; FOBT kit; nurse gave basic instructions about completing FOBT kit; telephone reminder if FOBT kit not returned within a month.
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Civic centers; 16 of the 39 Hawaii based clubs volunteered to participate	
INCLUSION CRITERIA:	Age 50+	
EXCLUSION CRITERIA:	NR	
POPULATION CHARACTERISTICS:	**Experimental**	**Control**
Mean age & range (years):	Mean age: 65.68	Mean age: 65.77
Sex (% female):	Sex: 70% female	Sex: 75% female
Race:	Ethnicity: 90% Hawaiian, 10% Non-Hawaiian	Ethnicity: 90% Hawaiian, 10% Non-Hawaiian
Other population qualities:		
	Experimental	**Control**
Attrition/Drop-out (not available for endpoint measurement):	95% data-completion rate	95% data-completion rate
Adherence in control group:		
Contamination in control group:		
OUTCOME ASSESSMENT:	**Outcome Measures:** FOBTs returned	
RESULTS:		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Braun, K.L., Fong, M., Kaanoi, M.E., Kamaka, M.L., Gotay, C.C.[69] **Year of publication:** 2005 **Dates of data collection:** January 2003 to May 2003 **Trial name:** NA
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** • 33% of the experimental group (n=23) completed the free FOBT, compared to 40% (n=21) of the control group (no p-value given). • 13 were screened for 1st time (5 in experimental and 8 in control) • People in the intervention group were less likely to be screened than people in the control group (AOR, 20.9 percentage points; 95% CI, 14.34-27.46 percentage points); RR 4.4 (2.6-7.7)
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		
Was the treatment allocation concealed?		X	
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Was the outcome assessor blinded?			NR
Was the care provider blinded?			NA
Was the patient blinded?			
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		Actually, only a 50% response rate to final questionnaire
Was the differential drop-out rate acceptable (≤ 15%)?	X		
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?		X	Only the experimental group was measured on whether they took an FOBT kit for family members.
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Campbell, MK, James, A, Hudson, MA, Carr, C, Jackson, E, Oates, V, Demissie, S, & Farrell, D [70] **Year of publication:** 2004 **Dates of data collection:** 1999-2000? **Trial name:** WATCH			
OBJECTIVE OR AIM:	To compare the effectiveness of 2 strategies to promote multiple health behaviors including colorectal cancer preventive behaviors among African American members of 12 rural North Carolina churches.			
DESIGN:	**Setting:** Churches in rural NC **Study design:** RCT **Duration (mean followup):** 1 year **Overall study size (N enrolled/N analyzed):** 587 individuals, 12 churches			
INTERVENTIONS:	**G1: TPV**	**G2: LHA**	**G3: Combined**	**G4: Control**
Sample size:	Sample size: 76 (50 years or older)	Sample size: 51 (50 years or older)	Sample size: 87 (50 years or older)	Sample size: 69 (50 years or older)
Describe intervention:	Intervention: included four personalized computer-tailored newsletters and four targeted videotapes corresponding to the same behaviors mailed to participants' homes bimonthly for the first 6 months after baseline data collection (Months 2, 4, and 6); the fourth mailing occurred 9 months postbaseline.	Intervention: Church members who volunteered were invited to a reception and orientation to participate in the LHA training program. A total of seven monthly or bimonthly group training sessions (approximately 16 hr of training) were scheduled at respective churches at times chosen by the LHAs. Each trained LHA was required to identify up to 3 specific church-wide activities where they could spread the word about the intervention.	Intervention: Both TPV and LHA interventions	Intervention: Control churches were offered health education sessions and materials and speakers on topics of their choice not directly related to study objectives.
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based; members of 12 African American churches in five rural eastern North Carolina counties			
INCLUSION CRITERIA:	Medically incapable of participation, less than 18 years old			
EXCLUSION CRITERIA:	NR			
POPULATION CHARACTERISTICS: (NOTE: Of total sample, not just those 50 years or older) **Mean age & range (years):** **Sex (% female):** **Race:** **Other population qualities:**	**Control** Sex: 77.3% female Age: 21.1% <40, 26.6% 40-49, 52.3% 50+	**LHA** Sex: 72.4% female Age: 21.1% <40, 37.5% 40-49, 41.4% 50+	**TPV** Sex: 73.6% female Age: 30.1% <40, 22.7% 40-49, 47.2% 50+	**Combined** Sex: 74.0% female Age: 27.8% <40, 23.1% 40-49, 49.1% 50+
Attrition/Drop-out (not available for endpoint measurement):	**All** 10 of 26 eligible churches participated (38%)			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Campbell, MK, James, A, Hudson, MA, Carr, C, Jackson, E, Oates, V, Demissie, S, & Farrell, D [70] **Year of publication:** 2004 **Dates of data collection:** 1999-2000? **Trial name:** WATCH
Adherence in control group: **Contamination in control group:**	58% of eligible people completed baseline survey CASRO response rate = 66%
OUTCOME ASSESSMENT:	**Outcome Measures:** • Baseline telephone interviews were conducted before randomization. • Participants were asked whether they had ever had any CRC screening tests and, if so, how long ago (< 1 year, 1–2 years, 2–5 years, or > 5 years). • From these items, authors computed two variables indicating compliance with recommendations: FOBT in the past year and any combination of tests indicating up-to-date adherence with recommendations (FOBT in the past year plus or minus sigmoidoscopy in the past 5 years, double contrast barium enema in the past 5 years, or colonoscopy in the past 5 years).
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** G1: 36.8% received FOBT test; 21.1% received another CRC test G2: 33.3% received FOBT test; 25.5% received another CRC test G3: 31.0% received FOBT test; 14.9% received another CRC test G4: 21.7% received FOBT test; 27.5% received another CRC test • Differences in group are not statistically significant (p=0.08 for FOBT, NR for 'other' tests; only 'ns' noted). Rates of other screening tests did not differ among study groups at baseline or follow-up.
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?		X	
Was the treatment allocation concealed?		X	
Were the groups similar at baseline regarding the most important prognostic indicators?			
Was the outcome assessor blinded?		X	
Was the care provider blinded?		X	
Was the patient blinded?	X	X	
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			CD
Was the differential drop-out rate acceptable (≤ 15%)?			CD
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?		X	
Were all randomized participants analyzed in the group to which they were originally assigned?			
Quality Rating (Good, Fair, or Poor): Fair			

X

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Church, T.R., Yeazel, M.W., Jones, R.M, Kochevar, L.K, Watt, G.D., Mongin, S.J., Cordes, J.E., Engelhard, D. [71] **Year of publication:** 2004 **Dates of data collection:** February 2000 to March 2001 **Trial name:**		
OBJECTIVE OR AIM:	Test whether direct mailing of FOBT kits with and without reminders to a general population could increase colorectal cancer screening.		
DESIGN:	**Setting:** Mailed questionnaires and FOBT kits to study participants'home **Study design:** Randomized trial **Duration (mean followup):** 1 year **Overall study size (N enrolled/N analyzed):** 1255 baseline, 1144 1 year follow-p		
INTERVENTIONS:	**Reminders**	**No Reminders**	**Control**
Sample size:	Sample Size: 404 baseline, 351 1 year	Sample Size: 434 baseline, 390 1 year	Sample Size: 417 baseline, 403 1 year
Describe intervention:	Intervention: questionnaire, FOBT kits with mailed reminders	Intervention: questionnaire, FOBT kits with no reminders	Intervention: questionnaire
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Minnesota State Driver's License and Identification Card database		
INCLUSION CRITERIA:	at least 50 years old and had a mailing address with a ZIP code that included some part of the county as of January 1, 2000		
EXCLUSION CRITERIA:			
POPULATION CHARACTERISTICS:	**Reminders**	**No Reminders**	**Control**
Mean age & range (years):	Mean age: 63.4 baseline, 63.1 year 1	Mean age: 63.1 baseline, 62.6 year 1	Mean age: 63.3 baseline; 63.4 year 1
Sex (% female):	Sex: 55.9% female baseline; 56.4% 1 year	Sex: 52.5% female baseline, 53.6% 1 year	Sex: 51.8% female baseline, 53.3% 1 year
Race:			
Other population qualities:			
	Reminders	**No Reminders**	**Control**
Attrition/Drop-out (not available for endpoint measurement):	84.1% response rate baseline, 76.5% year 1	89% response rate baseline, 83.3% year 1	86.4% response rate baseline, 86.1% year 1
Adherence in control group:			
Contamination in control group:			
OUTCOME ASSESSMENT:	**Outcome Measures:** The primary outcome of the study was the change in overall self-reported adherence to screening guidelines.		
RESULTS:			
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** NA		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Church, T.R., Yeazel, M.W., Jones, R.M, Kochevar, L.K, Watt, G.D., Mongin, S.J., Cordes, J.E., Engelhard, D. [71] **Year of publication:** 2004 **Dates of data collection:** February 2000 to March 2001 **Trial name:**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** • The 1-year rate changes for self-reported adherence to FOBT use were 1.5% (95% CI: –2.9% to 5.9%) for the control group, 16.9% (95% CI : 11.5% to 22.3%) for the group receiving direct mail FOBT with no reminders, and 23.2% (95% CI:17.2% to 29.3%) for the group receiving direct mail FOBT with reminders. • The 1-year rate changes for self-reported adherence to any colorectal cancer screening test were 7.8% (95% CI: 3.2% to 12.0%) for the control group, 13.2% (95% CI: 8.4% to 18.2%) for the group receiving direct mail FOBT with no reminders, and 14.1% (95% CI: 9.1% to 19.1%) for the group receiving direct mail FOBT with reminders. • Self-reported adherence to guidelines for FOBT increased 18.4% more (95% CI: 12.5% to 24.3%) in the direct mail group than in the control group; overall self-reported adherence to guidelines for any of the colorectal cancer screening tests increased 5.9% more (95% CI: 0.5% to 11.5%) in the direct mail group than in the control group. • By contrast, the differences in the 1-year rate change between the FOBT-with-reminders group versus the FOBT-with-noreminders group were smaller and not statistically significant.
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?			
Was the treatment allocation concealed?			
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Was the outcome assessor blinded?		NR	NA
Was the care provider blinded?	X		NA
Was the patient blinded?	X		
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Was the differential drop-out rate acceptable (≤ 15%)?	X		
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?			?
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Costanza, M.E., Luckmann, R., Stoddard, A.M., White, M.J., Stark, J.R., Avrunin, J.S., Rosal, M.C., Clemow, L.[72] **Year of publication:** 2007 **Dates of data collection:** 2001-2004 **Trial name:**		
OBJECTIVE OR AIM:	This study's purpose was to implement and evaluate stage-based computer-assisted tailored telephone counseling to promote colorectal cancer screening in a primary care population.		
DESIGN:	**Setting:** Practices of community-based PCPs in the UMass Health Care system (UMHC) **Study design:** Randomized controlled trial **Duration (mean followup):** 3 months **Overall study size (N enrolled/N analyzed):** 51 active office-based PCPs; 2,448 patients		
INTERVENTIONS:	**Intervention**	**Control**	
Sample size:	Sample Size: 1187 records audited	Sample size: 1261 records audited	
Describe intervention:	Intervention: mailed booklet on colorectal cancer screening followed by computer-assisted telephone counseling that was based on the Precaution Adoption Process Model three months later	Regular care	
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based; patients of PCPs in the UMass Health Care system		
INCLUSION CRITERIA:	Patients were between 50 and 75 years old, had documentation of a visit to a study practice within the prior two years and no record of a colonoscopy within the prior 10 years		
EXCLUSION CRITERIA:	Patients with a limited life expectancy, cognitive impairment, a history of CRC or adenomatous polyps, other colon disease requiring frequent screening or non-English speakers		
POPULATION CHARACTERISTICS:	**All**		
Mean age & range (years):	Mean age: 61.4 years, between 50-75 years		
Sex (% female):	57% female		
Race:	92% non-Hispanic white		
Other population qualities:			
	Group 1	**Group 2**	**Overall**
Attrition/Drop-out (not available for endpoint measurement):	NA		
Adherence in control group:			
Contamination in control group:			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Costanza, M.E., Luckmann, R., Stoddard, A.M., White, M.J., Stark, J.R., Avrunin, J.S., Rosal, M.C., Clemow, L.[72] **Year of publication:** 2007 **Dates of data collection:** 2001-2004 **Trial name:**
OUTCOME ASSESSMENT:	**Outcome Measures:** • Chart audit was used to document completion of colonoscopy, sigmoidoscopy or fecal occult blood testing; completed between 17 and 22 months after a subject's baseline survey mailing. • Patients were coded as having a test in the post-TCC period if the test date was more than 3 • months after the mailing of the brochure. Patients were coded as having a test in the post-brochure period if the test date was within three months following the mailing of the brochure • For each test authors coded patients as up-to-date with the test if the medical record indicated a test within the recommended period. If there was no indication of a test in the record, patients were coded as not up-to-date.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	G1: 25% completed any CRC test G2: 24% completed any CRC test (*P* = 0.68)
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?			NR
Was the treatment allocation concealed?			NR
Were the groups similar at baseline regarding the most important prognostic indicators?	X		However, statistics on each group were not reported. Author just said they were similar.
Was the outcome assessor blinded?			NR
Was the care provider blinded?			NR
Was the patient blinded?			NR
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Was the differential drop-out rate acceptable (≤ 15%)?			NA
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Denberg, TD, Coombes, JM, Byers, TE, Marcus, AC, Feinberg, LE, Steiner, JF, & Ahnen, DJ [73] **Year of publication: 2006** **Dates of data collection: pt enrollment in 2005** **Trial name: NA**	
OBJECTIVE OR AIM:	Test whether a mailed brochure after referral for screening colonoscopy will lead to a 10% increase in colonoscopy completion compared to those receiving usual care	
DESIGN:	**Setting:** 2 general internal medicine practices affiliated with University of Colorado Health Sciences Center. **Study design: randomized controlled trial** **Duration (mean followup):** hospital claims record reviewed 4 months after referral to determine if c-scope had been completed **Overall study size (N enrolled/N analyzed):** 781 consecutive patients enrolled. 25 duplicates removed for patients who had received more than 1 c-scope referral.	
INTERVENTIONS:	**No Mailer (control)**	**Mailer (intervention)**
Sample size:	395	386
Describe intervention:	"usual care"	Brochure was mailed within 10 days of referral for screening colonoscopy; it mentioned name of patient's primary care physician and encouraged patients to schedule a procedure. Also described colorectal cancer and polyps and similar lifetime risks for colorectal cancer for men and women, colonoscopy and risk for perforation, nature of bowel preparation for procedure, and alternative screening tests.
RECRUITMENT: (population-based, clinic-based, volunteer, other)	2 General Internal Medicine practices associated with University of Colorado Health Science System. Consecutive patients recruited	
INCLUSION CRITERIA:	Authors included asymptomatic men and women 50 years of age and older who received referrals for screening colonoscopy.	
EXCLUSION CRITERIA:	Patients referred because of gastrointestinal symptoms, iron-deficiency anemia, positive fecal occult blood test results, or any other diagnostic purpose were excluded.	

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Denberg, TD, Coombes, JM, Byers, TE, Marcus, AC, Feinberg, LE, Steiner, JF, & Ahnen, DJ [73] **Year of publication: 2006** **Dates of data collection: pt enrollment in 2005** **Trial name: NA**	
POPULATION CHARACTERISTICS:	**No mailer (control)**	**Mailer (intervention)**
Mean age & range (years):		
50-64y		
>=65y	75.7% (n=299)	78.5% (n=303)
Sex (% female):	24.3% (n=96)	21.5% (n=83)
Race:	62.5% (n=148)	61.1% (n=236)
White, non-Latino		
Black, non-Latino	53.7% (n=212)	59.6% (n=230)
Latino	10.1% (n=40)	7.0% (n=27)
Other or unknown	3.8% (n=15)	4.2% (n=16)
	32.4% (n=128)	29.3% (n=113)
Marital status		
Not married		
Married	29.4% (n=116)	29.5% (n=114)
Unknown	58.0% (n=229)	58.0% (n=224)
	12.7% (n=50)	12.4% (n=48)
	Group 1	**Intervention** **Overall**
Attrition/Drop-out (not available for endpoint measurement):		2 mailers returned as undeliverable
Adherence in control group:		No attrition, since medical record
Contamination in control group:		claims were reviewed after mailing
OUTCOME ASSESSMENT:		
	Outcome Measures: Medical claims examined at 4 months to see if a record had been generated. If yes, c-scope completed. If no claims record, recorded as not completed. Pt demographics obtained from medical record, cross-referenced with medical record number Blinded manual review of claims data was unnecessary because the primary outcome was based on the presence and tabulation of electronic claims generated within 4 months of patient enrollment.	
Results		
KQ2 - What factors influence the use of colorectal cancer screening?	NA	
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	Receiving a mailer was associated with a rate of colonoscopy completion that was 11.7 percentage points (95% CI, 5.1 to 18.4 percentage points) greater than that seen with usual care (70.7% vs. 59.0%, respectively; *P* = 0.001).	
QUALITY RATING:	Fair	

Quality Assessment-Internal Validity

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	x		
Was the method of randomization adequate?	x		(random # generator)
Was the treatment allocation concealed?			
Were the groups similar at baseline regarding the most important prognostic indicators?	x		
Was the outcome assessor blinded?			
Was the care provider blinded?	x		NA
Was the patient blinded?			
Was the drop-out rate acceptable?	**x**		
Was the differential drop-out rate acceptable?	**x**		
Were co-interventions avoided or similar?	**x**		
Were outcome measures valid, reliable, and equally applied?	x		Medical records claim will underestimate utilization, but this should blunt the intervention's effect
Were all randomized participants analyzed in the group to which they were originally assigned?	x		
Quality Rating: Fair			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Dietrich AJ, Tobin JN, Cassells A, Robinson CM, Greene MA, Sox CH, Beach ML, DuHamel KN, Younge RG[74] **Year of publication:** 2006 **Dates of data collection:** November 2001 to April 2004 **Trial name:** NA	
OBJECTIVE OR AIM:	To evaluate the effect of a telephone support intervention to increase rates of breast, cervical, and colorectal cancer screening among minority and low-income women.	
DESIGN:	**Setting:** 11 community and migrant health centers in New York City **Study design:** Randomized controlled trial **Duration (mean followup):** 18 months **Overall study size (N enrolled/N analyzed):** 707 in control, 706 in intervention	
INTERVENTIONS:	**Control**	**Intervention**
Sample size:	Sample size: 707	Sample size: 706
Describe intervention:	Intervention: Usual care	Intervention: Over 18 months, women assigned to the intervention group received an average of 4 calls from prevention care managers (PCM). PCM worked with patients to address barriers, including providing motivational intervention. Physician recommendations were provided to all patients via letter or in the office. Mailing of FOBT was done but data NR.
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based	
INCLUSION CRITERIA:	Women were 50 to 69 years of age, were overdue for at least 1 cancer screening according to their medical records, were patients of the center for at least 6 months, and had no plans to move or change health centers within 15 months	
EXCLUSION CRITERIA:	Language barriers, up-to-date on all screenings, unresolved abnormal screening, declined to participate	
POPULATION CHARACTERISTICS:	**Intervention**	**Control**
Mean age & range (years):	Mena age: 58.1	Mean age: 58.1
Sex (% female):		
Race:		
Other population qualities:		
	All	
Attrition/Drop-out (not available for endpoint measurement):	64% consented to participate	
Adherence in control group:		
Contamination in control group:		
OUTCOME ASSESSMENT:	**Outcome Measures:**	

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Dietrich AJ, Tobin JN, Cassells A, Robinson CM, Greene MA, Sox CH, Beach ML, DuHamel KN, Younge RG[74] **Year of publication:** 2006 **Dates of data collection:** November 2001 to April 2004 **Trial name:** NA
	• Medical record documentation of mammography, Papanicolaou testing, and colorectal cancer screening according to U.S. Preventive Services Task Force recommendations. • A woman was also considered up to date for colorectal cancer screening if she had received a colonoscopy within the past 10 years or a barium enema or sigmoidoscopy within the past 5 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	G1: 63% obtained any CRC test in follow-up period (0.24 point change from baseline) G2: 50% obtained any CRC test (0.11 point change from baseline) 0.13 point difference between G1 and G2 (95% CI, 0.07-0.19)
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		
Was the treatment allocation concealed?		X	
Were the groups similar at baseline regarding the most important prognostic indicators?			
Was the outcome assessor blinded?	X		
Was the care provider blinded?			
Was the patient blinded?			
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X	X	64% consented to participate
Was the differential drop-out rate acceptable (≤ 15%)?	X		NA
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Dietrich, A.J., Tobin, J.N., Cassells, A., Robinson, C.M., Reh, M., Romero, K.A., Flood, A.B., Beach, M.L.[75] **Year of publication:** 2007 **Dates of data collection:** May 2005 – March 2006 **Trial name:**	
OBJECTIVE OR AIM:	This study evaluated the impact of a streamlined prevention care management (PCM) delivered through a Medicaid managed care organization (MMCO), an infrastructure with the potential to sustain this program for the long term.	
DESIGN:	**Setting:** Medicaid managed care organization (MMCO); New York City **Study design:** Randomized trial **Duration (mean followup):** **Overall study size (N enrolled/N analyzed):** 1,316 (626 women 50 years or older)	
INTERVENTIONS:	**PCM intervention**	**Affinity's Mammography Outreach Program (AMOP) Comparison Group**
Sample size:	Sample size: 317	Sample size: 309
Describe intervention:	Intervention: received up to 3 scripted telephone calls to identify and overcome barriers and provide support to obtain needed breast, cervical, and colorectal cancer-screening tests and provided scheduling assistance and appointment reminders for CRC screening; educational material on breast, cervical, and CRC screening,	Intervention: received up to 3 scripted telephone calls to encourage participation and schedule mammography appointment, remind patient of upcoming mammography appointment, and verify that patient received mammography; $25 gift certificate on confirmation of mammogram; brochure providing educational information on breast, cervical, and CRC screening; and a brief recommendation during the first telephone call to discuss CRC screening with healthcare professional.
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Women were identified through Affinity's (the MMCO) administrative database	
INCLUSION CRITERIA:	Age 40-68; received care at 1 of 6 participating Community Health Centers, had been enrolled with Affinity for at least 12 months, and were overdue for at least 1 of the targeted cancer-screening tests.	
EXCLUSION CRITERIA:		
POPULATION CHARACTERISTICS:	**PCM intervention**	**Affinity's Mammography Outreach Program (AMOP) Comparison Group**
Mean age & range (years):		
Sex (% female):		
Race:		
Other population qualities:		
	PCM intervention	**Affinity's Mammography Outreach Program (AMOP) Comparison Group**
Attrition/Drop-out (not available for endpoint measurement):		
Adherence in control group:		
Contamination in control group:		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Dietrich, A.J., Tobin, J.N., Cassells, A., Robinson, C.M., Reh, M., Romero, K.A., Flood, A.B., Beach, M.L.[75] **Year of publication:** 2007 **Dates of data collection:** May 2005 – March 2006 **Trial name:**
OUTCOME ASSESSMENT:	**Outcome Measures:** • Screening status was assessed through MMCO administrative data • Definitions of up-to-date status were derived from US Preventive Services Task Force guidelines and matched Health Plan Employer Data and Information Set (HEDIS) breast and cervical cancer-screening guidelines used to assess the quality of MMCOs. • Up-to-date screening status for colorectal cancer (limited to women aged 50 years and older), home fecal occult blood testing within the past year, sigmoidoscopy or double-contrast barium enema within 5 years, or colonoscopy within 10 years
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** **NA**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** In an intent-to-treat comparison adjusted for baseline screening status, PCM women were 1.69 times more likely to be up-to-date for colorectal cancer screening tests at follow-up than women in the comparison group (95% confidence interval, 1.03-2.77). Comparison of Up-to-Date Status between Study Groups at Baseline and Follow up (CRC results only) Colorectal Cancer Screening (smaller N reflects that this analysis was done on a subset of participants who were aged 50 years and older) PCM group N = 317 AMOP group N = 309 Adjusted Comparison (only adjusted for baseline screening status): Baseline Up to Date N = 56 (18%) in PCM group, N = 48 (16%) in AMOP group Baseline OR – none reported Follow up Up-to Date N= 103 (32%) in PCM group, N = 78 (25%) in AMOP group Follow up OR – 1.69 (95% CI 1.03 – 2.77), p = .04
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?			NR
Was the treatment allocation concealed?			NR
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Was the outcome assessor blinded?	X		
Was the care provider blinded?			NR
Was the patient blinded?		X	
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]		X	
Was the differential drop-out rate acceptable (≤ 15%)?		X	
Were co-interventions avoided or similar?		X	
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Dolan, J.G., Frisina, S.[76] **Year of publication:** 2002 **Dates of data collection:** NR **Trial name:** NA	
OBJECTIVE OR AIM:	To conduct a pilot test of a decision aid designed to help patients choose among currently recommended colorectal cancer screening tests.	
DESIGN:	**Setting:** Clinic; Rochester, New York **Study design:** Randomized controlled trial **Duration (mean followup):** 2-3 months post-visit **Overall study size (N enrolled/N analyzed):** 95	
INTERVENTIONS:	**Experimental**	**Control**
Sample size:	• Sample size: 49	• Sample size: 46
Describe intervention:	• Intervention: description of colorectal cancer and the 5 screening tests, patients were urged to discuss colorectal cancer screening with their physician at their upcoming visit.	• Intervention: standardized interview consisting of a preliminary phase and an educational phase. The preliminary phase consisted of a brief description of colorectal cancer and the purpose of the study, and a demographic survey, questions regarding past colorectal cancer screening and whether patients had a preference for a particular screening method, a question regarding how colorectal cancer screening decisions should be made, and a 10-question test of patient knowledge about colorectal cancer and its prevention
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Clinic-based; patients at average risk for colon cancer being seen for routine appointments at 2 internal medicine practices in Rochester, New York. Most patients were recruited from a suburban practice with 5 general internists; 4 additional patients were obtained from an inner city faculty-resident teaching practice	
INCLUSION CRITERIA:	At average risk for colorectal cancer (defined as ≥50 years old, a negative family history, and no personal history of inflammatory bowel disease, colorectal cancer, or polyps), spoke English fluently, had normal mental status, were not too physically ill to participate, were able to hear conversational level speech, had a life expectancy of at least 3 years, were eligible for a colorectal cancer screening test according to the guideline recommendations (i.e., no history of fecal occult blood testing within the past 11 months, flexible sigmoidoscopy or double contrast barium enema within the past 5 years, or colonoscopy within the past 10 years), and were willing to participate	
EXCLUSION CRITERIA:	Recent screening, history of polyp, positive family history, too ill, abnormal mental status, history of "colitis", history of colorectal cancer, non-compliant or refuses all screening, not fluent enough in English, "no" per physician	

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Dolan, J.G., Frisina, S.[76] **Year of publication:** 2002 **Dates of data collection:** NR **Trial name:** NA	
	Experimental	**Control**
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other population qualities:**	Mean age: 65 Age range: 50 to 81 Sex: 53% female Race: 98% white	Mean age: 67.3 Age range: 50 to 83 Sex: 52% female Race: 98% white
	Experimental	**Control**
Attrition/Drop-out (not available for endpoint measurement):	2% (1 patient) withdrew	NA
Adherence in control group:		
Contamination in control group:		
OUTCOME ASSESSMENT:	**Outcome Measures:** • Decision process and decision outcomes • Note that they gave the patients numerous surveys that don't seem to have validated or piloted questions. Materials given to those in experimental group don't seem to be culturally tested or tested for literacy levels. There seems to be differences at baseline in the control and intervention group on some scales like decisional conflict (Table 2) but no data are provided.	
RESULTS:		
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** NA	
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** • Substantially fewer patients in the experimental group chose the no screening "wait & see" option before the physician visit: 18%versus 37% (*P* = 0.06). However, there was no difference between the groups in the number of patients who completed planned screening tests: 14 (52%) of 27 in the control group and 18 (49%) of 37 in the experimental group, *P* = 1.0.	
KQ4 - What are the current and projected capacities to deliver colorectal	**Outcomes:** NA	

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Dolan, J.G., Frisina, S.[76] **Year of publication:** 2002 **Dates of data collection:** NR **Trial name:** NA
cancer screening and surveillance at the population level?	
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		
Was the treatment allocation concealed?		X	
Were the groups similar at baseline regarding the most important prognostic indicators?	X		Some measures were not assess for the control
Was the outcome assessor blinded?	X		
Was the care provider blinded?			
Was the patient blinded?			
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Was the differential drop-out rate acceptable (≤ 15%)?	X		
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair	NR		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID: Jandorf, L., Gutierrez, Y., Lopez, J., Christie, J., Itzkowitz, S.H.[77]** **Year of publication: 2005** **Dates of data collection: January to May 2002** **Trial name:**	
OBJECTIVE OR AIM:	Test the effectiveness of a patient navigator (PN) in increasing compliance with screening colonoscopy in a minority community health setting.	
DESIGN:	**Setting:** Clinic; primary care practice in East Harlem, New York City **Study design:** Prospective clinical trial **Duration (mean followup):** 6 months **Overall study size (N enrolled/N analyzed):** 78 total	
	Intervention	**Control**
INTERVENTIONS: **Sample size:** **Describe intervention:**	Sample size: 38 Intervention: Patient Navigator: provided written reminders, telephone calls, and /or scheduling assistance; FOBT card placed in chart; physicians were asked to recommend screening to patients (but did not assess whether all participants received a recommendation for endoscopic screening from their physician)	Sample size: 40 FOBT card placed in chart to ensure clinician was blinded; physicians were asked to recommend screening to patients (but did not assess whether all participants received a recommendation for endoscopic screening from their physician)
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Patients that attended the clinic; reviewed charts of patients to find eligibility and approached patients.	
INCLUSION CRITERIA:	Men and women; aged 50 or older	
EXCLUSION CRITERIA:	Had an FOBT within the past year; had an FS or barium enema within the past 3–5 years; had a colonoscopy within the past 10 years	
	Intervention	**Control**
POPULATION CHARACTERISTICS:	Mean age: 61.1 76.3% female 78.9% Hispanic 68.5% have public health insurance	Mean age: 61.3 72.5% female 85% Hispanic 70% have public health insurance

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID: Jandorf, L., Gutierrez, Y., Lopez, J., Christie, J., Itzkowitz, S.H.[77]** **Year of publication: 2005** **Dates of data collection: January to May 2002** **Trial name:**	
Mean age & range (years):	36.8% had family history of cancer	38.5% had family history of cancer
Sex (% female):		
Race:		
Other population qualities:		
	Total	
Attrition/Drop-out (not available for endpoint measurement):	70% agreed to participate	
Adherence in control group:		
Contamination in control group:		
OUTCOME ASSESSMENT:	**Outcome Measures:** • CRC screening; Completion of CRC screening tests was determined by a series of sequential chart reviews conducted in a nonblinded fashion by the PN/RA • A second chart review took place 2–3 weeks after the initial interview and medical visit. FOBT completion as well as referral for FS or colonoscopy was recorded. • The third chart review was performed 3 months after the initial contact. During this time, FOBT completion as well as FS or colonoscopy completion was noted. After 6 months, the charts of all participants were reviewed for a fourth and final time to assess FOBT, FS, and/or colonoscopy completion.	
RESULTS:		
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** NA	

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID: Jandorf, L., Gutierrez, Y., Lopez, J., Christie, J., Itzkowitz, S.H.[77]** **Year of publication: 2005** **Dates of data collection: January to May 2002** **Trial name:**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	G1: 23.7% completion rate for endoscopy; 42.1% for FOBT G2: 5% completion rate for endoscopy (*P* = 0.019); 25.0% for FOBT (*P* = 0.086)
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?			NR
Was the treatment allocation concealed?			NR
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Was the outcome assessor blinded?			
Was the care provider blinded?	X		
Was the patient blinded?		X	
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Was the differential drop-out rate acceptable (≤ 15%)?	X		
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Applicability Assessment

Population	Mean age 61.2, primarily Hispanic women
Intervention	Patient Navigator: provided written reminders, telephone calls, and /or scheduling assistance
Comparison	Control group that received an FOBT card and recommendation from physician for screening
Outcomes	CRC screening rates
Timing of follow-up	3 and 6 months
Setting	Clinic

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Ling BS, Schoen RE, Trauth JM, Wahed AS, Eury T, Simak DM, Solano FX, Weissfeld JL[78] **Year of publication:** 2009 **Dates of data collection:** June 1, 2002, through April 30, 2004 **Trial name:** NA	
OBJECTIVE OR AIM:	In a controlled study of primary care patients eligible for colorectal cancer screening, authors sought to compare 2 PPIP-based physician office and patient management interventions for their effect on completion of endoscopic screening.	
DESIGN:	**Setting: 10** Primary care practices participating in the Physician Research in Office Network (PRONET) **Study design:** Randomized controlled trial. 2x2 factorial design. **Duration (mean followup):** 1 year **Overall study size (N enrolled/N analyzed):** 599 patients	
Methods:	Practices were paired according to the number of physicians, specialty, location, and clientele, and then randomized one member of each pair to enhanced office and patient management and the second to a nonehnanced office and patients management. Within each physician group practice, eligible patients were randomized individually to receive a personalize (tailored) or nonpersonalized letter that recommended endoscopic screening. Flips of a coin witnessed by a person not involved in the research was used to allocate practices and computer generated random numbers to allocate individuals. Patients were recruited via a mailed packet (see Recruitment). Following recruitment and randomization, patients received letters recommending endoscopic CRC screening and asking recipients to telephone for an appointment. The non tailored letter lacked a personalized salutation or patient specific content. The tailored letter included a personalized salutation, named the personal physician, commented on the patients age, family history, history of CRC testing.	
INTERVENTIONS: **Sample size:** **Describe intervention:**	**Enhanced Office and Patient Management Practices (with and without tailored letters to patients)** Intervention: The enhanced office and patient management intervention used research staff to help office staff (1) adapt office-based protocols for endoscopic screening referral, (2) track patient outcomes, and (3) resolve patient-specific barriers to screening. They also worked with the office staff to develop protocols for CRC screening and implement them within their practice. This was combined with: Tailored letter mailed to patients (n=152) No tailored letter sent (n=190)	**Nonenhanced Office and Patient Management Practices (with and without tailored letters to patients)** Intervention: In the nonenhanced office and patient management intervention, authors educated physicians and office staff members about colorectal cancer screening guidelines and common barriers and misperceptions related to colorectal cancer screening. Working with office managers, authors also helped offices write protocols to guide patient referrals for endoscopic screening of the lower gastrointestinal tract. The nonenhanced intervention represented a current standard of care in which providers use published tools (e.g., PPIP10) and existing resources to initiate and sustain office procedures for promoting preventive clinical services. This was combined with: Tailored letter mailed to patients (n=133) No tailored letter sent (control group) (n=124)
RECRUITMENT: **(population-based, clinic-based,**	Clinic-based (primary care physician-based practices). 10 practices from among unknown number of PRONET practices were identified and recruited. Patients within these practices were recruited via: electronic billing records	

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Ling BS, Schoen RE, Trauth JM, Wahed AS, Eury T, Simak DM, Solano FX, Weissfeld JL[78] **Year of publication:** 2009 **Dates of data collection:** June 1, 2002, through April 30, 2004 **Trial name:** NA			
volunteer, other)	identified age-=eligible patients who had an office visit in the preceding fiscal year. Patients were mailed a packet with an invitation letter requesting participation in the project. The packet also included a survey with included questions about exclusion criteria.			
INCLUSION CRITERIA:	Patients aged 50 to 79 years, no personal history of colorectal cancer or polyp and no recent lower gastrointestinal tract procedures (FS or BE in 5 years or colonoscopy in 10 years)			
EXCLUSION CRITERIA:	Patients with a personal history of colorectal cancer or polyp, recent lower gastrointestinal tract procedure			
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other population qualities:**	**Enhanced Office and Patient Management** Sex: 56.7% women Age: 36.3% age 50-54, 24.6% age 55-59, 14.3% age 60-64, 10.8% age 65-69, 7.9% age 70-74, 6.1% age 75+ Race: 90% White, 10% Other		**Nonenhanced Office and Patient Management** Sex: 52.9% women Age: 31.1% age 50-54, 22.2% age 55-59, 12.8% age 60-64, 13.6% age 65-69, 12.5% age 70-74, 7.8% age 75+ Race: 84.4% White, 15.6% Other	
Attrition/Drop-out (not available for endpoint measurement): **Adherence in control group:** **Contamination in control group:**	**Tailored/enhanced** 92.1% completed follow-up	**Nontailored/enhanced** 86.8% completed follow-up	**Tailored/nonenhanced** 96.2% completed follow-up	**Nontailored/nonenhanced** 96.0% completed follow-up
OUTCOME ASSESSMENT:	**Outcome Measures:** • The primary end point was medical-record-verified flexible sigmoidoscopy or colonoscopy. • To ascertain procedures missed by medical record reviews, authors telephoned patients in the enhanced and nonenhanced management intervention to ask about completed or planned procedures. The enhanced office intervention included periodic telephone contacts. Authors attempted to contact patients in the non enhanced management intervention after the anniversary of the letter if preliminary medical record reviews failed to document occurrence of the end point. • Statistical end-point analysis (according to randomization intent) used generalized estimating equations to account for correlated outcomes according to physician group. • Because authors realized that the outcome from 2 individuals belonging to the same matched pair of physician practices will be correlated, statistical analysis of the clinical trial end point (analyzed according to randomization intent) used generalized estimating equation (GEE) methods to model the association of interventions with the outcome. This approach consists of 2 models fitted simultaneously. The main model specifies the logistic regression of the outcome on the independent variables and the other model accounts for the correlations between patients arising from their belonging to the same physician group practice (within practice) and to the same matched pair (between practice). • Authors used alternate logistic regression models to specify within- and between-practice associations in terms of pair-wise odds ratios.			
RESULTS:				
KQ2 - What factors influence the use of colorectal cancer screening?	NA			
KQ3 - Which strategies are effective in	**Outcomes:**			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Ling BS, Schoen RE, Trauth JM, Wahed AS, Eury T, Simak DM, Solano FX, Weissfeld JL[78] **Year of publication:** 2009 **Dates of data collection:** June 1, 2002, through April 30, 2004 **Trial name:** NA
increasing the appropriate use of colorectal cancer screening and followup?	• During a one year period, endoscopy occurred in 48.2%. This included: 53.3% of patients in the group with tailored letter and enhanced management, 54.2% in the group with nontailored letter and enhanced management; 43.6% in the group with tailored letter and nonenhanced management; and 37.9% in the group with nontailored letter and nonenhanced management. • Enhanced management increased the odds of completing a colonoscopy or FS by 1.63 fold (95% CI 1.11-2.41). However, the tailored letter increased the odds of completion by only 1.08 fold (0.72-1.62).
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		
Was the treatment allocation concealed?			
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Was the outcome assessor blinded?		X	
Was the care provider blinded?		X	
Was the patient blinded?		X	
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Was the differential drop-out rate acceptable (≤ 15%)?	X		
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?		x	Phone contact with enhanced group was greater, introducing possible measurement bias
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Applicability Assessment:

Population	Patients age 50-79
Intervention	Enhanced office and patient-based management training
Comparison	Compared those with enhanced and non-enhanced management training
Outcomes	Flexible sigmoidoscopy or colonoscopy
Timing of follow-up	1 year
Setting	Primary care practices

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Myers, RE, Sifri, R, Hyslop, T, Rosenthal, M, Vernon, SW, Cocroft, J, Wolf, T, Andrel, J, & Wender, R [79] **Year of publication:** 2007 **Dates of data collection:** 2002-2004 **Trial name:** NR			
OBJECTIVE OR AIM:	To determine whether targeted and tailored interventions can increase screening use.			
DESIGN:	**Setting:** Jefferson Family Medicine Associates (JFMA), a large urban practice located at Thomas Jefferson University in Philadelphia (1 central practice site) **Study design:** RCT **Duration (mean followup):** 24 months **Overall study size (N enrolled/N analyzed):** 1546/1546			
	SI	**TI**	**TIP**	**Control**
INTERVENTIONS: **Sample size:** **Describe intervention:**	387 Targeted intervention by mail (i.e., personalized screening invitation letter, informational booklet, FOBT fit, and reminder letter)	386 SI intervention plus Targeted intervention with tailored "message pages."	386 (SI and TI combined) Targeted intervention, tailored message pages, and a telephone reminder.	387 Usual care
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Clinic-based; practice billing database was used to identify potential study participants. In February and March of 2002, JFMA sent a letter to potential participants introducing the research study. The letter informed recipients of the purpose of the study, provided details regarding participation, and explained opt-out procedures			
INCLUSION CRITERIA:	Adult male and female patients of JFMA, between 50-74 years old, no prior diagnosis with colorectal neoplasia or inflammatory bowel disease, had had at least one visit to JFMA within the previous 2 years, had complete contact information (i.e., address and telephone number) available, and had not undergone recent CRC screening. The latter criterion related to having an SBT within the previous year, FS within the previous 5 years, a DCBE X-ray within the previous 5 years, or a colonoscopy within the previous 10 years.			
EXCLUSION CRITERIA:	See above			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Myers, RE, Sifri, R, Hyslop, T, Rosenthal, M, Vernon, SW, Cocroft, J, Wolf, T, Andrel, J, & Wender, R [79] **Year of publication:** 2007 **Dates of data collection:** 2002-2004 **Trial name:** NR			
POPULATION CHARACTERISTICS:	**Overall**			
Mean age & range (years):	NR			
Sex (% female):	67%			
Race:	58% African American			
Other population qualities:	5%			
Family history of CRC	51%			
> high school education	41%			
Prior cancer screening test				
	SI	**TI**	**TIP**	**Control**
	19%	19%	20%	21%
Attrition/Drop-out (not available for endpoint measurement):				
Adherence in intervention group:				
Contamination in control group:				
OUTCOME ASSESSMENT:	**Outcome Measures:** Screening use			
RESULTS:				
KQ2 - What factors influence the use of colorectal cancer screening?	NA			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Myers, RE, Sifri, R, Hyslop, T, Rosenthal, M, Vernon, SW, Cocroft, J, Wolf, T, Andrel, J, & Wender, R [79] **Year of publication:** 2007 **Dates of data collection:** 2002-2004 **Trial name:** NR
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** • Univariate analyses showed screening rates in study groups were 33% in the control group, 46% in the SI group, 44% in the TI group, and 48% in the TIP group. Screening was found to be significantly higher in all 3 intervention groups compared with the control group (OR 1.7 [95% CI 1.3–2.5], OR 1.6 [95% CI, 1.2–2.1], and OR 1.9 [95% CI, 1.4–2.6], respectively), but did not vary significantly across intervention groups.
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		
Was the treatment allocation concealed?			
Were the groups similar at baseline regarding the most important prognostic indicators?			CD
Was the outcome assessor blinded?			
Was the care provider blinded?	X		
Was the patient blinded?			
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Was the differential drop-out rate acceptable (≤ 15%)?	X		
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Applicability Assessment

Population	Patients (50-74) of a large urban primary care practice
Intervention	Standard and tailored interventions to increase CRC screening
Comparison	Usual care
Outcomes	CRC screening
Timing of follow-up	24 months after intervention
Setting	Primary care practice center

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Pignone, M., Harris, R., Kisinger, L.[80] **Year of publication:** 2000 **Dates of data collection:** May to November 1998 **Trial name:** NA	
OBJECTIVE OR AIM:	To test whether a decision aid consisting of an educational video, targeted brochure, and chart marker increased performance of colon cancer screening in primary care practices.	
DESIGN:	**Setting:** Community primary care practices **Study design:** Randomized controlled trial **Duration (mean followup):** 3-month chart review **Overall study size (N enrolled/N analyzed):** 249	
INTERVENTIONS:	**Intervention**	**Control**
Sample size:	Sample size: 125	Sample size: 124
Describe intervention:	Intervention: Questionnaire about intentions for CRC screening, watched video about CRC screening options, received brochure about CRC screening, then another questionnaire about CRC screening intentions	Intervention: Questionnaire about intentions for CRC screening, watched video about traffic safety, then another questionnaire about CRC screening intentions
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Clinic-based; Patients were contacted by telephone before their scheduled visits and asked to participate in a study of preventive care.	
INCLUSION CRITERIA:	Adults 50 to 75 years of age who were scheduled to be seen for a new or ongoing health problem by one of the participating providers from the three practices	
EXCLUSION CRITERIA:	Reported a personal or family history of colon cancer, had home fecal occult blood testing (FOBT) in the past year or flexible sigmoidoscopy, colonoscopy, or barium enema in the past 5 years, were judged by the research assistant to be too ill to participate, or appointments were only for laboratory blood work.	
POPULATION CHARACTERISTICS:	**Intervention**	**Control**
Mean age & range (years):	Mean age: 63.1	Mean age: 62.7
Sex (% female):	Sex: 59% female	Sex: 61% female
Race:	Race: 84% white	Race: 90% white
Other population qualities:		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Pignone, M., Harris, R., Kisinger, L.[80] **Year of publication:** 2000 **Dates of data collection:** May to November 1998 **Trial name:** NA
Attrition/Drop-out (not available for endpoint measurement):	**All** None
Adherence in control group:	
Contamination in control group:	
OUTCOME ASSESSMENT:	**Outcome Measures:** Intervention group participants were less likely than controls to have graduated from high school (73% vs. 84%) and were more likely to have Medicare as their main form of insurance (56% vs. 45%).
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** N
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** • At baseline, the mean score for intent to ask for screening (measured on a 4-point Likert scale) was 2.2 in both groups. • After the participants watched the video, the mean 6 SD score for intent to ask for screening was significantly higher in the intervention group (3.1 6 1.0) than the control group (2.5 6 1.1) (*P* , 0.001, Wilcoxon rank-sum test). In the intervention group, 50.0% of participants moved from low (1 or 2) to high (3 or 4) intent to be screened after watching the video compared with 26.5% of controls. • When asked after their visits whether they had had any conversation about colon cancer screening, 68.5% of intervention group participants and 43.4% of controls reported some conversation (difference, 25.1 percentage points [95% CI, 12.7 to 37.6 percentage points]). • For the main outcome of any test completed, the absolute difference between the intervention (36.8%) and control (22.6%) groups was 14.2 percentage points (CI, 3.0 to 25.4 percentage points).
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Pignone, M., Harris, R., Kisinger, L.[80] **Year of publication:** 2000 **Dates of data collection:** May to November 1998 **Trial name:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		
Was the treatment allocation concealed?			
Were the groups similar at baseline regarding the most important prognostic indicators?	X	X	Intervention group participants were less likely than controls to have graduated from high school (73% vs. 84%) and were more likely to have Medicare as their main form of insurance (56% vs. 45%).
Was the outcome assessor blinded?	X		
Was the care provider blinded?		X	
Was the patient blinded?		X	
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Was the differential drop-out rate acceptable (≤ 15%)?	X		
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Applicability Assessment

Population	North Carolina adults age 50-75
Intervention	Questionnaire about intentions for CRC screening, watched video about CRC screening options, received brochure about CRC screening, then another questionnaire about CRC screening intentions
Comparison	Compared to patients who received a video about traffic safety
Outcomes	CRC screening rates
Timing of follow-up	3 month chart review
Setting	Primary care clinics

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Potter MB, Phengrasamy L, Hudes ES, McPhee SJ, Walsh JME[81] **Year of publication:** 2009 **Dates of data collection:** September 2006-March 31, 2007 **Trial name:** NA		
OBJECTIVE OR AIM:	Authors wanted to determine whether providing home fecal occult blood test (FOBT) kits to eligible patients during influenza inoculation (flu shot) clinics can contribute to higher colorectal cancer screening (CRCS) rates.		
DESIGN:	**Setting:** Family Health Center, a residency-based clinic at San Francisco General Hospital **Study design:** Time-randomized trial **Duration (mean followup):** **Overall study size (N enrolled/N analyzed):** 514		
INTERVENTIONS:	**Control**	**Intervention**	
Sample size:	Sample size: 8 flu shot sessions, n= 247	Sample size: 9 flu shot session, 264 flu shots given	
Describe intervention:	Intervention: Flu shot given	Intervention: Flu shot and FOBT kit given	
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based; patients aged 50 to 79 years were mailed multilingual flu shot campaign announcements in English, Chinese, Russian, Spanish, and Vietnamese		
INCLUSION CRITERIA:	Age 50-79 years, had not had a FOBT since the end of the prior influenza season, a colonoscopy in the past 10 years, any previously unevaluated abnormal FOBT results, a history of recent unevaluated rectal bleeding. Persons with FS in the last 5 years alone were eligible.		
EXCLUSION CRITERIA:	NR		
POPULATION CHARACTERISTICS:	**Control**	**Intervention**	
Mean age & range (years): **Sex (% female):** **Race:** **Other population qualities:**	Mean age: 65.6 Sex: 65.9% female Ethnicity: 6.1% African American, 56.1% Asian/Pacific Islander, 25.2% Latino, 9.8% Non-Latino White, 2.8% Other/Unknown	Mean age: 63.7 Sex: 61.2% female Ethnicity: 5.6% African American, 48.1% Asian/Pacific Islander, 35.8% Latino, 7.8% Non-Latino White, 2.6% Other/Unknown	
	Overall	**Group 2**	**Overall**
Attrition/Drop-out (not available for endpoint measurement):	264 flu shots given		
Adherence in control group:	153 eligible for FOBT		
Contamination in control group:	149 offered FOBT and 4 missed		
	143 given FOBT and 6 refused		
OUTCOME ASSESSMENT:	**Outcome Measures:** • The primary study outcome was change in CRCS up-to-date status from being due for a screening test, defined as not having a FOBT in the last year, a flexible sigmoidoscopy or double-contrast barium enema in the past 5 years, a colonoscopy in the past 10 years, or having any previously unevaluated abnormal FOBT results or recent unevaluated rectal bleeding, to having completed the FOBT. • Authors compared baseline characteristics of the intervention and control groups using the 2-sample *t* test for continuous variables and the Pearson $\chi 2$ test for categorical variables. • To compare the changes in CRCS status between the 2 study arms, a −1, 0, +1 score was created for the preintervention to postintervention change for each patient. In this scoring system, +1 indicates		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Potter MB, Phengrasamy L, Hudes ES, McPhee SJ, Walsh JME[81] **Year of publication:** 2009 **Dates of data collection:** September 2006-March 31, 2007 **Trial name:** NA
	being due for screening at preintervention and up-to-date at postintervention; −1 indicates being up-to-date at preintervention and due for screening at postintervention; and 0 indicates no preintervention to postintervention change in CRCS status. • A 2-sample Wilcoxon test was used to compare these change scores for the 2 groups. Within each arm, the McNemar test was used to compare preintervention to postintervention percentage point change in CRCS status. • Using available preselected predictor variables that have been associated with variations in screening completion, authors next explored predictors of CRCS with multivariate logistic regression models.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**NA**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	G1: 83 (68.0%) became up-to-date with any CRC screening at follow-up (29.8 percentage point change from baseline; 95% CI, 23.7- 36.0) G2: 24 (20.7%) became up-to-date with any CRC test (4.4 percentage point change; 95% CI, -0.7- 9.7) *P* < 0.001
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Good

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		Not well described
Was the treatment allocation concealed?		X	
Were the groups similar at baseline regarding the most important prognostic indicators?	X		Except for age, p=.004
Was the outcome assessor blinded?			Not stated
Was the care provider blinded?		x	The clinic staff was not told in advance on what dates they would perform the intervention. However, contamination possible as the same staff were conducting flu shots on all days
Was the patient blinded?		x	
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	x		
Was the differential drop-out rate acceptable (≤ 15%)?			NA
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Good			

Applicability Assessment:

Population	Patients age 50-79 in a San Francisco clinic
Intervention	FOBT kits handed out during flu shots
Comparison	Compared FOBT screening rates of patients who had flu shot with no FOBT kit and those who received an FOBT kit
Outcomes	FOBT screening
Timing of follow-up	FOBT returned within 7 months
Setting	Clinic in San Francisco

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Roetzheim RG, Christman LK, Jacobsen PB, Cantor AB, Schroeder J, Abdulla R, Hunter S, Chirikos TN, Krischer JP [82) AND {#3521] **Year of publication:** 2004, 2005 **Dates of data collection:** **Trial name:**	
OBJECTIVE OR AIM:	Authors developed a low-cost office systems intervention, Cancer Screening Office Systems (Cancer SOS), for primary care clinics serving disadvantaged populations. Authors tested the efficacy of the system among patients attending community health centers, a representative setting of care for the target population.	
DESIGN:	**Setting:** Community health centers **Study design:** Randomized controlled trial **Duration (mean followup):** Follow-up at 12 and 24 months **Overall study size (N enrolled/N analyzed):** 8 clinics—each time period, a different set of random medical charts were selected for data collection—1196 at baseline; 1237 at 12 months; 1296 at 24 months	
INTERVENTIONS:	**Intervention Group**	**Control Group**
Sample size:	**Sample size**: 600	**Sample size**: 596
Describe intervention:	**Intervention**: Key components of the intervention included a cancer-screening checklist completed by patients and indicating whether patients were due for screening, and a series of red, yellow, and green stickers that indicated whether recommended screening tests had been ordered and completed.	**Intervention**: Control
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based; To target an underserved population, clinics were recruited from among 16 clinics participating in a county-funded health insurance plan in Hillsborough County, Fla.	
INCLUSION CRITERIA:	• Clinics were eligible for the randomized trial if (1) they provided primary medical care 5 days a week, (2) a majority of the physician and nonphysician providers agreed to participate, and (3) the clinic was expected to continue operating in the same fashion for the following 24 months. • Patient's records were eligible to be abstracted if both the following criteria were met: (1) the patient was 50 to 75 years of age, and (2) the patient was established in the clinic (defined as having had at least 1 visit 12 months or more before the sampled visit).	
EXCLUSION CRITERIA:	Patients with a personal history of colon cancer and those who had received a colonoscopy or double-contrast barium enema in the previous 10 years were excluded from the analysis of FOBT.	
POPULATION CHARACTERISTICS:	**Intervention Group**	**Control Group**
Mean age & range (years):	Age: 38.7% 50-56, 33.1% 57-63, 28.3% 64-75	Age: 35.6% 50-56, 32.9% 57-63, 31.5% 64-75
Sex (% female):	Sex: 78% female	Sex: 78% female
Race:	Race: 34% African American, 45.3% White, 20.7% Hispanic	Race: 24.2% African American, 51.5% White, 24.3% Hispanic
Other population qualities:		
	Intervention Group	**Control Group**
Attrition/Drop-out (not available for endpoint measurement):	NA	NA
Adherence in control group:		
Contamination in control group:		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Roetzheim RG, Christman LK, Jacobsen PB, Cantor AB, Schroeder J, Abdulla R, Hunter S, Chirikos TN, Krischer JP [82) AND {#3521] **Year of publication:** 2004, 2005 **Dates of data collection:** **Trial name:**
OUTCOME ASSESSMENT:	**Outcome Measures:** • Authors defined being up-to-date as having completed FOBT within either the 12 months before the audited visit or within the 3 months after the audited visit. • Chart abstracters used a standardized method and instrument to abstract chart information and were trained by the project manager. Relevant clinical data were abstracted from all sections of the chart, including progress notes, laboratory reports, radiology reports, consultation letters, and hospital records. • Interrater reliability was calculated (0.91)
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** At the 12 month follow-up • FOBT screening rates in intervention group was 40.1% vs. 11.9% in control • Multivariate analysis results: FOBT – Odds ratio=2.56, 95% CI 1.65-4.01, p<.0001 At 24 months, the intervention had no significant effect on FOBT screening • OR =1.17 (95% CI, 0.92-1.48) • When results were repeated comparing patients having a Cancer SOS screening checklist with those who did not, presence of a checklist was associated with increased odds of FOBT screening (OR = 3.28; 95% CI, 2.05-5.23; *P* <.0001). • Compliance with the Cancer SOS intervention decreased during the course of the intervention, with 334 of 615 (54.3%) showing evidence of the checklist at 24 months, compared to 74% at 6 month f/u.
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?			Not described
Was the treatment allocation concealed?			NR
Were the groups similar at baseline regarding the most important prognostic indicators?	X		Except for race: Intervention-34% African American, 45.3% White, 20.7% Hispanic; Control- 24.2% African American, 51.5% White, 24.3% Hispanic
Was the outcome assessor blinded?		X	
Was the care provider blinded?		X	
Was the patient blinded?		X	
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Was the differential drop-out rate acceptable (≤ 15%)?			NA
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Applicability Assessment:

Population	Patients 50 to 75 years of age who went to a community health clinic in Hillsborough County, FL.
Intervention	Cancer-screening checklist completed by patients and indicating whether patients were due for screening, and a series of red, yellow, and green stickers that indicated whether recommended screening tests had been ordered and completed.
Comparison	Compared patients who received intervention to those who did not.
Outcomes	FOBT screening
Timing of follow-up	12 and 24 months
Setting	Community health centers

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Ruffin, MT, Fetters, MD, & Jimbo, M [83] **Year of publication:** 2007 **Dates of data collection:** 2002-2003 **Trial name:**	
OBJECTIVE OR AIM:	Compare Colorectal Web and an existing stand-alone Web site in a RCT	
DESIGN:	**Setting:** 5 urban, suburban, rural communities in MI **Study design: RCT** **Duration (mean followup):** 24 weeks **Overall study size (N enrolled/N analyzed):** 174/174	
INTERVENTIONS:	**Intervention**	**Control**
Sample size:	• 87	• 87
Describe intervention:	• At study sites that were community locations (hotels, meeting rooms in malls, other public meeting areas) participants were provided a laptop and they viewed either the Colorectal web or alternative website	
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	• Population based • 5 communities selected based on 1) CRC burden and 2) presence of minority populations • List of 3000 residential telephone numbers likely to meet the age and geographical eligibility requirements purchased by a marketing company (1000 each urban, suburban, rural) • Up to 5 calls per number to recruit	
INCLUSION CRITERIA:	• Between ages of 50-70 • Resident in one of the urban, suburban, or rural communities selected in MI • Not previously screened for CRC • Comfortable using a computer to find information on the Internet • Self-reported health status better than poor	
EXCLUSION CRITERIA:	'Screened for CRC', Age, ability to use computer (no explanation of how that's assessed), and poor health	
POPULATION CHARACTERISTICS:	**Intervention**	**Control**
Mean age & range (years):	56.9 52	57.4 57
Sex (% female):	54	52
Race: **Caucasian** **African-American**	46	48
Other population qualities:		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Ruffin, MT, Fetters, MD, & Jimbo, M [83] **Year of publication:** 2007 **Dates of data collection:** 2002-2003 **Trial name:**		
	Intervention	**Control**	**Overall**
Attrition/Drop-out (not available for endpoint measurement):	0	0	
Adherence in control group:			
Contamination in control group:			
OUTCOME ASSESSMENT:	**Outcome Measures:** Follow up phone calls at 2, 8, 24 weeks to ascertain whether participant had been screened for CRC		
RESULTS:			
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:**		
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** • Main result: At 24 weeks, 89 persons had been screened. In intervention group, 56% completed any CRC test compared to 33% in control group (23 percentage point difference; AOR, 3.23; 95% CI, 2.73-3.50; *P* = 0.035) • In a logistic regression model, with exposure to Colorectal Web, age, gender, ethnicity, preference for CRC screening, and interaction term between preference and exposure to Colorectal Web, and screening as the outcome, exposure to the intervention was associated with the outcome (OR = 3.23, CI, 2.73-3.50)		
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:**		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Ruffin, MT, Fetters, MD, & Jimbo, M [83] **Year of publication:** 2007 **Dates of data collection:** 2002-2003 **Trial name:**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:**
QUALITY RATING:	Good

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		
Was the treatment allocation concealed?	X		
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Was the outcome assessor blinded?	X		
Was the care provider blinded?	X		
Was the patient blinded?	X		
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Was the differential drop-out rate acceptable (≤ 15%)?	X		
Were co-interventions avoided or similar?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Good			

Applicability Assessment

Population	Urban, suburban, rural residents of one state
Intervention	Supervised viewing of a website, results may not translate to spontaneous viewing at home
Comparison	Viewing of a control website (standard site on CRC)
Outcomes	Self-reported CRC screening
Timing of follow-up	24 weeks, appropriate
Setting	Viewing websites under a research setting, in public spaces, likely is not the same as viewing websites at home.

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Sequist TD, Zaslavsky AM, Marshall R, Fletcher RH, Ayanian JZ [84] **Year of publication:** 2009 **Dates of data collection:** April 2006 to June 2007 **Trial name:** NA			
OBJECTIVE OR AIM:	Authors conducted a randomized controlled trial to compare the individual and joint impact of personalized mailings to patients and electronic reminders to primary care physicians to promote colorectal cancer screening within a multisite group practice.			
DESIGN:	**Setting:** Harvard Vanguard Medical Associates (HVMA), a multispecialty group practice composed of 14 ambulatory health care centers in eastern Massachusetts **Study design:** Randomized controlled trial **Duration (mean followup):** Screening within 15-month study period **Overall study size (N enrolled/N analyzed):** 21,860 patients and 110 primary care physicians			
INTERVENTIONS:	**Patient Mailing**	**Patient Control Group**	**Physician Reminder**	**Physician Control Group**
Sample size:	**Sample size**: 10,930 Patients	**Sample size**: 10,930 Patients	**Sample size**: 55 Physicians	**Sample size**: 55 Physicians
Describe intervention:	**Intervention**: Patients overdue for colorectal cancer screening received a mailing with the following 4 components: (1) a cover letter from the HVMA chief medical officer identifying the patient as overdue for screening and indicating the dates of their most recent screening examinations, (2) an educational pamphlet detailing screening options, (3) an FOBT kit with 3 Coloscreen stool cards from Helena Laboratories Corporation, Beaumont, Texas, instructions, and a stamped return envelope, and (4) a dedicated telephone number to schedule flexible sigmoidoscopy or colonoscopy.	**Intervention**: control	**Intervention**: Throughout the 15-month intervention period, physicians received electronic reminders during office visits with their patients overdue for colorectal cancer screening.	**Intervention**: Control
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based			
INCLUSION CRITERIA:	Patients aged 50 to 80 years who had a visit with 1 of the 110 primary care physicians at 11 centers during the prior 18 months			
EXCLUSION CRITERIA:	Patients who had been screened for colorectal cancer in accordance with the HVMA clinical guideline, having received either flexible sigmoidoscopy within 5 years along with FOBT in the prior year or colonoscopy within 10 years.			
POPULATION CHARACTERISTICS:	**Patient Mailing Intervention**	**Patient Control**	**Physician Reminder**	**Physician Control**
Mean age & range (years):	Mean age: 60.5	Mean age: 60.4	Mean age: 60.3	Mean age: 60.5
Sex (% female):	Sex: 56.8% female	Sex: 57% female	Sex: 54% female	Sex: 59.8% female
Race:	Race: 58% White, 8% Black, 2% Hispanic, 2% Asian, 3% Other, 27% Unknown	Race: 57% White, 8% Black, 2%Hispanic, 3% Asian, 3% Other, 27% Unknown	Race: 57% White, 9% Black, 2% Hispanic, 2% Asian, 3% Other, 28% Unknown	Race: 58% White, 8% Black, 2% Hispanic, 3% Asian, 3% Other, 27% Unknown
Other population qualities:				
	Patient Mailing	**Patient Control**	**Physician Reminder**	**Physician Control**

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Sequist TD, Zaslavsky AM, Marshall R, Fletcher RH, Ayanian JZ [84] **Year of publication:** 2009 **Dates of data collection:** April 2006 to June 2007 **Trial name:** NA
Attrition/Drop-out (not available for endpoint measurement): **Adherence in control group:** **Contamination in control group:**	**Intervention** 0% drop-out 0% drop-out 0% drop-out 0% drop-out
OUTCOME ASSESSMENT:	**Outcome Measures:** • All data were collected from the electronic record, and study outcomes were assessed 15 months following the start of the intervention for all randomized patients. • The primary study outcome was completion of 1 of the following 3 options during the 15-month study period: FOBT, flexible sigmoidoscopy, or colonoscopy. • Because the detection and removal of precancerous adenomas is a major objective of colorectal cancer screening,29 the secondary study outcome was detection of adenomas based on diagnostic codes.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** • Among this group of patients who were overdue for screening with usual care, patients who received the mailing were significantly more likely to complete colorectal cancer screening than those who did not (44.0% vs. 38.1%; *P*_.001). • The mailing primarily increased the performance of FOBT among the intervention group compared with the control group (25.4% vs. 20.4%; *P*<.001). • Patients whose physicians received electronic reminders during the study period were not more likely than patients whose physicians did not receive reminders to complete colorectal screening (41.9% vs. 40.2%; *P*=.47), but among patients with 3 or more primary care visits, reminders tended to increase screening rates (59.5% vs. 52.7%; *P*=.07) • The interaction between the patient intervention and the physician intervention was small, negative, and not statistically significant (−0.6%; 95% CI, −1.2% to 0.1%) (*P*=.08), indicating that the observed effect of the combined patient and physician reminders was 0.6% less than the sum of their effects when applied individually.
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Good

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		Within each physician panel, authors paired patients overdue for screening with similar values of this propensity and randomly assigned 1 patient in each pair to receive the intervention mailing, thus closely balancing treatment groups on characteristics related to their baseline screening propensity. The physician intervention was randomized at the physician level. Within each health care center, authors paired physicians with similar colorectal cancer screening rates and numbers of patients overdue for screening and then randomly assigned 1 physician in each pair to receive electronic reminders.
Was the treatment allocation concealed?		X	
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Was the outcome assessor blinded?			NR
Was the care provider blinded?			NR
Was the patient blinded?		X	
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Was the differential drop-out rate acceptable (≤ 15%)?			NA
Were co-interventions avoided or similar?	X		The interaction between the patient intervention and the physician intervention was small, negative, and not statistically significant (−0.6%; 95% CI, −1.2% to 0.1%) (*P*=.08), indicating that the observed effect of the combined patient and physician reminders was 0.6% less than the sum of their effects when applied individually
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Good			

Applicability Assessment:

Population	Patients aged 50 to 80 years who had a visit with 1 of the 110 primary care physicians
Intervention	Patient mailings and physician reminders
Comparison	Compared Patients who received mailings and those who did not and patients of physicians who received reminder and those who did not.
Outcomes	Screening during the 15-month study period
Timing of follow-up	None
Setting	Clinic

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Stokamer, CL, Tenner, CT, Chaudhuri, J, Vazquez, E, & Bini, EJ [85] **Year of publication:** 2004 **Dates of data collection:** 2002-2003 **Trial name:**	
OBJECTIVE OR AIM:	To determine whether intensive patient education increases FOBT card return rates.	
DESIGN:	**Setting:** primary care clinics at the VA New York Harbor Healthcare System in NYC, NY **Study design:** RCT **Duration (mean followup):** 6 months **Overall study size (N enrolled/N analyzed):** 794 referred/788 randomized/788 analyzed	
INTERVENTIONS:	**Intensive education**	**Standard education**
Sample size:	396	392
Describe intervention:	10-15 minutes educational session from 1 of 12 nurses: how to perform FOBT; meaning of test results; what would happen if test positive or negative; 2 page informational handout Nurses answered questions Instructed to return FOBT in 2 weeks and call with questions	Written instructions on how to perform FOBT Same instructions to return cards within 2 weeks and to call with questions
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Health-system based All patients referred to primary care nursing for patient education and distribution of FPBT kits (standard practice for this medical center)	
INCLUSION CRITERIA:	Age >=50 years old; outpatients in the primary care clinic; had an FOBT ordered by their health care provider, and referred to primary care nursing for patient education and distribution for FOBT kits	
EXCLUSION CRITERIA:	Refused participation	

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Stokamer, CL, Tenner, CT, Chaudhuri, J, Vazquez, E, & Bini, EJ [85] **Year of publication:** 2004 **Dates of data collection:** 2002-2003 **Trial name:**		
	Intensive	**Standard**	
POPULATION CHARACTERISTICS:			
Mean age & range (years):	67.0 (58.0-75.0) 95.2%	67.0 (58.0-74.0) 96.2%	
Sex (% male):	46.7	48.5	
Race:	37.1	32.9	
Non-Hispanic white	14.9	16.8	
Non-Hispanic black	1.3	1.8	
Hispanic	7.1	6.1	
Other			
Other population qualities: • Family history of CRC			
	Intensive	**Standard**	
	0	**0**	Note: Outcome measured % returning FOBT. If a pt. did not return the FOBT in 6 months, they were censored and considered not returned.
Attrition/Drop-out (not available for endpoint measurement):	Not reported		
Adherence in control group:			
Contamination in control group:			
OUTCOME ASSESSMENT:	**Outcome Measures:** Proportion of patients that returned FOBT cards within 6 months		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Stokamer, CL, Tenner, CT, Chaudhuri, J, Vazquez, E, & Bini, EJ [85] **Year of publication:** 2004 **Dates of data collection:** 2002-2003 **Trial name:**
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**NA**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** • Overall 462 of 788 participants returned FOBT cards in 6 months (58.6%): • A greater proportion of those with intensive education vs. standard returned the FOBT cards (65.9% vs. 51.3%; *P* < .001)
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**NA**
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**NA**
QUALITY RATING:	Fair

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	x		
Was the method of randomization adequate?			Can't assess how the randomization was done
Was the treatment allocation concealed?			
Were the groups similar at baseline regarding the most important prognostic indicators?	x		
Was the outcome assessor blinded?	x x		Nurses were all trained on both groups and then administered all education so knew from materials which patients were in which groups
Was the care provider blinded?		X	
Was the patient blinded?	x		Pt. unaware of what other patients receiving
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]		X (58.6 %)	Limited response rate and no responses at all from standard group and they don't know enough about possible differences in groups to assess the non-response
Was the differential drop-out rate acceptable (≤ 15%)?	x		65.9% vs. 51.3% which is their outcome
Were co-interventions avoided or similar?	x		
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Applicability Assessment

Population	Men in a NYC healthcare system; may not apply to women or to patients outside large city or in a different type of healthcare setting
Intervention	Intensive education on CRC screening and FOBT provided by a nurse; this might not be feasible for all healthcare systems
Comparison	At baseline, nurses provide FOBT kits to patients. Effect size would be even larger if standard practice of physicians handing kits to patients had been comparison.
Outcomes	FOBT return rate is appropriate
Timing of follow-up	6 month follow up appropriate for this study
Setting	Primary care setting is appropriate, however, the nature of the health care system and being in NYC make results potentially less generalizable

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Tu SP, Taylor V, Yasui Y, Chun A, Yip MP, Acorda E, Li L, Bastani R. [86] **Year of publication:** 2006 **Dates of data collection:** July 2003 – September 2004 **Trial name:**	
OBJECTIVE OR AIM:	Evaluate a clinic-based, culturally and linguistically appropriate intervention promoting FOBT screening.	
DESIGN:	**Setting:** International Community Health Services (ICHS), a community clinic serving predominately Asians in the metropolitan area of Seattle, Washington. **Study design:** Randomized Controlled Trial **Duration (mean followup):** 6 months **Overall study size (N enrolled/N analyzed):** 210	
INTERVENTIONS:	**Intervention**	**Control**
Sample size:	Sample Size: 105	Sample Size: 105
Describe intervention:	Intervention: Motivational video on CRC screening produced in Cantonese and dubbed into Mandarin, bilingual motivational pamphlet, an FOBT instruction sheet, bilingual CRC informational pamphlet, CRC screening education from a health educator, and an FOBT kit with instructions in Chinese and English.	Standard Care
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Clinic-based; randomized those that agreed to participate using a randomization table to assign eligible patients in chronological order to intervention or control status using a random number generator of R software.	
INCLUSION CRITERIA:	Age 50-78, spoke Cantonese, Mandarin and/or Chinese; patient for at least a year at ICHS	
EXCLUSION CRITERIA:	Less than 12 months of medical care at ICHS; history of CRC; en-stage disease (e.g., congestive heart failure and chronic obstructive pulmonary disease requiring oxygen), gastrointestinal symptoms requiring diagnostic work-up; adherence to CRC screening (defined as FOBT in the past year or colonoscopy in the past 10 years); and participation in qualitative interviews to discuss CRC screening.	
POPULATION CHARACTERISTICS:	**Group 1** Intervention	**Group 2** Control
Mean age & range (years):		
Sex (% female):	Age (50-78): 59.1% 50-64, 40.9% 65+ Sex: 63.8% Female	Age (50-78): 49.5% 50-64, 50.5% 65+ Sex: 61.9% female
Race:	Race: Asian (Chinese)	Race: Asian (Chinese)
Other population qualities:	Language: 78.1% Cantonese, 21.0% Mandarin, 0.9% English Insurance: 81.9% Public, 12.4% Private, 5.7% None	Language: 79.1% Cantonese, 20.0% Mandarin, 0.9% English Insurance: 83.8% Public, 11.4% Private, 4.8% None

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Tu SP, Taylor V, Yasui Y, Chun A, Yip MP, Acorda E, Li L, Bastani R. [86] **Year of publication:** 2006 **Dates of data collection:** July 2003 – September 2004 **Trial name:**		
	Group 1	**Group 2**	**Overall**
Attrition/Drop-out (not available for endpoint measurement): **Adherence in control group:** **Contamination in control group:**			
OUTCOME ASSESSMENT:	**Outcome Measures:** FOBT screening within 6 months of randomization, based on chart audit by a study personnel who was blinded to the patients' trial arm assignments. Only patients with 3 FOBT cards documented in their medical records were considered as having completed FOBT screening.		
Results			
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** NA		
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** • 69.5% of the intervention patients received FOBT screening, compared with 27.6% of control patients. Crude odds ratio for FOBT screening within 6 months of randomization by the intervention arm was 5.98. • In logistic regression models adjusting for covariates, the odds of FOBT increased to over 6-fold greater in the intervention arm than in the control arm (AOR, 6.38; 95% CI, 3.44-11.85). No effect modification by age, gender, language, insurance, or prior FOBT was found.		
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA		
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA		
QUALITY RATING:	Good		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		
Was the treatment allocation concealed?			
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Was the outcome assessor blinded?	X		
Was the care provider blinded?			
Was the patient blinded?		X	
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Was the differential drop-out rate acceptable (≤ 15%)?			
Were co-interventions avoided or similar?	CD	NR	NA
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Good		NA	

Applicability Assessment:

Population	Age (50-78), male/female, Chinese only
Intervention	Motivational video, bilingual motivational pamphlet, FOBT instruction sheet, bilingual CRC informational pamphlet, CRC screening education from a health educator, and an FOBT kit
Comparison	Same pop with no intervention
Outcomes	FOBT screening rates
Timing of follow-up	Screening within 6 months of randomization
Setting	Clinic

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Zapka JG, Lemon SC, Puleo E, Estabrook B, Luckmann R, Erban S.[87] **Year of publication:** 2004 **Dates of data collection:** February 1999 – December 2000 **Trial name:**	
OBJECTIVE OR AIM:	To test the effect of an educational video, mailed to patients' homes before a physical examination, on performance of colorectal cancer screening, particularly sigmoidoscopy.	
DESIGN:	**Setting:** 5 primary care practices in central Massachusetts **Study design:** randomized, controlled trial **Duration (mean followup):** 6 months **Overall study size (N enrolled/N analyzed):** 938 scheduled for physical exam	
INTERVENTIONS:	**Intervention Group**	**Control Group**
Sample size:	Sample size: 450	Sample size: 488
Describe intervention:	Treatment: Video about CRC, importance of early detection, and screening options	Treatment: Usual care
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Clinic-based; participants were recruited from 5 sites in central Massachusetts. Most were patients in internal medicine and family medicine clinics of an academic medical center. Computerized appointment system identified potentially eligible participants	
INCLUSION CRITERIA:	Age 50 to 74; had an upcoming periodic health assessment; eligible for sigmoidoscopy according to screening guidelines	
EXCLUSION CRITERIA:	No sigmoidoscopy within 5 years or colonoscopy within 10 years; recent or planned tests; did not undergo scheduled sigmoidoscopy in the past 10 years; reported colorectal cancer diagnosis or related symptoms, canceled periodic examination appointment; could not participate because or illness, death, disability, or dementia or because they were institutionalized; do not speak English; had a spouse enrolled in the study; moved out of the area; older than 74	

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Zapka JG, Lemon SC, Puleo E, Estabrook B, Luckmann R, Erban S.[87] **Year of publication:** 2004 **Dates of data collection:** February 1999 – December 2000 **Trial name:**		
	Intervention Group	**Group 2**	
POPULATION CHARACTERISTICS: **Mean age & range (years):**	Age: 290 age 50-64; 160 age over 65 Sex: 56.7% female Insurance: 8.2% private, non-HMO; 52.8% private, HMO; 12.5% Medicare, non-HMO; 20.3% Medicare, HMO; 6.2% Medicaid or other Ever had FOB: 60.4% No	Age: 322 age 50-64; 166 age over 65 Sex: 56.4% female Insurance: 5.5% private, non-HMO; 56.4% private, HMO; 10.5% Medicare, non-HMO; 19.5% Medicare, HMO; 8.2% Medicaid or other Ever had FOB: 62.7% No	
Sex (% female):			
Race:			
Other population qualities:			
	Group 1	**Group 2**	**Overall**
Attrition/Drop-out (not available for endpoint measurement):			20 were classified as not screened due to loss to follow-up.
Adherence in control group:			
Contamination in control group:			
OUTCOME ASSESSMENT:	**Outcome Measures:** Baseline and 4 to 6-month follow-up telephone assessments were conducted. Dependent variable classified screening since baseline as 1) sigmoidoscopy with or without other tests, 2) another test or test combination, or 3) no tests.		
Results			
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** NA		

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

STUDY:	**Authors, ref ID:** Zapka JG, Lemon SC, Puleo E, Estabrook B, Luckmann R, Erban S.[87] **Year of publication:** 2004 **Dates of data collection:** February 1999 – December 2000 **Trial name:**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	G1: 55% overall screening rate G2: 55% screening rate
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Good

Evidence Table 2. KQ 3: Which strategies are effective in increasing the appropriate use of colorectal cancer screening and surveillance? (continued)

Quality Assessment-Internal Validity for Controlled Trials

	Yes	No	Other (CD, NR, NA)
Was the study described as randomized?	X		
Was the method of randomization adequate?	X		
Was the treatment allocation concealed?	X		
Were the groups similar at baseline regarding the most important prognostic indicators?	X		
Was the outcome assessor blinded?	X		
Was the care provider blinded?	X		
Was the patient blinded?	X		
Was the drop-out rate acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Was the differential drop-out rate acceptable (≤ 15%)?	X		
Were co-interventions avoided or similar?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Were all randomized participants analyzed in the group to which they were originally assigned?	X		
Quality Rating (Good, Fair, or Poor): Good			

Applicability Assessment

Population	Age 50+, both sexes
Intervention	Video about CRC, importance of early detection, and screening options
Comparison	Usual care
Outcomes	CRC screening
Timing of follow-up	Baseline and 4 to 6-month follow-up telephone assessments were conducted.
Setting	Clinic

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance

STUDY:	**Authors, ref ID:** Ballew et al.[88] **Year of publication:** 2009 **Dates of data collection:** March May 2008 **Trial name:** NA
OBJECTIVE OR AIM:	Montana Department of Public Health and Human Services wanted to assess the colonoscopy capacity in Montana before embarking on a campaign to increase colorectal screening participation statewide.
DESIGN:	**Setting:** Montana **Study design:** Hospital survey **Duration (mean follow-up):** No follow-up **Overall study size (N enrolled/N analyzed):** 41 hospitals, 3 ambulatory surgical centers
	Group
Sample size:	Sample size: 41 hospitals, 3 ambulatory surgical centers
Describe intervention:	Intervention: None, 8-question survey about current and projected screening capacity
RECRUITMENT: (population-based, clinic-based, volunteer, other)	All hospitals and ambulatory surgical centers in Montana
INCLUSION CRITERIA:	Perform colonoscopy
EXCLUSION CRITERIA:	NA
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	NA
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	1 hospital did not respond
STATISTICAL ANALYSES:	Collected data on CRC screening capacity and ran comparative statistics
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NR
OUTCOME ASSESSMENT:	**Outcome Measures:** CRC screening capacity
RESULTS:	

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors, ref ID:** Ballew et al.[88] **Year of publication:** 2009 **Dates of data collection:** March May 2008 **Trial name:** NA
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** • In the aggregate, hospitals performed 36,636 colonoscopies per year, including 19,444 screening procedures (54% of total procedures, range 11% to 100%). Hospitals estimated that they could perform 23,096 more screening colonoscopies per year. • The number of Montana adults who need screening colonoscopy was estimated to be 142,627 in 2008, increasing to 159,863 in 2020. Assuming that all unscreened individuals demanded colonoscopy every 10 years, and utilizing 100% of hospitals' estimated screening capacity, full screening coverage by colonoscopy could be achieved by 2013. There was an uneven distribution of current volume and additional available capacity in Montana, a large and primarily rural state. Urban hospitals had more resources but also less additional available capacity. 35% of the population lived in urban areas where 49% of the total capacity was located but where only 24% of the unused capacity was located. 65% of the population lived in rural areas where 51% of the total capacity exists but where 76% of unused capacity was located.
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** NA
QUALITY RATING:	Fair

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors, ref ID:** Benuzillo JG, Jacobs ET, Hoffman RM, Heigh RI, Lance P, Martinez ME[89] **Year of publication:** 2009 **Dates of data collection:** 2004 **Trial name:** Rural urban differences in colorectal cancer screening capacity in Arizona		
OBJECTIVE OR AIM:	The aims of this work were to evaluate current colorectal cancer endoscopy screening capacity and to estimate potential volume for rural and urban regions in Arizona.		
DESIGN:	**Setting:** Arizona clinics **Study design:** Observational cohort study **Duration (mean followup):** No follow-up, one-time survey **Overall study size (N enrolled/N analyzed):** 105 gastroenterologists and colorectal surgeons		
	All		
Sample size:	**Sample size:** 105 gastroenterologists and colorectal surgeons		
Describe intervention:	**Intervention**: Survey that assessed current colonoscopy and sigmoidoscopy screening and estimated future capacity.		
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population-based (population of gastroenterologists and colorectal surgeons; membership directories of three specialist professional societies to identify gastroenterologists and colorectal surgeons practicing in Arizona). The names of the societies were not given.		
INCLUSION CRITERIA:	Physicians who indicated that they performed lower gastrointestinal endoscopies for colorectal cancer screening. How this was determined was not specified.		
EXCLUSION CRITERIA:	Other health care professionals, such as hepatologists, pathologists, and nurses with a shared interest in the care of patients with digestive diseases but who typically do not perform lower endoscopic screening procedures were excluded. Not clear whether they were not sampled or were excluded from the sample.		
POPULATION CHARACTERISTICS:	**All**		
Mean age & range (years):	Age range: 30-67		
Sex (% female):	Sex: 26.7% female		
Race:	Specialty: 90% gastroenterology		
Other:			
	All	**Group 2**	Overall
Attrition/Drop-out (not available for endpoint measurement):	338 identified to receive the survey; 104 not performing endoscopy or not practicing in AZ		
Adherence:	Therefore, 234 eligible physicians		
Contamination:	received the mailed surveys and of these, 105 were returned, resulting in a response rate of		
Response Rates (e.g. for surveys):	44.9%		
STATISTICAL ANALYSES:	**Describe:** Standard descriptive statistics, including means and medians, were used to analyze these data. All data were stratified according to rural/urban areas.		

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors, ref ID:** Benuzillo JG, Jacobs ET, Hoffman RM, Heigh RI, Lance P, Martinez ME[89] **Year of publication:** 2009 **Dates of data collection:** 2004 **Trial name:** Rural urban differences in colorectal cancer screening capacity in Arizona
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Authors compared survey responses by rural and urban regions in Arizona using the 2003 U.S. Department of Agriculture Rural–Urban Continuum Codes. For the present analyses, authors categorized the three counties corresponding to the metropolitan codes as urban and the remaining non-core counties as rural.
OUTCOME ASSESSMENT:	**Outcome Measures:** The Colon Cancer Screening Capacity Survey was modified from an instrument used to survey New Mexico gastroenterologists. The ten questions included in the original survey were created based on literature review, the Behavioral Risk Factor Surveillance System's (BRFSS) survey, and the experience of researchers and clinicians from New Mexico. Survey respondents were asked to report their average number of endoscopic procedures performed during a week and to estimate the number of additional procedures that could be performed.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**NA**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** • The average number of weekly colonoscopies and sigmoidoscopies per endoscopist were 21 and 2, respectively. When data were stratified by physician type, the median number of weekly colonoscopies was 20 (interquartile range, 15–25) for gastroenterologists and 14 (interquartile range, 10–20) for colorectal surgeons. Colorectal surgeons performed a median of 5 flexible sigmoidoscopies a week (interquartile range, 2–10) compared to a median of 1 (interquartile range, 0–2) procedure performed by gastroenterologists. • Overall, physicians reported performing 8,717 weekly endoscopic procedures (8,312 in urban and 405 in rural areas). The vast majority of the procedures were colonoscopies in both regions (91% in urban and 97% in rural areas).Responders estimated being able to increase their capacity by an additional 3,183 (36.5%) procedures per week (2,347 colonoscopies and 836 flexible sigmoidoscopies). While only 5% of all procedures were performed in rural areas, the data suggest that the potential increase in volume is greater for rural than urban areas (53.1% and 35.7%, respectively). This is an important finding given that rates of endoscopic screening are lower in rural (49.5%; 95% confidence interval [CI] 46.8–52.2) compared to urban areas (54.5%; 95% CI 51.4–57.5). • Among all respondents, more physicians was most commonly cited as the resource that would be needed to increase capacity (49.5%); although this was the most common response for urban physicians (52.1%), rural doctors noted appropriate compensation as the top response (54.6%). Further, urban physicians more frequently cited the need for additional resources, such as space and

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors, ref ID:** Benuzillo JG, Jacobs ET, Hoffman RM, Heigh RI, Lance P, Martinez ME[89] **Year of publication:** 2009 **Dates of data collection:** 2004 **Trial name:** Rural urban differences in colorectal cancer screening capacity in Arizona
	staff, to meet capacity than their rural counterparts. A total of 27.3% of rural physicians reported that they needed no additional resources to increase their endoscopic capacity whereas only 14.9% of urban practitioners did so.
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]		X	Response rate 44.9%
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			NA
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Current capacity for endoscopic colorectal cancer screening in the United States: data from the National Cancer Institute survey of colorectal cancer screening practices	**Authors, ref ID:** Brown et al.[90] **Year of publication:** 2003 **Dates of data collection:** November 1999 – April 2000 **Trial name:** Data from Survey of Colorectal Cancer Screening Practices
OBJECTIVE OR AIM:	The purpose of this study was to provide nationally representative data on endoscopic resources at the provider level.
DESIGN:	**Setting:** United States **Study design:** cross-sectional mailed survey + modeling study **Duration (mean follow-up):** NA **Overall study size (N enrolled/N analyzed):** 1235 primary care physicians, 349 gastroenterologists, 316 general surgeons (see response rates below)
Sample size:	1630 primary care physicians, 467 GI, 467 general surgeons
Describe intervention:	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Used survey data collected in 1999 – 2000. Physicians approached for this survey were identified through the American Medical Association's Physician Masterfile.
INCLUSION CRITERIA:	Little detail given. For more information, reader is referred to: http://healthservices.cancer.gov/surveys/colorectal/
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	Characteristics of respondents and their practice setting, Survey of Colorectal Cancer Screening Practices, 1999 – 2000

Characteristic	Primary care (n = 1235)	Gastroenterolgists (n = 349)	General surgeons (n = 316)
		Number (%)	
Male sex	960 (77.7)	324 (92.8)	294 (93.0)
White, non-Hispanic	894 (72.4)	279 (79.8)	256 (81.1)
Board certified	921 (74.6)	325 (93.1)	249 (78.8)
IMG	277 (22.4)	72 (20.6)	74 (23.4)
Age ≥ 50 years	589 (47.7)	109 (31.2)	164 (51.9)
Metropolitan location	751 (60.8)	252 (72.2)	181 (57.3)
Practice type			
Solo	316 (25.6)	78 (22.0)	126 (39.8)
Single-specialty	508 (41.1)	168 (48.2)	106 (33.7)
Multispecialty	411 (33.3)	103 (29.5)	84 (27.0)
Practice volume (per week)			
> 50 patients	548 (44.4)	102 (29.2)	40 (13.0)

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Current capacity for endoscopic colorectal cancer screening in the United States: data from the National Cancer Institute survey of colorectal cancer screening practices	**Authors, ref ID:** Brown et al.[90] **Year of publication:** 2003 **Dates of data collection:** November 1999 – April 2000 **Trial name:** Data from Survey of Colorectal Cancer Screening Practices			
	> 100 patients	441 (35.7)	39 (11.0)	10 (3.0)
	> 50% of patients covered by managed care	760 (61.5)	141 (40.5)	131 (41.6)
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	The authors obtained 1235responses to the primary care survey, a response rate of 72%, and 665 to the specialty survey (349 gastroenterologists, 316 general surgeons),a response rate of 83%.			
STATISTICAL ANALYSES:	The authors calculated means, proportions, and 95% confidence intervals based on weights that reflect the probability of selection into the sample, and adjusted for known sources of respondent bias. (Because of the high response rates, weighted and unweighted results were very similar.) In addition, the authors used MISCAN-COLON to obtain estimates of national endoscopy requirements implied by various programmatic approaches to colorectal cancer screening. MISCAN-COLON is a microsimulation model that takes into account national population estimates and assumptions about screening test performance characteristics and screening program policy parameters, including the frequency of screening, diagnostic, and surveillance procedures . The authors assumed that screening of average risk persons would occur from ages 50 to 80 years; that 70% of the population would comply with the first screening; and that if someone attended a screening, he or she had a 90% probability of attending the next screening, whereas if someone did not attend a screening, he or she had a 20% probability of attending the next screening. The authors further assumed a test positivity rate of 2% for fecal occult blood testing; that after discovery of a polyp _5 mm, a person was returned to routine screening; and that after discovery of a polyp _5 mm, a person received surveillance colonoscopy once every 5 years until no lesions were found.			
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NA			
OUTCOME ASSESSMENT:	The authors used items from the primary care and GI/general surgeon questionnaires that asked about the volume of FS and colonoscopy procedures performed in a typical month during the survey period. Screening endoscopy was defined as the use of a procedure to detect cancer or neoplasia in an asymptomatic patient; diagnostic endoscopy was defined as use in patients with symptoms or previously abnormal test results. Readers are referred to further details at: http://healthservices.cancer.gov/surveys/colorectal/. Surveys themselves are downloadable here, but no further detail on methods is given.			
RESULTS:				
KQ2 - What factors influence the use of colorectal cancer screening?	NA			
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-	NA			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Current capacity for endoscopic colorectal cancer screening in the United States: data from the National Cancer Institute survey of colorectal cancer screening practices	**Authors, ref ID:** Brown et al.[90] **Year of publication:** 2003 **Dates of data collection:** November 1999 – April 2000 **Trial name:** Data from Survey of Colorectal Cancer Screening Practices			
up?				
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	Reported volume of endoscopy procedures by physician specialty			
			Physician Specialty	
		Primary care (n = 1235)	Gastroenterology (n = 346)	General surgery (n = 251)
	Physicians in the United States	156,605	7,835	15,181
			Number (%) or Mean ± SD	
	Sigmoidoscopy procedures/ month	1.9 ± 4.3	14.2 ± 39.3	3.1 ± 32.6
	0	871 (71)	14 (4)	86 (34)
	1 – 5	203 (17)	47 (14)	93 (37)
	6 – 10	95 (7)	76 (22)	43 (17)
	11 – 20	38 (3)	88 (25)	7 (3)
	> 20	17 (1)	107 (31)	4 (2)
	Other	11 (1)	14 (4)	18 (7)
	Estimated total procedures in the U.S.	3,205,000 (64.8)	1,224,000 (24.7)	518,000 (10.5)
	Screening colonoscopy procedures/month	0.1 ± 1.1	12.4 ± 40.2	3.2 ± 35.0
	0	1182 (96)	19 (5)	110 (44)
	1 – 5	30 (2)	71 (21)	74 (30)
	6 – 10		83 (24)	39 (16)
	11 – 20		74 (21)	11 (4)
	> 20		89 (26)	4 (2)
	Other	23 (2)	10 (3)	13 (5)
	Total procedures in the U.S.	9100 (0.6)	1,071,000 (66.3)	535,000 (33.1)
	Diagnostic colonoscopy procedures/ month		19.5 ± 33.0	4.4 ± 42.7
	0		8 (2)	103 (41)
	1 – 5		11 (3)	65 (26)
	6 – 10		29 (8)	43 (17)
	11 – 20		97 (28)	26 (10)
	> 20		193 (56)	6 (2)
	Other		8 (2)	8 (3)
	Total procedures in the U.S.		1,678,000 (69.6)	731,000 (30.4)

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Current capacity for endoscopic colorectal cancer screening in the United States: data from the National Cancer Institute survey of colorectal cancer screening practices	**Authors, ref ID:** Brown et al.[90] **Year of publication:** 2003 **Dates of data collection:** November 1999 – April 2000 **Trial name:** Data from Survey of Colorectal Cancer Screening Practices
	Approximately 4.9 million sigmoidoscopies in 2000, 1.6 million screening colonoscopies, and 4 million (screening plus diagnostic) colonoscopies were performed. On averaqe, general surgeons performed about 8 colonoscopies per month, compared with about 32 for gastroenterologists11 of 11 group practices 9 or 12 solo practitioners Current capacity compared to projected national requirements The authors estimated national requirements for endoscopy associated with programs of colorectal cancer screening based on fecal occult blood testing, with or without sigmoidoscopy or colonoscopy, as the primary screening method under the counterfactual assumption that population usage levels of colorectal cancer screening were similar to current rates for screening mammography of 70% of eligible women. Under this assumption, screening based on sigmoidoscopy once every 5 years would require the delivery of almost 10 million flexible sigmoidoscopy procedures in 2000, about twice the number of sigmoidoscopy procedures currently performed. Screening with colonoscopy performed once every 10 years would require, under very conservative assumptions, the delivery of 4.8 million screening and surveillance colonoscopy procedures in 2000, about 20% more than the estimated 4 million procedures that were performed for all purposes in 2000. From discussion: the authors estimated that a national program of colorectal cancer screening based on colonoscopy would have required about 4.8 million procedures in 2000, about 20% more than the estimated 4 million procedures that were performed for all purposes in 2000. Alternatively, a screening program operating at the same level of population use based on annual fecal occult blood testing would have required the delivery of 1.2 million diagnostic and surveillance colonoscopies; sigmoidoscopy once ever y 5 years would have required 1.6 million colonoscopy procedures and a program of combined fecal occult blood testing and sigmoidoscopy would have required about 2.6 million procedures in 2000.
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Good

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		Yes, report response rate of greater than 70%
Were the differential drop-out or response rates acceptable (≤ 15%)?	X		72% response rate for generalists vs. 83% for GI and surgery
Were intervention/exposure measures valid, reliable, and equally applied?		X	Measurement of outcome # of procedures capped at 20
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		Self reported capacity
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			
Were the statistical methods used to assess the abstracted outcomes appropriate?			
Were data inputs valid?			Limited inputs described without references. Loeve F, Boer R, van Oortmarssen GJ, et al. The MISCAN-COLON simulation model for the evaluation of colorectal cancer screening. *Comput Biomed Res.* 1999;32:13B33. 13. Loeve F, Brown ML, Boer R, et al. Endoscopic colorectal cancer screening: a cost-saving analysis. *J Natl Cancer Inst.* 2000;92:557–563. This article describes the model but not data inputs.
Was an appropriate search strategy used to find data inputs?			
Were the calculations and statistical analyses adequate?			Not clear how screening strategies applied take into account risk groups.
Were appropriate sensitivity analyses conducted (especially for any variables that were not based on data from literature)?			
Other considerations: [These might include the following for various types of models: was the cost effectiveness analysis conducted from the societal perspective? Was an appropriate comparison used (standard of care or next most effective alternative)? Were the appropriate health benefits, harms, and costs described and included?]	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Colonoscopy Demand and Capacity in New Hampshire	**Authors, ref ID:** Butterly et al.[91] **Year of publication:** 2007 **Dates of data collection:** 2003-2004 **Trial name:** NA
OBJECTIVE OR AIM:	Evaluate the demand and capacity for colonoscopy in the state of New Hampshire.
DESIGN:	**Setting:** All endoscopy sites in NH contacted in 2003-2004 **Study design:** Observational **Duration (mean follow-up):**
Sample size:	**Overall study size (N enrolled/N analyzed):** 114 endoscopists at 36 centers **Endoscopists** 62 (54.4%) gastroenterologists 45 (39.5%) general or colorectal surgeons 3 (2.6% FP) or GIM docs 4 other
Describe intervention:	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	All endoscopy sites in NH contacted. Two-phase telephone interview: The 1st phase had questions regarding capacity and limitations to performing colonoscopies, # of colonoscopies done/week, description of scheduling processes, and barriers to increasing capacity. In the 2nd phase, sites were recontacted to obtain calculated number of colonoscopies for 2002.
INCLUSION CRITERIA:	All endoscopy sites in the state of New Hampshire
EXCLUSION CRITERIA:	All others
POPULATION CHARACTERISTICS:	NA
Response Rates (e.g. for surveys):	Phase 1: not described Phase 2: all sites but one
DATA INPUTS/Outcome assessment	Total # of colonoscopies reported per week (currently), including an estimate of the number performed for screening vs. diagnostic or therapeutic Number of colonoscopies conducted in 2002: calculated from procedure logs for the year or through billing codes for all forms of colonoscopy For colonoscopies done in hospital settings (with the exception of the VA), #s were compared to results of New Hampshire Hospital Association (NHHA) Of the 36 sites, nine sites were free-standing ambulatory surgical centers not associated with hospitals; no means of validating results from these sites was available To estimate demand, Census 2000 data obtained from the NH Office of State Planning. Estimates were included for individuals at increased risk as well as those at average risk. Demand equals all individuals needing screening or surveillance according to current guidelines. Estimated 30% increased risk and 65% at average risk. The increased risk population was assumed to require surveillance intervals of 5 years.

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Colonoscopy Demand and Capacity in New Hampshire	**Authors, ref ID:** Butterly et al.[91] **Year of publication:** 2007 **Dates of data collection:** 2003-2004 **Trial name:** NA
STATISTICAL ANALYSES:	Analysis of demand was modeled according to three compliance rates of 100%, 70% and 60%. Each of these rates was applied to population statistics for the years 2002, 2005, and 2010. Two proposed methods of improving capacity are to increase the percentage of current colonoscopy devoted to screening and to increase capacity itself. Capacity was therefore calculated for 40%, 50%, or 60% (the NH finding) of colonoscopy being devoted to screening, and the potential increase in capacity if known 2002 capacity increased by 10% and 20%. For the latter estimates, it was assumed that all of the 10% and 20% increase in capacity was devoted to screening.
RESULTS:	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	114 endoscopists at 36 centers performed 49,352 colonoscopies in 2002, an average of 39-43 /month/endoscopist. 60% of these estimated to have been done for CRC screening. To confirm the accuracy of the colonoscopy numbers, results were compared to the NHAA records, which show that 32,802 colonoscopies were performed in NH between 7/1/01 and 6/30/02. To adjust for the appropriate comparison, the total for centers that would be included in the NHAA database was calculated: 32,987. Estimated demand was approximately twice the available capacity for screening and surveillance. The primary factor reported to limit capacity was # of endoscopists (72% of centers), # of procedure rooms (65.6% of centers), and # of available endoscopy nurses and support staff (50% of centers). Demand for screening and surveillance colonoscopies per year by population 2002: Population aged >50 y 364,108; 65% avg. risk 23,667; 35% increased risk 25,487; Total 49,154 2005: Population aged >50 y 425,539; 65% avg. risk 27,660; 35% increased risk 29,788; Total 57,448 2010: Population aged >50 y 523,498; 65% avg. risk 34,027; 35% increased risk 36,645; Total 70,672 Potential increase in colonoscopy screening capacity varied by % of colonoscopies conducted for screening Total # of colonoscopes: 40% screening / 50% screening / 60% screening Total in 2002 (49,352): 19,741 / 24,676 / 29,611 If increase capacity by 10% (54,287): 24,676 / 29,611 / 34,546 If increase capacity by 20% (59,222): 29,611 / 34,546 / 39,481

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Colonoscopy Demand and Capacity in New Hampshire	**Authors, ref ID:** Butterly et al.[91] **Year of publication:** 2007 **Dates of data collection:** 2003-2004 **Trial name:** NA
	49,325 colonoscopies performed in 2002. If the capacity was increased by 10%, this would increase total # of colonoscopies/year to 54,287. If this capacity were increased by 20%, this would increase total # of colonoscopies/year to 59,222 Annual demand for screening and surveillance c-scope adjusted for varying compliance rates 2002 / 2005 / 2010 100% compliance: 49,154 / 57,448 / 70,672 70% compliance: 34,408 / 40,214 / 49,470 60% compliance: 29,493 / 34,469 / 42,203 Note top line of this table is the same as the totals in the 1st table above If capacity increases by 20%, at the current rate of 60% of procedures for screening, and estimated 70% compliance rate, capacity would almost meet demand. Monthly figure of 39-43 colonoscopies per months is similar to the results from NCI study. New Mexico reported 16-20/week.
QUALITY RATING:	Fair

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

Quality Assessment-Internal Validity

	Yes	No	Other (CD, NR, NA)
Did the authors report conducting a power analysis or some other basis for determining the adequacy of study group sizes for the outcome(s) being abstracted?			NA
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable?			NA
Were the differential drop-out or response rates acceptable?			NA
Were co-interventions avoided or similar?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		Capacity was self-reported, but validated with NHAA records
Were all participants analyzed in the group to which they were originally assigned?			NA
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			NA
Were the statistical methods used to assess the abstracted outcomes appropriate?			NA
Were data inputs valid?	X		
Was an appropriate search strategy used to find data inputs?		X	Data inputs relatively simple, however: Ratio of average to above average risk was estimated, no reference given
Were the calculations and statistical analyses adequate?	X		
Were appropriate sensitivity analyses conducted (especially for any variables that were not based on data from literature)?			none
Other considerations: [These might include the following for various types of models: was the cost effectiveness analysis conducted from the societal perspective? Was an appropriate comparison used (standard of care or next most effective alternative)? Were the appropriate health benefits, harms, and costs described and included?]	X		
Quality Rating: Fair			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: New Mexico's capacity for increasing the prevalence of colorectal cancer screening with screening colonoscopies	**Authors, ref ID:** Hoffman et al.[92] **Year of publication:** 2005 **Dates of data collection:** October – December 2001 **Trial name:** Colorectal Cancer Working Group of the Clinical Prevention Initiative (CPI)
OBJECTIVE OR AIM:	The authors evaluate New Mexico's capacity to increase the prevalence of colorectal cancer screening using colonoscopy.
DESIGN:	**Setting:** New Mexico endoscopists **Study design:** Descriptive, cross-sectional and modeling **Duration (mean follow-up):** One-time survey **Overall study size (N enrolled/N analyzed):** Survey information collected from 9/12 solo practitioners and all 11 group practices representing 40 endoscopists (2-8 practitioner / group)
Sample size: **Describe intervention:**	9 solo practitioners and 11 group practices representing 40 endoscopists **NA**
RECRUITMENT: (population-based, clinic-based, volunteer, other)	The authors The authors identified endoscopists in New Mexico by using data from the Board of Medical Examiners, contacting manufacturers of endoscopic equipment, and obtaining the membership lists of a statewide gastroenterology journal club, the New Mexico Medical Society, and the American Medical Association. Eligible subjects for this analysis were gastroenterologists actively practicing in New Mexico, which included 40 gastroenterologists practicing in one of the 11 group practices and 12 solo practitioners.
INCLUSION CRITERIA:	Gastroenterologists actively practicing in New Mexico
EXCLUSION CRITERIA:	
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	Physicians and practices were based in 12 different counties 10/11 group practices and 6/12 solo practitioners were in urban areas
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	11 of 11 group practices 9 or 12 solo practitioners
STATISTICAL ANALYSES:	The authors used descriptive nonparametric statistics to estimate the weekly median number of procedures performed by endoscopists in group practice and solo practice and the estimated weekly potential increase in capacity. Endoscopic capacity. The authors determined the number of additional screening colonoscopies that could be performed using survey responses. Responses were averaged when multiple members of a group practice completed the survey and provided different estimates for the weekly number of baseline and additional procedures performed by the practice. The weekly number of base-line and additional colonoscopies for the solo-practitioner nonrespondents was imputed

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: New Mexico's capacity for increasing the prevalence of colorectal cancer screening with screening colonoscopies	**Authors, ref ID:** Hoffman et al.[92] **Year of publication:** 2005 **Dates of data collection:** October – December 2001 **Trial name:** Colorectal Cancer Working Group of the Clinical Prevention Initiative (CPI)
	using data from the responding solo practitioners. For the annual number of colonoscopies, it was assumed that endoscopists performed procedures for 40 weeks. Similar estimates were performed for the number of flexible sigmoidoscopies. Volume of colonoscopies. The authors modeled the number of procedures required for a statewide screening colonoscopy strategy. To identify the number of subjects potentially eligible for colonoscopic screening, they used data from the 2000 United States Census for New Mexico that reported 468,000 resident adults aged 50 to 85. Based on the census data, they evaluated the additional number of screening colonoscopies required to increase the prevalence of current screening by 5% (23,400 additional people being screened), 10% (46,800), 15% (70,200), 20% (93,600), and 25% (117,000) during a five-year period. The authors assumed that the additional screening procedures would be performed in equal numbers during the five-year period. The authors then modeled the number of surveillance procedures that would be required following the initial screening colonoscopy, and used clinical data on the yield of colorectal cancers and adenomatous polyps from a recent, large Department of Veterans Affairs (VA) colonoscopic screening trial and consensus guidelines for the timing of surveillance procedures. A sensitivity analysis was performed by reducing the expected rates of detected colorectal cancers and adenomatous polyps by approximately 50%.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	**NA**
OUTCOME ASSESSMENT:	The CPI colorectal cancer group developed a brief survey to obtain information about endoscopic capacity, including colonoscopies and flexible sigmoidoscopies. Questions were based on literature review, the BRFSS, and the clinical experience of the CPI colorectal cancer group, which included two gastroenterologists and two internists who performed sigmoidoscopy. Revisions were based on pilot testing the survey with clinical colleagues and other members of the CPI.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**NA**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	# of procedures currently being performed weekly and the weekly capacity for additional procedures, stratified by type of practice

Practice type	Total # endoscopists	Current c-scopes/ endoscopist*	Total current c-scopes	Weekly capacity for additional procedures	Weekly capacity for total additional c-scopes
Group	40	16.3 (12.9, 26.50	652	6.3 (1.8, 10)	252

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: New Mexico's capacity for increasing the prevalence of colorectal cancer screening with screening colonoscopies	**Authors, ref ID:** Hoffman et al.[92] **Year of publication:** 2005 **Dates of data collection:** October – December 2001 **Trial name:** Colorectal Cancer Working Group of the Clinical Prevention Initiative (CPI)

Solo	9	20 (15, 21)	180	10 (5, 15)	90
combined	49	NA	832	NA	342

*values are median (interquartile range)

Overall, gastroenterologists reported performing 832 colonoscopies a week. They estimated being able to increase their capacity by an additional 342 (41%) procedures each week.

Statewide, endoscopists could perform an estimated 13,680 additional colonoscopic procedures each year. If the nonresponding solo practitioners performed similarly to those completing the survey, the estimated annual additional capacity for colonoscopy would be 14,880 procedures.

Number of c-scopes required to increase the prevalence of current screening during a 5-year period for NM adults aged 50 – 85 years

Screening increase over 5 years (%)	Annual # of c-scopes (based on detection rates from VA study)[a]	Annual # of c-scopes (based on detection rates from sensitivity analysis) [b]
5	5568 (5983)*	5137 (5360)
10	11,136 (11,966)	10,274 (10,721)
15	16,704 (17,949)	15,411 (16,082)
20	22,272 (23,932)	20,548 (21,442)
25	27,840 (29,915)	25,568 (26,800)

[a] Includes numbers of screening tests based on 2000 New Mexico census data and numbers of surveillance tests based on applying cancer (1.0%) and adenomatous polyp (37%) detection rates from a Department of Veterans Affairs (VA) study.[b] Includes numbers of screening tests based on 2000 New Mexico census data and numbers of surveillance tests based on applying cancer (0.5%) and adenomatous polyp (20%) detection rates from sensitivity analysis.

*Numbers in parentheses reflect the strategy of performing a three-year surveillance colonoscopy on all patients with adenomatous polyps compared to five- year surveillance interval.

All but one of the group practices performed flexible sigmoidoscopies, but only five of the solo practitioners performed them. Overall, however, only 165 procedures were performed weekly; respondents estimated that they could perform an additional 188 procedures.

New Mexico gastroenterologists responding to the survey estimated having the capacity to increase their weekly number of colonoscopies by about 41%, from 832 to 1174. This substantial increase could raise the prevalence of current endoscopic screening by approximately 15% within five years.

KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: New Mexico's capacity for increasing the prevalence of colorectal cancer screening with screening colonoscopies	**Authors, ref ID:** Hoffman et al.[92] **Year of publication:** 2005 **Dates of data collection:** October – December 2001 **Trial name:** Colorectal Cancer Working Group of the Clinical Prevention Initiative (CPI)
QUALITY RATING:	Fair

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were data inputs valid?	X		
Was an appropriate search strategy used to find data inputs?	X		Few modifications to population estimates were made.
Were the calculations and statistical analyses adequate?	X		Static model.
Were appropriate sensitivity analyses conducted (especially for any variables that were not based on data from literature)?	X		
Other considerations: [These might include the following for various types of models: was the cost effectiveness analysis conducted from the societal perspective? Was an appropriate comparison used (standard of care or next most effective alternative)? Were the appropriate health benefits, harms, and costs described and included?]	X		
Quality Rating (Good, Fair or Poor): Fair			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors:** Hur et al.[93] **Year:** 2004 **Trial name (if applicable):**
DESIGN:	**Study design:** Mathematical model **Number of subjects:** NA **Time period covered:** 5 years
QUESTIONAIM/OBJECTIVE:	To analyze the impact of CTC on colonoscopy demand
DATA INPUTS:	• Colonoscopy practice patterns data from 1998 to 2002 were used as the foundation to estimate current (2003) colonoscopy practice. • The number of screening colonoscopies was observed to increase after July 2001 in published and presented reports as well as in the endoscopy unit experience at Massachusetts General Hospital (the percentages of colonoscopies for average-risk screening were 14.2%, 3 20%, and 47% from other reports and 33.5% for Massachusetts General Hospital). These trends were applied to the 2001 data to provide current (2003) national estimates for the total number of screening colonoscopies. • Parameters: Population estimate; CTC and polyp characteristics: sensitivity, specificity, prevalence, % CTC studies (positive findings), Number of patients (positive CTC findings); follow-up interval for second CTC after first study; surveillance colonoscopy for subsequent colonoscopies after colonic adenoma detected; • Because positivity thresholds are so pivotal to the analysis and no consensus exists regarding the optimal value, the authors chose to perform all analyses using both 6-mm and 10-mm values (lower and upper boundaries).
ANALYSIS AND CALCULATIONS:	• With a range between 40% (current or lower limit) and approximately 70% (mammography or upper limit), the authors estimated a CRC screening compliance of 55% (or a 15% increase) with implementation of CTC. • Applying this estimate eliminated 45% (noncompliant, 100%-55%) of the eligible cohort from the screening pool. • The authors reasoned that, within the 5 years following implementation of CTC (time horizon of first period), all of the patients who underwent any of these screening modalities would be due for another CRC screening; therefore, all of these patients were included in the screening pool. However, because screening colonoscopies are recommended every 10 years, the authors the authors estimated that 8.75% (one half of the 17.5% of patients who had undergone colonoscopy within the past 5 years) would need CRC screening in the following 5 years. The remaining cohort was divided by 5 to reflect the time horizon of the first period of the model for reasons described previously, resulting in 7.21 million patients. • In the 323 subjects studied, when given information about both procedures, 60.2% chose CTC, 25.7% chose colonoscopy, and 14.2% were undecided. Based on these results, the base-case estimate used for CTC penetrance was 67.3% (60.2% + one half of the undecided group) • The percentages of CTC examinations with positive findings using the base-case CTC sensitivity, specificity, and prevalence values were 24.9% (6 mm) and 7.0% (10 mm). These percentages multiplied

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors:** Hur et al.[93] **Year:** 2004 **Trial name (if applicable):**
	by the number of patients undergoing a CTC per year (4.85 million) yielded 1.21 million (6 mm) and .34 million (10 mm) patients who would require a follow-up colonoscopy in the base cases. • Patients who had negative findings on CTC examination were modeled to undergo a follow-up CTC screening every 5 years, with colonoscopy reserved for those patients who had positive findings. Using published polyp data from the Veterans Affairs Cooperative Study and definitions of higher- and lower-risk groups from published polyp surveillance recommendations, the model assumed that 41% of patients with previous adenomatous polyps would undergo surveillance colonoscopy every 3 years and 59% every 5 years.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**NA**
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	**NA**
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** Current volume: 6.47 million COLON 1.98 COLON for screening (29%) • If CTC used as primary modality for CRC screening, assuming 55% adherence and 67% CTC penetrance, in the initial 5 year period after implementation of CTC, demand for COLON could decrease by 1.78 million. This would be partially offset by 0.34 million follow up COLON for CTC with positive findings (10 mm polyp) • The total additional colonoscopies for the second period (years 6–10) after implementation of CTC would yield 1.67 million (6 mm) or .49 million (10 mm) procedures. These figures partially offset the 1.78 million reduction associated with implementation of CTC, resulting in a net reduction of .11 million (1.7%) (6 mm) or 1.29 million (19.9%) (10 mm) of the current total number of colonoscopies performed. • To summarize the numerous sensitivity analyses performed, the model was sensitive to CTC specificity and polyp prevalence and also sensitive to the percentage of screening colonoscopies and the improvement in population compliance but only if the 6-mm polyp size cutoff was used.
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

Quality Assessment for Modeling Studies

	Yes	No	Other (CD, NR, NA)
Were data inputs valid?		X	Based on non-representative database
Was an appropriate search strategy used to find data inputs?	X		
Were the calculations and statistical analyses adequate?	X		
Were appropriate sensitivity analyses conducted (especially for any variables that were not based on data from literature)?	X		
Other considerations: [These might include the following for various types of models: was the cost effectiveness analysis conducted from the societal perspective? Was an appropriate comparison used (standard of care or next most effective alternative)? Were the appropriate health benefits, harms, and costs described and included?]	X		This focused analysis did not incorporate costs or other adjustments (e.g., discounting) commonly performed in cost-effectiveness analyses in an effort to keep the model simple and easily comprehendible.
Quality Rating (Good, Fair or Poor): Fair			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors:** Ladabaum et al.[94] **Year:** 2005 **Trial name (if applicable):** NA
DESIGN:	**Study design:** Modeling study **Number of subjects:** **Time period covered:**
QUESTIONAIM/OBJECTIVE:	To use a model and national census data to produce integrated, comprehensive estimates of the impact of widespread screening on national clinical and economic outcomes and health services demand. The authors explored the potential demand for colonoscopy in detail, including the relative contribution of surveillance.
DATA INPUTS:	2000 Census data. Authors make reference to a previous publication for details about the model (model estimates clinical effectiveness and cost-effectiveness of CRC screening with established and emerging strategies).
ANALYSIS AND CALCULATIONS:	Decision analytic Markov model. The natural history model was calibrated to reproduce the age-specific prevalence at autopsy of small and large adenomatous polyps and age and stage-specific CRC incidence rates. The authors superimposed screening on the natural history model. The model was used to calculate conditions under various screening proportions. The proportion of different screening tests was varied. Cost was used as an input for various screening tests. Costs were determined in a prior publication in 2003 dollars, and were updated using the medical component of the CPI. For each strategy, the model yielded the number of CRC cases by stage, deaths by cause, discounted (3% annually) and undiscounted average life-years and costs per person, and number and type of tests performed The authors include results for each strategy's average life-years and costs per person as well as cost-effectiveness compared with natural history (no screening) from the perspective of a third-party payer. The authors assumed a 75% screening uptake rate for the national projections. The authors assumed a steady state for the population size and age distribution, as represented by year 2000 US census data. The authors determined age-specific clinical model outputs per person and economic outputs and adjusted these to reflect the fraction of persons still alive at a given age out of the original hypothetical cohort. The authors then multiplied these corrected, age-specific model outputs per person by the number of people of that age in the US population based on year 2000 census data. Next, the authors corrected our estimates to represent a 75% screening uptake rate for each strategy. Adding the results for all ages under each strategy yielded the annualized national estimates.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors:** Ladabaum et al.[94] **Year:** 2005 **Trial name (if applicable):** NA					
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	NA					
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	Numbers of tests, including colonoscopies by indication and intervention (assuming 75% uptake)	FOBT	FS	FS/FOBT	Colonoscopy	CT colonography
	FS		10.0 million	6.9 million		
	Colonoscopy	3.8 million	2.7 million	4.7 million	8.1 million	3.3 million
	CT colonography					6.2 million

Table: National demand for health services under current and potential future scenarios

Scenario Description	Current screening uptake and rates by strategy	Uptake increases to 75%: all established strategies grow in same proportion	Uptake increases to 75%: FOBT, FS, FS/FOBT remain stable; only COLO increases	Uptake increases to 75%; FOBT, FS, FS/FOBT remain stable; remainder of screening with COLO or VC-Pickhardt (ratio 1:1)	Uptake increases to 75%; FOBT, FS, FS/FOBT remain stable; remainder of screening with COLO or VC-Pickhardt (ratio 1:3)
Associated assumptions					
Total fraction of population screened (%)	40	75	75	75	75
Demand for health services (test #'s in					
FOBT	10	19	10	10	10
FS	8	15	8	8	8
FOBT/FS	8	15	8	8	8
COLO	14	26	49	25	12
VC-Pickhardt	0	0	0	25	37

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors:** Ladabaum et al.[94] **Year:** 2005 **Trial name (if applicable):** NA

millions/year)

FOBT	7.1	13.3	7.1	7.1	7.1
FS	1.8	3.4	1.8	1.8	1.8
VC	0	0	0	2.0	3.0
COLO Screening	3.0	5.3	6.6	5.2	4.5
Postpolypectomy surveillance	1.9	3.5	4.7	3.3	2.7
To diagnose symptomatic CRC on surveillance after CRC treat	0.88	1.6	1.7	1.7	1.7
	0.23	0.16	0.15	0.16	0.16

Assuming current screening patterns and 40% uptake, 3.0 million total colonoscopies were required annually, with 1.9 million related to screening (primary screening with COLO or to follow up on positive screening test results with the other strategies) and 0.88 million for postpolypectomy surveillance. With increased screening uptake to 75%, colonoscopy demand increased even under the scenario assuming substantial utilization of VC. Under all 4 scenarios examined, the number of postpolypectomy surveillance colonoscopies was similar (1.6-1.7 million per year), as was the number of colonoscopies for diagnosing symptomatic CRC or surveillance after CRC treatment (0.15-0.16 million per year). In contrast, the number of colonoscopies related to screening varied from 2.7 to 4.7 million per year and was a function of the rate of utilization of COLO.

Focusing on colonoscopy, the authors estimated annual colonoscopy demand of 8.1 million with COLO and 1.4-4.7 million with the other strategies.

KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Good

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

Quality Assessment for Modeling Studies

	Yes	No	Other (CD, NR, NA)
Were data inputs valid?	X		Steady state population Other reports reviewed: Song K, Fendrick AM, Ladabaum U. Fecal DNA testing compared to conventional colorectal cancer screening methods: a decision analysis. Gastroenterology 2004; 126:1270–1279. Ladabaum U, Song K, Fendrick AM. Colorectal neoplasia screening with virtual colonoscopy: when, at what cost, and with what national impact? Clin Gastroenterol Hepatol 2004; 2:554–563. Ladabaum U, Chopra CL, Huang G, Scheiman JM, Chernew ME, Fendrick AM. Aspirin as an adjunct to screening for prevention of sporadic colorectal cancer. A cost-effectiveness analysis. Ann Intern Med 2001; 135:769–781. Ladabaum U, Scheiman JM, Fendrick AM. Potential effect of cyclooxygenase-2-specific inhibitors on the prevention of colorectal cancer: a cost-effectiveness analysis. Am J Med 2003;114: 546–554.
Was an appropriate search strategy used to find data inputs?	X		
Were the calculations and statistical analyses adequate?	X		
Were appropriate sensitivity analyses conducted (especially for any variables that were not based on data from literature)?			NR
Other considerations: [These might include the following for various types of models: was the cost effectiveness analysis conducted from the societal perspective? Was an appropriate comparison used (standard of care or next most effective alternative)? Were the appropriate health benefits, harms, and costs described and included?]			3rd party payer perspective Not clear time horizon (costs for CRC are projected, but no discounting was used)
Quality Rating (Good, Fair or Poor): Good			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Is there sufficient MDCT capacity to provide colorectal cancer screening with CT colonography for the U.S. population?	**Authors:** Pickhardt et al.[95] **Year:** 2008 **Trial name (if applicable):** NA
DESIGN:	**Study design:** modeling study **Number of subjects NA** **Time period covered:** # of existing scanners based on 2006 data, population data from U.S. census. Results projected over 10 year period.
QUESTIONAIM/OBJECTIVE:	The aim was to assess the ability of the available MDCT capacity in the United States to provide population screening with CTC.
DATA INPUTS:	Model construction: To address the first issue regarding the startup phase, the authors constructed a simple mathematic model for predicting CTC demand by simulating progressive uptake of CTC on the compliant population. The primary measured outcome was the total number of CTC examinations needed per year, assuming a 10-year span as a realistic time frame for catching up with all the millions of unscreened 50- to 75-year-old individuals in the United States. Because the authors assumed the routine screening interval for CTC would initially be set at 5 years, repeat screenings in the second half of the 10-year startup period were added to the new screenings in the startup phase. To deal with the second issue of steady-state demand, the authors used a previously validated Markov model to estimate the total number of CTC examinations needed to be performed each year once the screening program reaches this steady state. The CTC totals from the two phases were then divided among all operational MDCT units available in the United States for the standard number of working days per year to establish the number of CTC procedures per day that each MDCT unit should perform to meet the simulated demand (expressed as CTC/MDCT/day). Inputs: The baseline values for the main parameters used in the startup and steady-state phase models, and the ranges applied for the sensitivity analysis, are reported in Table 1. 2007 census data and literature is cited as references. Population variables: U.S. adults 40 – 75 years old, all cause mortality per year (%), too frail for colonoscopy (%), population at increased CRC risk (%), overall screening compliance (%), CTC penetrance (%), compliance to repeat CTC (%), duration of startup period (y), routine CTC screening interval (y), CT capacity variables: total CT units in United States, MDCT units from total (%), MDCT units performing CTC (%). The initial population consisted of the entire average-risk 40 to 75-year-old population available from U.S. census data. This population figure was adjusted to account for mortality from all causes and was further reduced by those considered to be too frail to undergo colonoscopy. The authors assumed that CTC implementation and patient acceptance for a noninvasive screening option would result in a gradual increase in the overall CTC compliance rate during the 10-year startup period. For this reason, overall CRC screening compliance (by any means) was assumed to grow in a linear fashion from 40% in year 1 to 60% at the end of the 10-year startup period. The authors assumed that only a certain fraction of the compliant screening population will favor CTC over other

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Is there sufficient MDCT capacity to provide colorectal cancer screening with CT colonography for the U.S. population?	**Authors:** Pickhardt et al.[95] **Year:** 2008 **Trial name (if applicable):** NA
	available screening options, which progressively increased from an initial penetration of 10% in year 1 to 67% in year 10 of the startup phase. Assuming third-party reimbursement for screening CTC, balanced by the need for appropriate training and investment in CTC-specific equipment (i.e., CTC software and carbon dioxide insufflator), the authors estimated that this rate would only gradually rise to 90% by the end of the 10-year startup period. Furthermore, the authors simulated a progressive annual increase of 3.5% in the total number of CT scanners over the 10-year period and an increase of the relative percentage of MDCT scanners from the current 71% to 85% by year 10.
ANALYSIS AND CALCULATIONS:	To evaluate the number of CTC examinations performed in the steady-state phase of population screening, the authors used a Markov model on a hypothetical cohort of 100,000 average-risk subjects ranging from 50 to 100 years old, as previously modeled in articles focusing on colonoscopic screening capacity. Briefly, the natural history of colorectal neoplasia was calibrated to reproduce the age- and sex-specific adenoma prevalence at autopsy and screening studies as well as the incidence and mortality rate of CRC. The health intervention superimposed on the natural history model was CTC repeated every 5 years between 50 and 80 years old (inclusive). For this analysis, the authors assumed that those found to have an adenoma > 5 mm required endoscopic follow-up, which prevented further CTC screening. All others were eligible for repeat screening CTC in 5 years. Although all endoscopic and radiologic CRC screening tests are advised to be repeated every 5 or 10 years, compliance for repeated examinations over a lifetime period is largely unknown. Although some postpolypectomy trials have shown short-term compliance for repeated colonoscopy of 80%, the authors thought that a 50% compliance for 5-year CTC repetition over a lifetime to be a more realistic baseline assumption. To project the outcomes of our simulation on the entire U.S. population, the authors assumed a steady state for population size and age distribution, represented by the 2000 census data.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	

Year	Overall compliance (%)	CTC penetrance (%)	No. to be screened with CTC	Total CT units	MDCT fraction (%)	MDCT Units performing CTC (%)	CTC exams per MDCT unit per day
1	40	10	295,750	10,110	71	718 (10)	1.6
2	42	16	506,664	10,500	73	1,437 (19)	1.4
3	45	22	738,665	10,890	74	2,237 (28)	1.3
4	47	29	991,754	11,280	76	3,120 (37)	1.3

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: Is there sufficient MDCT capacity to provide colorectal cancer screening with CT colonography for the U.S. population?	**Authors:** Pickhardt et al.[95] **Year:** 2008 **Trial name (if applicable):** NA

5	49	35	1,265,929	11,670	77	4,090 (46)	1.2
6	52	41	1,709,066	12,060	79	5,150 (54)	1.3
7	54	47	2,130,872	12,450	80	6,303 (63)	1.4
8	56	53	2,584,309	12,840	82	7,551 (72)	1.4
9	58	60	3,069,376	13,230	83	8,899 (81)	1.4
10	60	67	3,586,073	13,620	85	10,349 (90)	1.4

Note—Overall compliance indicates total participation in screening, by any technique. CTC penetrance indicates the percentage of compliant adults who favor CTC over other available screening options. MDCT fraction indicates the percentage of all CT scanners that are multidetector and therefore CTC capable. MDCT units performing CTC indicates the number (and fraction) of MDCT scanners actually performing CTC.

Start up phase:
"At the simulated compliance and eligibility rate, 37,227,541 U.S. adults would need to be screened for CRC in the 10-year startup phase."

At sensitivity analysis, compliance to initial screening, CTC penetrance, MDCT capacity, the duration of the program, and the population size appeared to be key variables.

Steady-state phase:
Screening in the steady-state was simulated with 5-year repetition of CTC between the ages of 50 and 80 years. Initial compliance and penetrance were set at 60% and 67%, corresponding to the values reached in the final year of the startup period. Compliance for repeated CTC thereafter was set at 50%. The overall number of CTC procedures needed to be performed per year in the steady-state period for the average-risk U.S population was 3,064,151. Dividing this value by the estimated MDCT capacity at the end of the startup period corresponds to 296 CTC procedures per MDCT per year and 1.2 CTC/MDCT/day.

The authors conclude that available MDCT capacity in the US is large enough to satisfy the potential demand of population screening with primary CTC evaluation, for both start up and steady state periods.

KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Fair

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

Quality Assessment for Modeling Studies

	Yes	No	Other (CD, NR, NA)
Were data inputs valid?	X		Pickhardt PJ, Hassan C, Laghi A, Zullo A, Kim DH, Morini S. Cost-effectiveness of colorectal cancer screening with computed tomography colonography: the impact of not reporting diminutive lesions. *Cancer* 2007; 109:2213–2221
Was an appropriate search strategy used to find data inputs?	X		
Were the calculations and statistical analyses adequate?		X	Steady state population Very optimistic assumptions
Were appropriate sensitivity analyses conducted (especially for any variables that were not based on data from literature)?	X		
Other considerations: [These might include the following for various types of models: was the cost effectiveness analysis conducted from the societal perspective? Was an appropriate comparison used (standard of care or next most effective alternative)? Were the appropriate health benefits, harms, and costs described and included?]			
Quality Rating (Good, Fair or Poor): Fair			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors, ref ID:** Robertson et al.[96] **Year of publication:** 2006 **Dates of data collection:** 1999 - 2001 **Trial name:**
OBJECTIVE OR AIM:	Examine trends in the utilization of flex sig, DCBE, and colonoscopy and trends in the choices of colorectal cancer screening service providers within Tricare and Medicare from 1999 - 2001
DESIGN:	**Setting:** United States **Study design:** review of Tricare and Medicare claims data **Duration (mean follow-up):** **Overall study size (N enrolled/N analyzed):** (see tables below)
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Two sources of data were used in this study: the Medicare Physician/Supplier Summary (PSPS) File and the Military Health System's Management Analysis and Reporting Tool (M2).
INCLUSION CRITERIA:	Only those Medicare beneficiaries over age 65 and in fee-for-service plans were analyzed. The M2 file, which represents the military's commercial network (Tricare) claims, included beneficiaries age 50 through 64
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	NA
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	
STATISTICAL ANALYSES:	Since the data comprised the populations of Tricare and Medicare claims, descriptive rather than inferential statistics were used. The data were examined for changes in procedure volume for the three procedures over time and for changes in colonoscopy provider volume. For the analysis of colonoscopy provider data, six provider groups with low procedure volumes (i.e., colorectal surgeons, family practitioners, general practitioners, nurse practitioners, physician assistants, multi-specialty clinic) were combined into one provider category, “other”.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	
OUTCOME ASSESSMENT:	What type of provider performed screening test. Volume of screening tests performed. No distinction made between screening and diagnostic exams. These were evaluated in 1999, 2000, and 2001 for both Medicare and Tricare.

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors, ref ID:** Robertson et al.[96] **Year of publication:** 2006 **Dates of data collection:** 1999 - 2001 **Trial name:**
Results	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	NA
RESULTS:	**Colonoscopy by medical discipline, 1999 – 2001**

KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?

Discipline	1999				2000				2001				% ch ge 19 - 20 T
	TC N	% of total	MC N	% of total	TC N	% of total	MC N	% of total	TC N	% of total	MC N	% of total	
GI	18,208	59	1,047,044	66	26,455	72	1,202,192	66	32,344	73	1,404,713	66	78
GS	2,706	9	209,195	13	3,974	11	243,571	13	4,989	11	276,165	13	84
IM	3,197	10	187,954	12	3,939	11	201,079	11	4,675	10	219,602	10	46
Other	6,576	21	146,662	9	2,216	6	173,378	10	2,519	6	225,081	11	- 6
Total	30,687	100	1,590,855	100	36,584	100	1,820,220	100	44,527	100	2,125,561	100	45
Procedure volume by year 1999-2001													
B.E.	6,457	12	394,949	15	5,572	10	340,277	12	4,367	7	266,329	10	-3
Colo	30,687	58	1,590,855	59	36,584	64	1,820,220	66	44,527	74	2,125,561	76	45
F.S.	15,668	30	690,056	26	15,052	26	603,420	22	11,316	19	409,845	15	-2
Total	52,812	100	2,675,860	100	57,208	100	2,763,917	100	60,210	100	2,801,735	100	14

TC = Tricare
MC = Medicare
GI = Gastroenterologist
GS = general surgeon
IM = Internal Medicine
B.E. = barium enema
Colo = colonoscopy
F.S. = flexible sigmoidoscopy

Summary:

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors, ref ID:** Robertson et al.[96] **Year of publication:** 2006 **Dates of data collection:** 1999 - 2001 **Trial name:**
	"The total volume of procedures increased 5% and 14%, respectively, in Tricare and Medicare. Tricare and Medicare, respectively, saw 32% and 33% reductions in barium enemas and 28% and 41% reductions in flexible sigmoidoscopies. Colonoscopies increased by 45% and 34% in Tricare and Medicare, respectively. Gastroenterologists provided the majority of colonoscopies for both groups each year."
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			NA
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		No distinction between screening and diagnostic procedures
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			NA
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: "Is there endoscopic capacity to provide colorectal cancer screening to the unscreened population in the United States?"	**Authors, ref ID:** Seeff et al.[97] **Year of publication:** 2004 **Dates of data collection:** 2000 & 2001 **Trial name:**
OBJECTIVE OR AIM:	The authors designed a forecasting model to (1) estimate the number of average-risk people aged 50 years or older who have not been screened for colorectal cancer, (2) describe the sociodemographic characteristics of this population, and (3) estimate the annual number of procedures required to provide screening and follow-up examinations for this population. This report compares available capacity calculated in a companion publication {#3269) with the number of tests needed for the currently unscreened population, assuming that all or one half of the available capacity is used for colorectal cancer screening. The authors focused on the average-risk population in this analysis because consensus exists about when to begin and how to screen the average-risk population for colorectal cancer.
DESIGN:	**Setting:** United States **Study design:** Modeling study **Duration (mean follow-up):** NA **Overall study size (N enrolled/N analyzed):** NA
Data sources:	To estimate the size of the US population currently unscreened for colorectal cancer, the authors first estimated the size of the total US population aged 50 years or older in 2001, stratified by sex, race, ethnicity, income, region, and age, using US Census Bureau 2000 Public Use Microdata Sample data. Insurance status by sex, race, ethnicity, income, region, and age was estimated using data from the March Current Population Surveys for 2000 and 2001. The authors then identified and removed persons at increased risk for colorectal cancer, including those with a personal or family history of colorectal cancer and those with inflammatory bowel disease, because the model estimated the need for average-risk persons only. Colorectal cancer prevalence rates by age, race, ethnicity, and sex were obtained from the Surveillance, Epidemiology and End Results program. The size of the population with a family history of colorectal cancer was obtained from the 2000 NHIS. Persons were considered to have a family history of colorectal cancer if they had a parent, sibling, or child who had been diagnosed with colorectal cancer at any age. The number of individuals with inflammatory bowel disease was obtained from the National Institute of Diabetes and Digestive and Kidney Diseases. Although the prevalence of inflammatory bowel disease varies by age, race/ ethnicity, and sex, the authors assumed an equal prevalence across age, race/ethnicity, and sex and assumed a mortality rate for inflammatory bowel disease equal to that of the general population. Approximately 1.0 million persons (1.3% of the population aged 50 years or older) with a personal history of colorectal cancer, 5.2 million persons (6.8% of the population aged 50 years or older) with a family history of colorectal cancer, and .17 million persons (.2% of the population aged 50 years or older) with inflammatory bowel disease, all considered at increased risk for colorectal cancer, were excluded from the total population in need of screening.
STATISTICAL ANALYSES:	The authors used a 2-step modeling method to determine the size of the screened population. In step 1, the authors used data from the 2000 NHIS15 to construct a multivariate multinomial logistic regression model to determine the relationship between sociodemographic characteristics (e.g., age, sex, race, income level, health insurance status, region of the United States) and the probability that an individual has been screened for colorectal cancer according to current guidelines: FOBT in the past year, endoscopy (flexible sigmoidoscopy, colonoscopy, or proctoscopy) in the past 10 years, both FOBT in the past year and endoscopy in the past 10 years, or none of the above.

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: "Is there endoscopic capacity to provide colorectal cancer screening to the unscreened population in the United States?"	**Authors, ref ID:** Seeff et al.[97] **Year of publication:** 2004 **Dates of data collection:** 2000 & 2001 **Trial name:**
	NHIS respondents were asked about their use of any lower endoscopic procedure (sigmoidoscopy, colonoscopy, or proctoscopy) but were only asked to identify which of the 3 endoscopic procedures they had received most recently. The authors therefore measured the use of all endoscopies combined and used10 years as a measure of screening according to recommended guidelines to fully capture colonoscopy use. NHIS respondents were not asked about their use of double-contrast barium enema (DCBE). Stata 6.0 was used to account for the sampling weights and survey design and to calculate 95% confidence intervals. In step 2, the coefficients from the logistic regression model described previously were used to estimate the proportion of persons who have been screened. These proportions were applied to the average-risk US population aged 50 years or older to generate counts of the population already screened for colorectal cancer. Finally, the authors subtracted the number of individuals who have already been screened from the total average-risk population to produce an estimate of the number of average-risk persons in the US population currently in need of colorectal cancer screening. To determine the number of procedures needed to screen this unscreened average-risk population, the authors modeled 5 program options under which screening could occur. The first program assumed that screening would occur with a combination of screening tests in proportions consistent with the current test used based on the 2000 NHIS. To determine the number and type of tests needed in this scenario, the coefficients of the logistic regression analysis were applied to the unscreened average-risk population to predict the numbers of required screening tests (FOBT only, sigmoidoscopy only, sigmoidoscopy plus FOBT, and colonoscopy) based on sociodemographic characteristics of the unscreened average-risk population. To determine endoscopies by type, the authors assumed that the most recent test reported in the NHIS was the only test performed. The other 4 programs were selected because they each represent screening options recommended by national guidelines. These programs assumed that the unscreened population would be screened with (1) annual FOBT with diagnostic colonoscopy for positive tests, (2) FOBT plus sigmoidoscopy, (3) sigmoidoscopy with diagnostic colonoscopy for positive tests, or (4) colonoscopy. For the program using FOBT and sigmoidoscopy, the authors assumed that all persons would first be screened with FOBT, with positive FOBTs followed by a diagnostic colonoscopy. Persons with a negative FOBT would be offered screening sigmoidoscopy with positive sigmoidoscopies followed by a diagnostic colonoscopy. For any of the proposed screening programs, positive FOBTs and flexible sigmoidoscopies would be followed by a diagnostic colonoscopy. To estimate the number of diagnostic colonoscopies that would be generated by screening the unscreened population, the authors applied a positivity rate of 2.5% for unrehydrated FOBT and 5% sigmoidoscopy. For individuals undergoing both FOBT and sigmoidoscopy during 1 year, a 6.25% positivity rate was applied, which assumes that FOBT is performed annually but only one fifth of the people receive sigmoidoscopy each year and one half of the positive cases identified through sigmoidoscopy are not identified by FOBT.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of	NA

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: "Is there endoscopic capacity to provide colorectal cancer screening to the unscreened population in the United States?"	**Authors, ref ID:** Seeff et al.[97] **Year of publication:** 2004 **Dates of data collection:** 2000 & 2001 **Trial name:**
colorectal cancer screening and follow-up?	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	Assuming all available sigmoidoscopic capacity is used for colorectal cancer screening, the capacity would exist to screen the unscreened population with a program based on current screening patterns if tests were offered over 3 or more years, but 6 years would be required to screen the unscreened population using 100% sigmoidoscopy or FOBT plus sigmoidoscopy. If only one half of the available capacity were used for screening, it would take 5 years to screen the unscreened population based on current screening patterns and 10 years using screening sigmoidoscopy or FOBT plus sigmoidoscopy. This would not take into account repeat screening tests needed within that time period or tests needed to keep the screened population current with their screening tests.

Table 2. Number of Colorectal Cancer Screening and Follow-up Examinations Needed for Unscreened Population in Different Screening Programs (in Millions)

			Colonoscopy		
Screening programs[a]	FOBT	Flexible sigmoidoscopy	Screening colonoscopy	Follow-up colonoscopy	Total colonoscopy
US average-risk population, 50 years or older					
Current screening practices[b]	18.5	16.1	15.2	1.2	16.3
100% FOBT	41.8	NA	NA	1.0	1.0
FOBT plus sigmoidoscopy[c]	41.8	40.8	NA	3.0	3.0
100% sigmoidoscopy	NA	41.8	NA	2.1	2.1
100% colonoscopy	NA	NA	41.8	NA	41.8
US population, 50–64 years old, <250% of poverty level, no health insurance					
Mixed tests[d]	1.7	0.6	0.6	0.07	0.65
100% FOBT	2.3	NA	NA	0.06	0.06
FOBT plus sigmoidoscopy	2.3	2.3	NA	0.17	0.17
100% sigmoidoscopy	NA	2.3	NA	0.12	0.12
100% colonoscopy	NA	NA	2.3	NA	2.3

NA, not applicable.
[a]All positive screening FOBTs and sigmoidoscopies would be followed by a diagnostic colonoscopy.
[b]Current patterns of screening.
[c]FOBT performed first; sigmoidoscopy performed only if FOBT negative.
[d]50% FOBT, 25% FOBT plus flexible sigmoidoscopy, and 25% colonoscopy.

Comparing the need for colonoscopy with available capacity, if all available capacity were used for screening, it would take 5 years to screen the unscreened population using 100% screening colonoscopy and 2 years using a program based on current screening patterns. Two of the programs that have available colonoscopy capacity would require sigmoidoscopy as well; sigmoidoscopy is in a shortage until the sixth year. For a program using screening

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: "Is there endoscopic capacity to provide colorectal cancer screening to the unscreened population in the United States?"	**Authors, ref ID:** Seeff et al.[97] **Year of publication:** 2004 **Dates of data collection:** 2000 & 2001 **Trial name:**
	FOBTs with diagnostic colonoscopies for positive tests, there would be enough capacity to provide the necessary follow-up colonoscopies within 1 year. If only one half of the available colonoscopy capacity were used for screening, it would take 4 years to screen the unscreened population using a program based on current screening patterns and 10 years using 100% colonoscopy. For a program designed to screen only an uninsured, low-income population between 50 and 64 years of age, there is enough sigmoidoscopic and colonoscopic capacity to screen the unscreened population within 1 year using any of the proposed programs.

Table 3. Capacity by US Census Region to Perform Lower Endoscopic Procedures According to Current Screening Practices for Average-Risk Persons Aged 50 Years or Older[a] (in Millions), 2000

	Current volume[b] (95% confidence interval)	Potential volume[b] (95% confidence interval)	Available capacity[c]	Test need[d]	Available capacity minus test need
Flexible sigmoidoscopy					
Total	2.8 (2.4–3.1)	9.5 (8.4–10.5)	6.7	16.1	−9.4
Northeast	0.7 (0.4–1.0)	2.5 (1.7–3.2)	1.8	3.3	−1.5
Midwest	0.7 (0.6–0.9)	2.2 (1.8–2.7)	1.5	3.7	−2.2
South	0.8 (0.6–0.9)	3.2 (2.8–3.6)	2.4	5.7	−3.3
West	0.6 (0.4–0.7)	1.6 (1.3–1.9)	1.0	3.4	−2.4
Colonoscopy[e]					
Total	14.2 (12.1–16.3)	22.4 (20.1–24.8)	8.2	16.3	−8.1
Northeast	4.2 (2.2–6.1)	5.9 (3.9–7.8)	1.7	3.4	−1.7
Midwest	3.1 (2.6–3.7)	5.1 (4.4–5.9)	2.0	3.6	−1.6
South	4.8 (4.3–5.4)	8.0 (7.1–8.9)	3.2	6.3	−3.1
West	2.1 (1.8–2.5)	3.5 (2.9–4.0)	1.4	3.1	−1.7

[a]According to 2000 NHIS.
[b]Based on results of SECAP; 100% FOBT, follow-up with colonoscopy.
[c]Difference between current and potential volume.
[d]Based on results of forecasting model.
[e]Includes screening plus follow-up.

KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	Good

Quality Assessment for modeling studies:

	Yes	No	Other (CD, NR, NA)

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

Were data inputs valid?	X
Was an appropriate search strategy used to find data inputs?	X
Were the calculations and statistical analyses adequate?	X
Were appropriate sensitivity analyses conducted (especially for any variables that were not based on data from literature)?	X
Other considerations: [These might include the following for various types of models: was the cost effectiveness analysis conducted from the societal perspective? Was an appropriate comparison used (standard of care or next most effective alternative)? Were the appropriate health benefits, harms, and costs described and included?]	
Quality Rating (Good, Fair or Poor): Good	

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: "How many endoscopies are performed for colorectal cancer screening? Results from CDC's survey of endoscopic capacity"	**Authors, ref ID:** Seeff et al.[98] **Year of publication:** 2004 **Dates of data collection:** April to September 2002 **Trial name:** Data from Survey of Endoscopic Capacity (SECAP) used for this study
OBJECTIVE OR AIM:	The purpose of this survey was to provide an estimate of the current capacity for endoscopic screening and follow-up examinations in the United States.
DESIGN:	**Setting:** United States, medical practices that were known to have purchased or leased lower endoscopic equipment between 1996 and 2000 were surveyed. **Study design:** Telephone & mailed survey **Duration (mean follow-up):** **Overall study size (N enrolled/N analyzed):** Surveys were mailed to 1809 practices and 1346 (74.4%) completed surveys were returned. Of the returned surveys, 78 were ineligible; 1268 surveys were analyzed.
Sample size:	Sample of 1809 practices
Describe intervention:	The sampling frame included all US medical facilities known to have purchased or leased lower endoscopic (sigmoidoscopy and colonoscopy) equipment between January 1, 1996, and December 31, 2000. The authors obtained lists of these customers from the 4 leading US endoscopic equipment manufacturers: Fujinon Inc, Olympus America, Pentax Precision Instruments Inc, and Welch-Allyn. The authors also obtained a list of all single-specialty and multispecialty ambulatory endoscopy/surgery centers (AECs) in the United States from AmSurg Corp, a company that owns and manages AECs. The 4 manufacturer lists were merged and sorted by ZIP code, city, and purchaser name. Duplicate addresses were removed to create a sampling frame that represented a single record for each practice. The AEC list was sorted by ZIP code, city, and purchaser name and maintained in a separate file to allow for oversampling. Urban/rural practice locations were classified using a ZIP code version of the rural-urban commuting area coding scheme. To yield a rural-urban dichotomy, rural-urban commuting area codes 1 (urban core census tract) through 3 (census tract weakly tied to urban core) were considered urban, and codes 4 (large town census tract) through 10 (isolated small rural census tract) were considered rural. Stratified sample US census region and by urban/rural location. AECs and rural practices were oversampled.
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Sample of practices known to provide colonoscopy, as described above. $40 reimbursement for survey response
INCLUSION CRITERIA:	US medical facilities know to have purchased or leased lower endoscopic equipment during study period?
EXCLUSION CRITERIA:	Not currently performing lower GI procedures in adults, or address/phone number that could not be identified.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	Survey respondents identified themselves as physicians (81.6%), nurses (5.7%), and "other" (12.7%), which included administrators. Responding physicians identified their practice specialties as gastroenterology (49.0%), internal medicine (21.5%), surgery (16.9%), and family or general practice (12.0%).
Response Rates (e.g. for surveys):	Surveys were mailed to 1809 practices and 1346 (74.4%) completed surveys were returned. Of the returned surveys, 78 were ineligible; 1268 surveys were analyzed.

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: "How many endoscopies are performed for colorectal cancer screening? Results from CDC's survey of endoscopic capacity"	**Authors, ref ID:** Seeff et al.[98] **Year of publication:** 2004 **Dates of data collection:** April to September 2002 **Trial name:** Data from Survey of Endoscopic Capacity (SECAP) used for this study
STATISTICAL ANALYSES:	Once data collection was completed, the eligibility rate for the sampled facilities was applied to each stratum to produce a total number of possible practices in each stratum. Sampling weights were computed by dividing the total number of practices in each stratum by the total number of completed surveys in those strata. The sampling weights adjusted for differences in the probability of being selected and response rates across cells. The authors then multiplied each survey response by the corresponding survey weight to obtain an estimate of the total number of facilities in the United States that perform flexible sigmoidoscopy and colonoscopy, the total number of procedures that are currently being performed, and the maximum number of procedures that could be performed given current resources. These estimates are generalizable to the population of all US health care practices that use lower gastrointestinal flexible endoscopic equipment for the detection of colorectal cancer in adults. The weighted national weekly estimates were then multiplied by the number of workweeks per year to obtain national annual estimates. The authors assumed a 46-week working year across all practice specialties and facility types to account for vacations, professional travel, and nonprocedural time. The survey data were analyzed and 95% confidence intervals (CIs) were calculated using Stata to adjust for sampling design effects. For the estimation of endoscopic capacity, 2 survey questions were critical to the analysis: the number of procedures currently performed and the maximum number of procedures that could be performed. These data items were imputed when missing (40 surveys were missing current endoscopic volume data and 290 were missing potential endoscopic volume data) using a variation of the hot-deck method. For surveys with missing current volume data, a current volume estimate was randomly selected from all surveys with known current volume estimates and used as a replacement for the missing current volume value. For surveys with missing potential maximum volume data, a ratio of current volume to potential volume was randomly selected from among all surveys with known current and potential volume estimates, multiplied by the current volume estimate, and used as a replacement for the missing potential volume value.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NA
OUTCOME ASSESSMENT:	Respondents were asked to Identify their practice as private practice, an AEC, or a hospital. Responses were inconsistent, making it difficult to classify facilities by facility type. For this analysis, facilities were classified according to the practice specialty based on types of physicians that perform the majority of procedures. If ≥75% of procedures were performed by GI, the facility is classified as a GI practice. Same for primary care and for surgical. If no dominant physician specialty, the facility was classified as a mixed practice. Survey respondents were asked to estimate the weekly number of flexible sigmoidoscopies performed by the practice ("During a typical week, how many flexible sigmoidoscopies are performed by all physician and non-physician endoscopists in this practice site?") and the weekly potential maximum number the practice could perform ("If the demand for colorectal cancer screening were to increase substantially, what is the maximum number of flexible sigmoidoscopies that could be provided at this practice site per week with no other investment of resources?"). The same questions were asked about colonoscopy volume. Available capacity was then determined by taking the difference between the current and the potential volume.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in	NA

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: "How many endoscopies are performed for colorectal cancer screening? Results from CDC's survey of endoscopic capacity"	**Authors, ref ID:** Seeff et al.[98] **Year of publication:** 2004 **Dates of data collection:** April to September 2002 **Trial name:** Data from Survey of Endoscopic Capacity (SECAP) used for this study
increasing the appropriate use of colorectal cancer screening and follow-up?	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Number and Specialty of US Practice Sites that perform flexible sigmoidoscopy and colonoscopy, by region, 2002**

Procedure	Total (95% CI)	Gastroenterology practices (95% CI)	Primary care practices (95% CI)	Surgical practices (95% CI)	Mixed practices (95% CI)
Any lower endoscopy					
Total	8207	3800 (3582 – 4017)	1644 (1456 – 1832)	988 (838 – 1138)	1775 (1585 – 1965)
N.E.	1611 (1604 – 1618)	970 (874 – 1066)	195 (128 – 262)	154 (95 – 213)	292 (215 – 369)
South	2890 (2878 – 2901)	1417 (1287 – 1547)	542 (435 – 649)	429 (332 – 526)	502 (398 – 606)
M.W.	2082 (2074 – 2090)	678 (574 – 782)	463 (363 – 563)	257 (180 – 334)	684 (574 – 794)
West	1624 (1615 – 1634)	734 (633 – 835)	444 (345 – 543)	149 (87 – 211)	297 (211 – 383)
Flex Sig					
Total	6732 (6557 – 6907)	2851 (2644 – 3058)	1563 (1397 – 1769)	708 (577 – 839)	1590 (1408 – 1772)
N.E.	1363 (1292 – 1434)	756 (658 – 854)	195 (128 – 262)	147 (89 – 205)	265 (190 – 340)
South	2292 (2184 – 2400)	1046 (922 – 1170)	513 (409 – 617)	329 (242 – 416)	404 (309 – 499)
M.W.	1752 (1667 – 1837)	508 (414 – 602)	456 (357 – 555)	141 (82 – 200)	647 (539 – 755)
West	1325 (1243 – 1407)	541 (445 – 637)	420 (323 – 517)	91 (40 – 142)	273 (190 – 356)
Colonoscopy					
Total	6214 (6016 – 6412)	3373 (3158 – 3588)	300 (211 – 389)	822 (684 – 960)	1719 (1532 – 1906)
N.E.	1217 (1130 – 1304)	825 (727 – 923)	13 (0 – 32)	94 (47 – 235)	285 (209 – 361)
South	2230 (2118 – 2342)	1266 (1138 – 1394)	128 (71 – 185)	360 (270 – 450)	475 (373 – 577)
M.W.	1602 (1505 – 1699)	596 (495 – 697)	109 (56 – 162)	228 (156 – 300)	669 (561 – 777)
West	1165 (1065 – 1265)	686 (586 – 786)	49 (12 – 86)	140 (80 – 200)	289 (204 – 374)

Number of flex sigs and colonoscopies performed by week by practices that own or lease lower endoscopic equipment, per practice, by practice specialty, 2002

Procedure	GI practices (95% CI)	Primary Care practices (95% CI)	Surgical practices (95% CI)	Mixed practices (95% CI)
Flex sig				
% of practices that perform	76.0 (72.5 – 79.5)	96.3 (93.8 – 98.8)	72.7 (65.2 – 80.2)	89.6 (85.8 – 93.4)

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: "How many endoscopies are performed for colorectal cancer screening? Results from CDC's survey of endoscopic capacity"	**Authors, ref ID:** Seeff et al.[98] **Year of publication:** 2004 **Dates of data collection:** April to September 2002 **Trial name:** Data from Survey of Endoscopic Capacity (SECAP) used for this study				
	Current # (mean)	9.0 (7.0 – 11.0)	5.0 (4.1 – 5.9)	14.4 (8.9 – 19.9)	10.1 (7.8 – 12.4)
	Performed for screening (%)	38.0 (34.5 – 41.5)	78.6 (75.1 – 82.1)	43.9 (36.4 – 51.4)	61.9 (57.3 – 66.5)
	Potential maximum # (mean)	37.7 (31.0 – 44.4)	14.3 (12.6 – 16)	34.6 (26.2 – 43)	11.0 (9.0 – 13.0)
	Colonoscopy				
	% of practices that perform	88.8 (86.2 – 91.4)	18.6 (13.6 – 23.6)	83.2 (77.1 – 89.3)	97.6 (95.7 – 99.5)
	Current # (mean)	65.5 (52.8 – 78.2)	8.3 (6.5 – 10.1)	15.8 (13.1 – 18.5)	42.6 (36.4 – 48.8)
	Performed for screening (%)	45.6 (43.5 – 47.7)	52.3 (44.6 – 60)	48.3 (42.5 – 54.1)	46.9 (43.7 – 50.1)
	Potential maximum # (mean)	100.0 (86.3 – 113.7)	19.7 (15.7 – 23.7)	32.9 (26.9 – 38.9)	68.6 (59.5 – 77.7)

Percentage of all FS and Colonoscopies performed by physician specialty, 2002 Specialty

Flex sig % (95% CI)	Colonscopy % ((%% CI)
GI	43.7 (37.2-50.2)
PCP	24.9 (20.3-29.5)
Surgeon	20.5 (14.2-26.8)
Resident with supervising MD	1.4 (0.2-2.6)
Fellow with supervising MD	2.5 (1.3-3.7)
Non MD	6.1 (2.1-10.1)
Other	0.7 (0-1.9)
	82.5 (80.3-84.7)
	2.0 (1.4-2.6)
	10.8 (9.l2-12.4)
	0.2 (0.1-0.3)
	4.3 (2.1-6.7)
	0.0 (0-0.1)
	0.1 (0-0.2)

Current Volume, potential volume and available capacity for annual [a] flex sigs and colonoscopies by region (in millions), 2002

	Current volume (95% CI)	Potential volume (95% CI)	Available capacity [b]
Flex sig			
All regions	2.8 (2.4 – 3.1)	9.5 (8.4 – 10.5)	6.7
N.E.	0.7 (0.6 – 0.9)	2.5 (1.7 – 3.2)	1.8
M.W.	0.7 (0.6 – 0.9)	2.2 (1.8 – 2.7)	1.5
South	0.8 (0.6 – 0.9)	3.2 (2.8 – 3.6)	2.4
West	0.6 (0.4 – 0.7)	1.6 (1.3 – 1.9)	1.0
Colonoscopy			
All regions	14.2 (12.1 – 16.4)	22.4 (20.1 – 24.8)	8.2
N.E.	4.2 (2.2 – 6.1)	5.9 (3.9 – 7.8)	1.7
M.W.	3.1 (2.6 – 3.7)	5.1 (4.4 – 5.9)	2.0
South	4.8 (4.3 – 5.4)	8.0 (7.1 – 8.9)	3.2
West	2.1 (1.8 - 2.5)	3.5 (2.9 – 4.0)	1.4

[a] Assuming 46 workweeks / year

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY: "How many endoscopies are performed for colorectal cancer screening? Results from CDC's survey of endoscopic capacity"	**Authors, ref ID:** Seeff et al.[98] **Year of publication:** 2004 **Dates of data collection:** April to September 2002 **Trial name:** Data from Survey of Endoscopic Capacity (SECAP) used for this study
	[b] Difference between current and potential volumes A total of 8207 practice sites across the county performed flexible sigmoidscopy or colonoscopy for CRC screening and follow up. Approximately 2.8 million flexible sigmoidoscopies and 14.2 million colonoscopies were estimated to have been performed in 2002, approximately one half of them for screening. Across all practice specialties, 53.8% of FS and 64.7% of colonoscopies were performed for screening. Survey respondents reported that they could increase their flexible sigmoidoscopy volume to 9.5 (95% CI, 8.4 –10.5) million procedures annually, an increase of 29%, and could increase their colonoscopy volume to 22.4 (95% CI, 20.1–24.8) million annually, an increase of 63%. Additional available capacity for FS and colonoscopy greatest in the South in terms of absolute number as well as percentage of potential volume that is additional available capacity; lowest additional available capacity in terms of absolute number is the West; in terms of percentage it is the Northeast.
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	NA
QUALITY RATING:	

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Were the differential drop-out or response rates acceptable (≤ 15%)?			Not measured
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			NA
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors:** Vijan et al.[99] **Year:** 2004 **Trial name (if applicable):** NA
DESIGN:	**Study design:** Use of previous Markov model **Number of subjects:** The authors used the current population of the United States, ages 50–79 **Time period covered:** October 2002 to October 2003
QUESTIONAIM/OBJECTIVE:	To quantify the demand for colonoscopy with different screening tests, and to estimate the ability of the United States health care system to meet demand.
DATA INPUTS:	• For this analysis, the authors used the decision model to estimate the number of colonoscopies and flexible sigmoidoscopies undergone using several screening strategies: flexible sigmoidoscopy combined with fecal occult-blood testing (FS/FOBT), a single colonoscopy at ages 50, 60, or 65 twice lifetime colonoscopy undergone at ages 50 and 60, or colonoscopy every 10 years. Positive results with screening FS/FOBT resulted in performance of colonoscopy. Patients in whom high risk adenomatous polyps were diagnosed (polyps 1 cm or greater, three or more polyps, or polyps with advanced histology) underwent an initial surveillance colonoscopy at 3-years; if this endoscopy was negative, further surveillance was carried out at 5-year intervals. • The average rate of colonoscopy performance was then extrapolated to all USA gastroenterologists. The authors then increased this number by 33%, based on the assumption that some screening-related colonoscopies that are performed by providers other than gastroenterologists
ANALYSIS AND CALCULATIONS:	• The cohort was divided into 5 year clusters and the model was run to assess the total number of colonoscopies and flexible sigmoidoscopies that would be necessary for each of these age clusters over the remaining lifetime of the cohort. • The authors ran these calculations using two main scenarios. In the first, the authors assumed a fixed adherence level of 70%; i.e. 70% in the age-range were eligible for and followed recommendations for initial screening. In the second, as an upper bound of demand estimates, the authors assumed that all patients were eligible, but that the total proportion of eligible and willing patients declined with age (a proxy measure for comorbidity). • The authors used the CORI data to calculate the average number of colonoscopies performed per month by USA gastroenterologists from October 2002 through September 2003. • The average rate of colonoscopy performance was then extrapolated to all USA gastroenterologists (11,044). The authors then increased this number by 33%, based on the assumption that some screening-related colonoscopies that are performed by providers other than gastroenterologists • The authors then calculated the incremental number of colonoscopies that would be performed under various screening scenarios by subtracting the number of screening-related colonoscopies that are done at present from the total number of colonoscopies predicted by the decision model. • The authors also conducted sensitivity analyses varying the proportion of endoscopies undergone by specialties other than gastroenterology. • In the base case, approximately 46% of colonoscopies are related to screening and/or surveillance of average risk individuals; the authors ranged this from 46 (e.g. no shift) to 66% (a 20% shift) in sensitivity analyses.

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors:** Vijan et al.[99] **Year:** 2004 **Trial name (if applicable):** NA
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** • Current volume: Estimated 1.27 million screening colonoscopies per year conducted by gastroenterologists; estimated 1.69 m screening colonoscopies per year by all types of providers Average of 21 colonoscopies (range 0-102) per month Even under the most favorable sensitivity analysis assumptions, a single colonoscopic screening at age 65, which requires the fewest number of colonoscopies, would require between 1360 and 4160 more gastroenterologists. • The more effective but also more resource intensive strategies would require a three to four times increase from the current number (11 044) of gastroenterologists in order to meet demand. However, even the FOBT/FS-based strategy would require a substantial increase in the number of gastroenterologists, ranging from a 30 to 110% increase, depending on assumptions about eligibility and the number of colonoscopies that could be performed. • If a group of dedicated endoscopists were trained a much smaller number of new endoscopists would be required to meet the projected demand. For example, if colonoscopy every 10 years is the predominant strategy, and a dedicated endoscopist can perform 200 colonoscopies per month (about 10 per day), then between 2100 and 2600 endoscopists could theoretically meet demand. 70% of age-eligible subjects Incr. # of screen-related colonoscopies FOBT/FS 1.20 COLON every 10 years 5.03 100% of age-eligible subjects Incr. # of screen-related colonoscopies FOBT/FS 2.39 COLON every 10 years 6.27 1
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer	NA

Evidence Table 3. KQ 4: Current and projected capacity to deliver colorectal cancer screening and surveillance (continued)

STUDY:	**Authors:** Vijan et al.[99] **Year:** 2004 **Trial name (if applicable):** NA
screening?	
QUALITY RATING:	Fair for capacity estimates; Good for demand estimates

Quality Assessment for Modeling Studies

	Yes	No	Other (CD, NR, NA)
Were data inputs valid?		X	Inputs based on CORI database which is not representative
Was an appropriate search strategy used to find data inputs?	X		
Were the calculations and statistical analyses adequate?	X		
Were appropriate sensitivity analyses conducted (especially for any variables that were not based on data from literature)?	X		
Other considerations: [These might include the following for various types of models: was the cost effectiveness analysis conducted from the societal perspective? Was an appropriate comparison used (standard of care or next most effective alternative)? Were the appropriate health benefits, harms, and costs described and included?]			NA
Quality Rating (Good, Fair or Poor): Fair for capacity estimates; Good for demand estimates			

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening

STUDY: The use of screening colonoscopy for patients cared for by the Department of Veterans Affairs	**Authors, ref ID:** El-Serag, Peterson, Hampel, Richardson, Cooper [100] **Year of publication:** 2006 **Dates of data collection:** 1998 - 2003 **Trial name:** NA
OBJECTIVE OR AIM:	To investigate whether colonoscopy use increased disproportionately in the VA system and changes in rates of FS, DCBE, and FOBT use between October 1, 1998, and September 30, 2003.
DESIGN:	**Setting:** United States, VA medical centers **Study design:** cross-sectional **Duration (mean followup):** NA **Overall study size (N enrolled/N analyzed):**
Sample size: **Describe intervention:** NA	NA
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population based- from VA databases
INCLUSION CRITERIA:	Procedures for VA users aged 49 to 75 years.
EXCLUSION CRITERIA:	NR

POPULATION CHARACTERISTICS:

Feature	Screening c-scope (n=178,853)	FOBT (n=1,635,364)	DCBE (n=78,830)	FS (n=217,327)
Race				
White	105,746 (59.1)	815,582 (49.9)	45,894 (58.2)	118,789 (54.7)
Black	17,934 (10.0)	133,822 (8.2)	10,458 (13.3)	20,358 (9.4)
Other	55,173 (30.8)	685,960 (41.9)	22,478 (28.5)	78,180 (36.0)
Sex				
Male	174,356 (97.5(	1,583,775 (96.8)	76,427 (97.0)	211,824 (97.5)
Female	4,497 (2.5)	51,589 (3.2)	2,403 (3.0)	5,503 (2.5)

Mean age & range (years):
Colonoscopy: 62.3 (7.6) years
FOBT: 63.9 (7.8)
DCBE: 62.6 (7.8)
FS: 61/8 (7.7)
Sex (% female):
Race:
Other:

The mean (SD) age of those undergoing screening colonoscopy was 62.3 (7.6) years; FOBT, 63.9 (7.8) years; DCBE, 62.6 (7.8) years; and FS, 61.8 (7.7) years.

Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NR
STATISTICAL ANALYSES:	The frequencies and proportions of the 4 types of CRC screening procedures, and of unique individuals undergoing these procedures, were calculated for each fiscal year. The temporal changes and potential determinants (age, sex,

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY: The use of screening colonoscopy for patients cared for by the Department of Veterans Affairs	**Authors, ref ID:** El-Serag, Peterson, Hampel, Richardson, Cooper [100] **Year of publication:** 2006 **Dates of data collection:** 1998 - 2003 **Trial name:** NA
	and race) of screening colonoscopy (vs other CRC screening tests) were examined in unadjusted and adjusted logistic regression analyses. Similar calculations were performed for screening colonoscopy (vs other colonoscopy). Statistical comparisons of these proportions were not performed because of overlapping groups. The authors used the predictive values to perform a sensitivity analysis of the calculated proportions for screening colonoscopy.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	National inpatient and outpatient VA databases used to assess potential confounders/covariates
OUTCOME ASSESSMENT:	National inpatient and outpatient VA databases were searched for codes indicative of colonoscopy, FS, FOBT, and DCBE recorded during fiscal years 1998 to 2003. The authors also used the VA Patient Treatment File, which contains hospital discharge records and up to 10 diagnostic codes, 5 operating room procedures, and 32 nonoperating room procedures coded according to the *International Classification of Diseases, Ninth Revision, Clinical Modification*. The indications for CRC screening tests were classified as screening, diagnosis, or surveillance based on the predefined Algorithm. All FOBT procedures were designated as screening procedures. Flexible sigmoidoscopy and DCBEwere considered diagnostic in the presence of specific conditions recorded within the year before the date of the procedure. They were considered to be surveillance procedures in the presence of a second set of prespecified conditions (coded as 17-28). The remaining procedures were considered to be screening procedures Colonoscopy was considered for CRC screening in the absence of conditions associated with diagnostic or surveillance indications and if no colonoscopy had been performed within the past 4 years. Because of concerns of the accuracy of diagnosis and procedure codes for specifying procedural indications, the authors also conducted a medical record review study in a subset of colonoscopic procedures nested within the main study cohort to validate and refine the algorithm that was used. A review of procedure, pathology, and progress notes was performed by 2 boardcertified gastroenterologist investigators who were blinded to the designated status based on the VA administrative data sets. They categorized indications for procedures as screening, surveillance, or diagnostic. A total of 303 medical records of unique patients with colonoscopy performed at the Michael E. DeBakey VA Medical Center, between October 6, 1999, and September 30, 2003, were identified at random using a computer generated algorithm, and reviewed from the national databases (ie, a subset from the main study cohort). Agreement between the 2 reviewers was achieved in 92.0% of cases, and differences were resolved by discussion. The predictive values of the database algorithm for identifying screening colonoscopy (compared with the medical record as a gold standard) were calculated.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY: The use of screening colonoscopy for patients cared for by the Department of Veterans Affairs	**Authors, ref ID:** El-Serag, Peterson, Hampel, Richardson, Cooper [100] **Year of publication:** 2006 **Dates of data collection:** 1998 - 2003 **Trial name:** NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	The authors calculated that the algorithm has approximately 70.1% sensitivity and 71.6% specificity to define screening colonoscopy. The findings of medical record review were then applied in a sensitivity analysis to recalculate the estimated annual frequency of screening colonoscopy. Apart from reducing the total number of screening colonoscopies by up to 25%, changing the definition of screening colonoscopy had little effect on the observed trends. Concordance or kappa not calculated
QUALITY RATING:	Fair

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		
Were the differential drop-out or response rates acceptable (≤ 15%)?	X		
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	x		Algorithm used to differentiate screening from diagnostic procedures, verified through dual review (see statistical methods section of abstraction) Concordance/kappa not calculated
Does the analysis control for baseline differences?	x		Logistic regression models used
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	x		
Were the statistical methods used to assess the abstracted outcomes appropriate?	x		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fiscella[101] **Year of publication:** 2006 **Dates of data collection:** 1998-2002 **Trial name:** NR
OBJECTIVE OR AIM:	To determine whether estimates of racial and racial disparities in receipt of six different types of largely preventive procedures differ between self-report and Medicare claims data
DESIGN:	**Setting:** Medicare claims data **Study design: observational** **Duration (mean followup):** 2 to 4 years **Overall study size (N enrolled/N analyzed):** 88509 # observations (n = 1474 for colorectal testing)
Sample size: **Describe intervention:**	1474 Includes fecal occult blood testing, sigmoidoscopy, or colonoscopy
RECRUITMENT: (population-based, clinic-based, volunteer, other)	Population
INCLUSION CRITERIA:	Medicare Beneficiaries 65 and older who participated in the Medicare Current Beneficiary Survey, 1999–2002.
EXCLUSION CRITERIA:	Participated in facility interviews (i.e., resided in long-term care facilities), were less than 65 years of age (i.e., were Medicare recipients due to having a qualifying disability), reported race/ethnicity *other than* Hispanic, non-Hispanic African American, or non-Hispanic White, i.e. majority, were enrolled in a Medicare HMO, or were not eligible for Medicare B (or Medicare A and B) coverage dropped due to incomplete claims.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**Overall** 65-69 16.7% 70-74 35.1% 75-79 26.7% 80-84 14.3% 85+ 7.2% 56% female Hispanic, African American 8.8% Majority 91.2%
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA
STATISTICAL ANALYSES:	Describe: used SAS Survey and logistic regression to assess the relationship, adjusted, between minority status and self report
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Predictors of self report
OUTCOME ASSESSMENT:	**Outcome Measures:**

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Fiscella[101] **Year of publication:** 2006 **Dates of data collection:** 1998-2002 **Trial name:** NR
	• Prevalence of receipt of FOBT, FS, or colonoscopy as measured by: • Self-report in the MCBS of having any of the tests in the last year (MCBS) (indication was not specified) • Medicare claims, including both screening and diagnostic codes (administrative data)
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** Unadjusted prevalence of CRC screening White: Survey 38.0 Administrative 30.1 Minority: Survey 34.8 Administrative 20.4 Concordance between self-report and administrative data (measured by kappa score) for CRC screening White 0.37 Minority 0.19 The authors also calculated an odds ratios for reporting a procedure in the absence of a claim, or vice versa. Minorities were more likely to report receipt of CRC screening in the absence of a claim (OR=1.92, 95% CI, 1.32-2.79), with little change after adjustment for age, gender, income, educational level, health status, proxy response, and supplemental insurance. Having a claim for CRC testing in the absence of self-report did not differ by race or ethnicity.
QUALITY RATING:	Good

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Response rate for MCBS not reported. Possible that non-respondents differ from respondents in terms of associations between self report and administrative claims.
Were the differential drop-out or response rates acceptable (≤ 15%)?			
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	x		
Does the analysis control for baseline differences?	x		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	x		
Were the statistical methods used to assess the abstracted outcomes appropriate?	x		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Hall et al.[102] **Year of publication:** 2004 **Dates of data collection:** December 1999 – June 2001 **Trial name:** NA
OBJECTIVE OR AIM:	To examine the accuracy of self-reports of prostate and colorectal cancer testing and reasons for testing using questions included in national surveys, the authors conducted a survey and reviewed the medical records for procedures performed among members of three health maintenance organizations (HMOs)
DESIGN:	**Setting:** member lists of Kaiser Permanente-Northern California (NC), Kaiser Permanente- Georgia (GA), and HealthPartners (HP), Minnesota **Study design:** cross-sectional **Duration (mean follow-up):** NA **Overall study size (N enrolled/N analyzed):** 3546

	Black men	White and other men	Women
Sample size:	363	847	920

Describe intervention:

RECRUITMENT: (population-based, clinic-based, volunteer, other): H.M.O. population based

INCLUSION CRITERIA: Men aged 45 years and older and women aged 55 years and older as of September 1, 1999 who had been enrolled in the plan for at least 5 years were eligible for selection.
Simple random sample for women. For men, an SRS for men at one site. At 2 sites, separate sample of black and white men recruited until all strata were filled. Also at one site, sample was drawn from members who had participated in a past survey.

EXCLUSION CRITERIA: Screened out (statrum filled); language barrier, dead, out of network, phone disconnected, other

POPULATION CHARACTERISTICS: Characteristics of study sample from 3 HMO's

Mean age & range (years):
Sex (% female):
Race:
Other:

	Black men (n=363)		White and other men (n = 847)		Women (n = 920)	
	%	(n)	%	(n)	%	(n)
Age (y)						
45 – 49	19.8	(72)	14.3	(121)	0.0	0
50 – 59	41.0	149	38.6	327	23.3	(214)
60 – 69	19.3	(70)	23.4	(198)	33.8	(311)
70+	19.8	(72)	23.7	(201)	42.9	(394)
Ethnicity						
Hispanic	0.6	(2)	3.5	(30)	3.2	(29)
Non-Hispanic	99.4	(361)	96.5	(816)	96.8	(888)
Education						
< HS	10.2	(37)	6.3	(53)	9.9	(91)
HS/GED	22.6	(82)	17.9	(152)	27.1	(249)

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Hall et al.[102] **Year of publication:** 2004 **Dates of data collection:** December 1999 – June 2001 **Trial name:** NA						
	Some college/tech school	38.8	(141)	31.6	(268)	35.7	(328)
	College grad	28.4	(103)	44.2	(374)	27.2	(250)
	Marital status						
	Married	78.0	(283)	82.4	(698)	55.8	(512)
	Unmarried	22.0	(80)	17.6	(149)	44.2	(406)
	Employment						
	Employed	62.9	(227)	59.2	(499)	31.5	(288)
	Retired	33.8	(122)	39.3	(331)	62.0	(566)
	Unemployed /other	3.3	(12)	1.5	(13)	6.5	(59)
	Income						
	<= $20,000	13.6	(46)	9.4	(72)	29.5	(236)
	$20,000 - $40,000	24.2	(82)	16.9	(130)	30.0	(240)
	$40,001 - $60,000	23.9	(81)	25.8	(199)	21.4	(171)
	> $60,000	38.3	(130)	47.9	(369)	19.0	(152)
	Health status						
	Excellent/ good	82.3	(298)	87.6	(741)	82.1	(754)
	Fair / poor	17.7	(64)	12.4	(105)	17.9	(164)
	Smoking status						
	Current	17.9	(65)	10.0	(85)	7.5	(69)
	Former	46.6	(169)	49.9	(423)	36.2	(333)
	Never	35.5	(129)	40.0	(339)	56.3	(518)
Attrition/Drop-out (not available for endpoint measurement):	**Response Rates (for survey):** 4,833 members contacted 3,546 eligible 1,248 refused 2,298 completed						
Adherence:							
Contamination:	Response rate = 64.8% among those contacted and eligible 1181 not contacted (no answer, busy, answering service, exceeded call limit)						
STATISTICAL ANALYSES:	The authors analyzed the data according to our sampling frame, that is, for all women, black men, and white and other men separately. Few participants were of races other than white or black (67 [3.1%] were of other races and 83 [3.9%] were multiracial). Therefore, non-Black men of other races and multiracial men were grouped together with white men. At HP, few men were black, and no statistics are presented for them. Participants with a history of prostate or colorectal cancer were excluded from the analyses. The final sample sizes were 363 black men, 847 white and other men, and 920 women. Respondent characteristics were summarized as frequencies and percentages. The authors calculated the percentages of respondents who reported having had their most recent DRE, PSA, or FOBT within 2 years before interview and sigmoidoscopy or colonoscopy within 5 years before interview. The percentages of respondents who had tests as determined by the medical record audit were similarly calculated; for FOBT, the authors counted only home kits to match with the survey question. On the basis of these time frames, the						

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Hall et al.[102] **Year of publication:** 2004 **Dates of data collection:** December 1999 – June 2001 **Trial name:** NA
	authors calculated the concordance (agreement) between the self-report and medical record audit for the tests. The authors also calculated agreement for endoscopy by combining sigmoidoscopy and colonoscopy. The authors calculated the kappa statistic by the method of Landis and Koch, which accounts for agreement expected by chance. Excellent agreement is defined as a kappa statistic greater than 0.75, fair to good agreement as 0.40 to 0.75, and poor agreement as less than 0.40. The authors also calculated the sensitivity and specificity of self-reports using the information from the medical records as the standard. Differences in sensitivity and specificity between health plans were determined with a pairwise test of proportions. The authors assessed the relationships between agreement and demographic characteristics (age, sex-race groups, and education) with polytomous regression models. The reference was agreement between self-reports and medical records and was compared to over- and underreporting. The authors also assessed the relationship with income, but because of the relatively large number of missing observations and no significant associations in any of the models, it was not included in the final models. All analyses were adjusted for study site. Further, the authors determined the reasons for testing and the concordance between the reasons reported by participants and the reasons recorded in the medical records. Tests were defined as screening tests when the reason for testing was screening, family history, or ''part of exam/ doctor just did it.'' Tests were defined as being performed for ''other reasons'' when the reasons were symptoms, problems, follow-up of an abnormal test, or other reasons. Finally, the authors evaluated whether and how frequently participants confused sigmoidoscopy and colonoscopy.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	**Computer assited telephone interviews (CATI)**: The survey instrument elicited information on demographic and health characteristics, including a personal or family history of prostate or colorectal cancer, whether they had ever been tested for prostate or colorectal cancer and, if so, when they had the most recent tests (see Appendix for the questions asked). In addition, participants were asked the reasons for testing and the test results. The initial questions on prostate and colorectal cancer testing were based on the questions proposed for the Year 2000 National Health Interview Survey Cancer Control Supplement and Behavioral Risk Factor Surveillance System. The questionnaire is available from the authors upon request. **Medical record reviews:** Medical records were reviewed to determine whether any of the cancer tests included in the survey had been recorded within 5 years before the interview date. In addition, the dates and results of the tests were obtained. For each test recorded in the medical records, the authors ascertained the reason for or symptoms associated with the test by reviewing the records for up to 6 months before the test date but no more than 5 years before the survey (index) date. At each site, each page of all relevant medical records in the study time period was physically reviewed by a trained medical record analyst. Each provider note, all laboratory, radiology, endoscopy, and pharmacy information were abstracted using a standardized medical record abstraction form. Quality control procedures included a review of all abstraction forms for missing data and ambiguous responses and duplicate abstraction for 10% of the records. Data entry for all forms was conducted at Kaiser Permanente- NC with double key entry. Programs for internal consistency and validity were used to identify and correct errors of coding and data entry.
OUTCOME ASSESSMENT:	(see above)
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which	NA

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Hall et al.[102] **Year of publication:** 2004 **Dates of data collection:** December 1999 – June 2001 **Trial name:** NA
strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	Percentage of respondents who received prostate or colorectal cancer tests according to self-report and medical record audits, 1999 - 2001

	Black men (n=363)		White + other men (n=847)		Women (n = 920)	
	%	(n)	%	(n)	%	(n)
FOBT*						
Survey	22.2	(79)	20.3	(169)	25.9	(234)
Med recs	11.6	(42)	9.5	(80)	14.1	(129)
Sig oscpy**						
Survey	38.4	(138)	42.0	(352)	50.0	(447)
Med rec	29.6	(107)	30.6	(258)	34.1	(313)
C-scope**						
Survey	13.7	(49)	14.6	(121)	15.7	(140)
Med rec	8.1	(29)	11.1	(94)	9.6	(88)
End scopy**						
Survey	44.4	(159)	49.9	(415)	58.6	(523)
Med rec	34.4	(124)	37.8	(319)	39.8	(365)

Note: endoscopy indicates sigmoidoscopy OR colonoscopy
* test within past 2 years
** test within past 5 years

CRC screening information: agreement between self-reports and medical record audits, 1999 - 2001

procedure	Black men					White and other men					Women				
	n	sens	spec	conc	K	n	sens	spec	conc	K	n	sens	spec	conc	K
Kaiser Permanente-Georgia															
Fobt	187	0.89	0.86	0.86	0.57	293	0.90	0.85	0.86	0.56	310	0.89	0.82	0.84	0.62
Sig	188	0.84	0.81	0.82	0.56	294	0.95	0.86	0.89	0.77	310	0.87	0.77	0.81	0.61

n

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY: **Authors, ref ID:** Hall et al.[102]
Year of publication: 2004
Dates of data collection: December 1999 – June 2001
Trial name: NA

Col	185	0.56	0.93	0.90	0.43	292	0.73	0.95	0.91	0.69	309	0.81	0.93	0.91	0.68
End	186	0.87	0.83	0.84	0.64	294	0.96	0.88	0.92	0.83	311	0.95	0.73	0.83	0.67
Kaiser Permanente – northern California															
Fobt	165	0.73	0.86	0.85	0.29	271	0.72	0.86	0.85	0.32	304	0.79	0.86	0.86	0.35
Sig	166	0.83	0.77	0.80	0.58	271	0.80	0.77	0.78	0.53	301	0.83	0.76	0.78	0.55
Col	165	0.67	0.88	0.87	0.36	270	0.80	0.93	0.92	0.60	300	0.95	0.94	0.94	0.65
end	165	0.93	0.76	0.82	0.65	269	0.91	0.75	0.81	0.62	299	0.91	0.76	0.82	0.63
HealthPartners, Minnesota															
Fobt	4	NA	NA	NA	NA	269	0.59	0.87	0.84	0.31	287	0.55	0.81	0.78	0.23
Sig	4	NA	NA	NA	NA	270	0.77	0.67	0.70	0.38	280	0.86	0.53	0.63	0.31
Col	4	NA	NA	NA	NA	267	0.69	0.90	0.89	0.38	280	0.73	0.87	0.86	0/30
end	4	NA	NA	NA	NA	267	0.85	0.64	0.71	0.43	279	0.93	0.45	0.61	0.30

Fobt = fecal occult blood test
Sig = flexible sigmoidoscopy
Col = colonoscopy
End = endoscopy

Predictors of agreement between self-reports and medical record audits of crc screening tests, generalized logits models, 1999 – 2001

Predictor	Outcome	FOBT		Sig		Col	
		OR	95% CI	OR	95% CI	OR	95% CI
Age (y)							
50 – 59	Over	1.69	0.91, 3.13	2.13	1.20, 3.80	6.81	1.62, 28.58
	Under	1.22	0.34, 4.41	3.98	1.20, 13.19	6.86	0.90, 52.15
60 – 69	Over	2.8	1.50, 5.25	3.07	1.70, 5.54	9.29	2.19, 39.42
	Under	1.9	0.51, 7.05	3.41	0.99, 11.72	9.95	1.27, 77.94
70+	Over	2.78	1.46, 5.29	2.85	1.56, 5.19	14.36	3.38, 61.06
	Under	2.47	0.66, 9.31	4.06	1.18, 13.93	13.91	1.72, 111.45
Sex/race							
White / other men	Over	0.92	0.62, 1.37	0.75	0.52, 1.10	0.51	0.31, 0.83
	Under	0.74	0.29, 1.90	0.82	0.45, 1.5	0.86	0.40, 1.85
women	Over	0.9	0.60, 1.34	0.91	0.62, 1.32	0.44	0.27, 0.73
	Under	0.88	0.34, 2.24	0.79	0.43, 1.45	0.34	0.14, 0.81
Education							
HS/GED	Over	0.87	0.54, 1.4	1.48	0.91, 2.39	1.17	0.64, 2.16
	Under	1.74	0.49, 6.19	1.42	0.63, 3.24	0.93	0.32, 2.73
Some college / tech school	Over	0.73	0.46, 1.16	1.15	0.72, 1.84	0.84	0.46, 1.55
	Under	1.55	0.45, 5.40	1.07	0.48, 2.40	0.92	0.33, 2.56
College grad	Over	0.85	0.54, 1.36	1.24	0.77, 2.00	0.77	0.41, 1.45
	Under	1.6	0.45, 5.70	1.09	0.48, 2.48	0.73	0.25, 2.10

[a]Reference levels for predictors are: age = 40– 49; sex/race group = black men; education = < high school; all analyses are adjusted for

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Hall et al.[102] **Year of publication:** 2004 **Dates of data collection:** December 1999 – June 2001 **Trial name:** NA
	site. [b]Reference level for outcome variable is ''agreement'' between the survey and medical record. Over = overreport Under = underreport
QUALITY RATING:	Good

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	X		Cooperation rate 68% Some concern about exclusion criteria (language barrier)
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?	X		
Were outcome measures valid, reliable, and equally applied?	X		
Does the analysis control for baseline differences?	X		
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?	X		
Were the statistical methods used to assess the abstracted outcomes appropriate?	X		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Haque et al.[103] **Year of publication:** 2005 **Dates of data collection:** **Trial name:** NA
OBJECTIVE OR AIM:	The goal of this study was to develop an automated data algorithm designed to distinguish screening and diagnostic endoscopy (sigmoidoscopy and colonoscopy) exams. The authors assessed the algorithm's ability to correctly classify the exams using paper medical records as the "gold standard."
DESIGN:	**Setting:** Kaiser Permanente Southern California (KPSC) cares for approximately 3 million members, of whom 13% are older than 50 years and targeted for colorectal cancer screening. Automated data tracks outpatient and inpatient care received. **Study design:** cross-sectional **Duration (mean follow-up):** **Overall study size (N enrolled/N analyzed):** Stratified random sample of 220 medical records reviewed.
Sample size: **Describe intervention:**	**Had Colonoscopies** 110 **Had Sigmoidoscopies** 110
RECRUITMENT: (population-based, clinic-based, volunteer, other)	HMO based (Kaiser Permanente)
INCLUSION CRITERIA:	Participants included all health plan members between the ages 50 and 70 years, who were continuously enrolled from 1998 to 2002, and completed an endoscopy during those years. Stratified random sample based on the algorithm's classification. 110 FS, 30 classified as diagnostic and 80 as screening, and 110 COLON, 30 diagnostic and 80 screening.
EXCLUSION CRITERIA:	Participants with a history of colorectal cancer were excluded (N = 1972). Of the 220, 32 excluded due to mismatches in participants endoscopy dates.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	NA
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	NA
STATISTICAL ANALYSES:	The authors conducted cross-tabulations between the algorithm and medical review classification to examine the sensitivity, specificity, and κ. The classification after medical record review was considered the gold standard.

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Haque et al.[103] **Year of publication:** 2005 **Dates of data collection:** **Trial name:** NA
	Sensitivity indicates the probability that a diagnostic endoscopy was classified as such by medical records review. Specificity indicates the probability that a nondiagnostic endoscopy was classified as screening. The κ indicates the overall agreement between the two sources.
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	NA
OUTCOME ASSESSMENT:	Endoscopies were identified using International Classification of Disease (ICD 9 CM) and Current Procedural Technology-4 codes.In instances in which a participant completed multiple endoscopies in the 5-year period, the authors retrieved data for the first endoscopy. FOBT (due to poor sensitivity) and BE (due to infrequent use) were not included in the study. The algorithm used automated data to presumptively classify the endoscopies as diagnostic or screening. Endoscopies were classified as diagnostic if automated data included certain gastrointestinal conditions in the year prior to the exam, or signs or symptoms or a FOBT in the 45 days prior. The study gastroenterologist (KRM) identified the conditions and signs and symptoms likely to result in diagnostic endoscopies.All other endoscopies were classified into the screening group. Two trained abstractors reviewed medical records from 1997 to 2002 to confirm endoscopy use. The abstractors also assessed screening or diagnostic indications for the endoscopies, including the presence of gastrointestinal conditions or signs and symptoms. To minimize interrater variability, one abstractor reviewed all participants' medical records classified as a diagnostic exam while the second reviewed all participants' medical records classified as a screening exam. Abstractors classified the endoscopies as diagnostic if the exam was a follow-up to a previous abnormality or when clear-cut conditions or signs and symptoms were present, using the same list and time frames as the algorithm. All other endoscopies were classified as screening.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	The sensitivities for identifying diagnostic sigmoidoscopy and colonoscopy were 48.1% and 23.8%, respectively. The algorithm missed most of the diagnostic endoscopies. Conversely, the sensitivities for identifying screening sigmoidoscopy and colonoscopy were high (87.9% and 84.4%, respectively) but were associated with low specificities. Comparison of classification by automated algorithm versus medical record review

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Haque et al.[103] **Year of publication:** 2005 **Dates of data collection:** **Trial name:** NA

	Classification by medical record review				
Classification by automated algorithm	Diagnostic (n = 90)	Screening (n=98)	% sensitivity	% specificity	kappa
Sigmoidoscopy					
Diagnostic	13	8	48.1 (13/27)	12.1 (8/66)	76.3
Screening	14	58	87.9 (58/66)	51.9 (14/27)	
Total	27	66			
Colonoscopy					
Diagnostic	15	5	23.8 (15/63)	15.6 (5/32)	44.2
Screening	48	27	84.4 (27/32)	76.2 (48/63)	
Total	63	32			

The authors conclude that studies relying solely on automated data overestimate screening rates if indication is not considered. They also conclude that the automated algorithm needs further improvements to better differentiate screening from diagnostic exams.

QUALITY RATING:	Fair

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			
Were the differential drop-out or response rates acceptable (≤ 15%)?			
Were intervention/exposure measures valid, reliable, and equally applied?	X		Algorithm developed by investigator
Were the outcome assessors blinded to the intervention or exposure status of subjects?		X	
Were outcome measures valid, reliable, and equally applied?		X	Medical chart review—single person review. Little detail on training provided, no IRR assessment done
Does the analysis control for baseline differences?			
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			
Were the statistical methods used to assess the abstracted outcomes appropriate?			
Were data inputs valid?	X		
Was an appropriate search strategy used to find data inputs?		X	Does not say how charts used were randomly selected
Were the calculations and statistical analyses adequate?	X		
Were appropriate sensitivity analyses conducted (especially for any variables that were not based on data from literature)?			
Other considerations:	X		
Quality Rating (Good, Fair, or Poor): Fair			

CD

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY: **Yield of claims data and surveys for determining cancer screening among health plan members**	**Authors, ref ID:** Pignone et al [104] **Year of publication:** 2009 **Dates of data collection:** **Trial name:** CHOICE
OBJECTIVE OR AIM:	To evaluate the independent and combined yield of claims and direct survey for identifying colorectal cancer screening among average risk health plan beneficiaries.
DESIGN:	**Setting:** 32 Primary care practices in Georgia, Florida taking part in a randomized trial of a CRC decision aid and practice-level academic detailing **Study design: Observational** **Duration (mean followup):** 2005-2007 **Overall study size (N enrolled/N analyzed):** 2558/1595 (responded to survey)
Sample size: **Describe intervention:**	**Group 1** 1595 none
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Claims data from Aetna
INCLUSION CRITERIA:	Members with ages between 52 and 80 years whose primary care physicians had agreed to participate in the CHOICE study
EXCLUSION CRITERIA:	Individuals at increased risk for colorectal cancer (because the intervention was designed for average-risk patients) or with medical conditions that would limit their ability to participate in the study or who might not be considered reasonable candidates for screening. Above average-risk persons were defined as adults with a personal history of colorectal cancer or polyps, a known history of colorectal cancer or polyps in a first-degree relative, or a known history of inflammatory bowel disease also, dementia, chronic obstructive pulmonary disease, heart failure, coronary artery disease, current treatment for cancer or history of metastatic cancer, cirrhosis, upper or lower gastrointestinal bleeding, unintentional weight loss of >10% within 6 months, blindness, or uncorrectable hearing impairment. To be excluded, the individual had to have at least two claims with either a diagnosis or procedure code indicating that they had one of these additional conditions.
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:** **Other:**	**Group 1** Age group 52-59 887 (69.90) 60-64 283 (22.30) 65-69 81 (6.38) 70-82 18 (1.42) % female 60% 75% white/ 19% black/ 6% other
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:** **Response Rates (e.g. for surveys):**	Overall Response rate was 62%
STATISTICAL ANALYSES:	**Describe: Descriptive analyses, logistic regression and examination of confounders**

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY: **Yield of claims data and surveys for determining cancer screening among health plan members**	**Authors, ref ID:** Pignone et al [104] **Year of publication:** 2009 **Dates of data collection:** **Trial name:** CHOICE
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	Yes
OUTCOME ASSESSMENT:	**Outcome Measures:** primary outcome was proportion of persons up to date with CRC screening Survey asked about individuals completion of CRC screening, whether even had and when tests were conducted Claims data on CRC screening, including FOBT (within 1 year), FS (5 years), colonoscopy (10 years) or BE (5 years), including most recent data for each type. Indication for the procedure was not specified.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes:** • Of 4,020 average-risk members identified, claims data indicated that 1,066 (27%) had recent colorectal cancer screening. Among the 1,269 average risk members with no evidence of screening by claims data who returned surveys, 498 (39%) reported being up-to-date with screening. • Combining claims data and survey data: • Prevalence of CRC screening, combining claims data plus self-reported data (and not including nonresponders to the survey): 47% • Prevalence of CRC screening, combining claims data plus self-reported data (assuming nonresponders were screened at the same rate as average-risk responders): 59%
QUALITY RATING:	Fair

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]	x		62% response rate
Were the differential drop-out or response rates acceptable (≤ 15%)?			Not known
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	x		However, screening vs. diagnostic procedures were not distinguished
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			NA
Were the statistical methods used to assess the abstracted outcomes appropriate?	x		
Quality Rating (Good, Fair, or Poor): Fair			

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY: Data sources for measuring colorectal endoscopy use among Medicare enrollees Evaluation of claims, medical records, and self-report for measuring fecal occult blood testing among Medicare enrollees in fee for service	**Authors, ref ID:** Schenck [105-106] **Year of publication:** 2007 and 2008 **Dates of data collection:** 1998-2002 **Trial name:**
OBJECTIVE OR AIM:	Comparison of different data sources used for measuring CRC testing
DESIGN:	**Setting:** **Study design: Observational** **Duration (mean followup):** Brief **Overall study size (N enrolled/N analyzed):** 936 eligible 561 analyzed
Sample size: **Describe intervention: NA**	**Overall** 561 endoscopy and FOBT
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Population – NC Medicare patients from 10 different counties
INCLUSION CRITERIA:	North Carolina Medicare enrollees, African American or white, in fee for service Medicare, between ages 55 and 80 without history of CRC, who had responded to a 2002 survey.
EXCLUSION CRITERIA:	HMO coverage or gap in coverage
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Race:**	**Overall** 50-64 10.5% 65-74 62.7% 75-80 26.8% 61% female African American 23.5% White 76.5%
Attrition/Drop-out (not available for endpoint measurement): **Adherence:** **Contamination:**	Overall – NA
Response Rates (e.g. for surveys):	Response rate to survey not reported. Sample consisted of 1001 persons who had responded to the survey.
STATISTICAL ANALYSES:	Describe: descriptive statistics, report to record ratio to detect bias, concordance amongst sources
ASSESSMENT OF EXPOSURES AND POTENTIAL CONFOUNDERS:	No
OUTCOME ASSESSMENT:	**Outcome Measures:** • Sigmoidoscoy, colonoscopy and FOBT (both at home and in office) • Ever use of an endoscopic procedure measured by survey, and date of most recent (outcome of FS in last 4 years and colonscopy in last 5 years) • FOBT, distinguishing in office from home, and whether test was part of a check up or because of a

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY: Data sources for measuring colorectal endoscopy use among Medicare enrollees Evaluation of claims, medical records, and self-report for measuring fecal occult blood testing among Medicare enrollees in fee for service	**Authors, ref ID:** Schenck [105-106] **Year of publication:** 2007 and 2008 **Dates of data collection:** 1998-2002 **Trial name:**
	problem, from survey • Medical record review (using a hierarchical algorithm to link the patient to a provider) to record date of endoscopic procedure, and whether screening or diagnostic; and dates of four most recent FOBTs • Claims (1/1998-12/2002) data using Medicare inpatient, outpatient, and physician claims. Screening and diagnostic codes were available.
RESULTS:	
KQ2 - What factors influence the use of colorectal cancer screening?	**Outcomes:** NA
KQ3 - Which strategies are effective in increasing the appropriate use of colorectal cancer screening and followup?	**Outcomes:** NA
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	**Outcomes:** NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	**Outcomes: %** Sigmoidoscopy: Self report 22.8; Claim 21.6; Medical record 15.2 Colonoscopy: Self report 38.5; Claim 35.1; Medical record 34.1 Endoscopy: Self report 50.1; Claim 44.9; Medical record 42.3 in last 5 yrs: Self report NR; Claim NR FOBT- home: Medical record 30.1 FOBT office: Medical record 31.4 FOBT in last year: Self report 28.7; Claim 21.2; Medical record 19.4 FOBT in last 2 years: Self report 44.0; Claim 34.2; Medical record 29.2 **Prevalence of endoscopy in the past year** Overall: Survey 50.1 Administrative 44.9 Medical record review 42.3 By sociodemographic characteristics:

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schenck [105-106]
Data sources for measuring colorectal endoscopy use among Medicare enrollees Evaluation of claims, medical records, and self-report for measuring fecal occult blood testing among Medicare enrollees in fee for service	**Year of publication:** 2007 and 2008 **Dates of data collection:** 1998-2002 **Trial name:**
	Age 55-64; 65-74; 65-80 Survey 50.8; 52.4; 44.0 Administrative 35.6; 43.9; 50.7 Medical record review 32.2; 40.7; 50.0 All African Americans; all whites; all women, all men: Survey 40.9; 52.9; 46.8; 55.3 Administrative 41.7; 45.9; 43.6; 47.0 Medical record review 42.4; 42.2; 42.7; 41.6 Less than high school; high school diploma; more than high school: Survey 28.7; 46.9; 59.8 Administrative 39.4; 45.9; 45.8 Medical record review 38.3; 41.8; 43.6 **Prevalence of FOBT in the past year** Overall: Survey 28.7 Administrative 21.2 Medical record review: 19.4 By sociodemographic characteristics: Age 55-64; 65-74; 65-80 Survey 35.2; 27.9; 28.4 Administrative 19.3; 21.0; 23.6 Medical record review: 19.3; 19.8; 19.6 All African Americans; all whites; all women, all men Survey 32.0; 27.8; 30.6; 25.9 Administrative 18.8; 22.4; 25.5; 15.3 Medical record review: 12.5; 21.9; 21.7; 16.7 Less than high school; high school diploma; more than high school Survey 26.6; 26.0; 31.6 Administrative 20.2; 20.4; 22.8

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schenck [105-106]
Data sources for measuring colorectal endoscopy use among Medicare enrollees Evaluation of claims, medical records, and self-report for measuring fecal occult blood testing among Medicare enrollees in fee for service	**Year of publication:** 2007 and 2008 **Dates of data collection:** 1998-2002 **Trial name:**
	Medical record review: 19.1; 16.3; 22.4 **Measures of concordance for endoscopy use** Administrative to medical record review Agreement: 95 (93-97) Kappa: 0.89 (0.81-0.98) Self-report to medical record review Agreement: 70 (66-73) Kappa: 0.39 (0.31-0.47) Self-report to administrative Agreement: 70 (66-74) Kappa: 0.40 (0.32-0.49) Agreement regarding test type (FS or colonoscopy) Claims to medical record review: 93 (88-97) Self-report to medical record review: 82 (75-89) Self-report to claims: 77 (70-85) Agreement regarding test purpose (screening or diagnostic): Administrative to medical record review: 52 (43-61) Self-report to medical record review: 65 (55-74) Self-report to administrative: 29 (20-36) **Measures of concordance for FOBT** Administrative to medical record review Agreement: 82 (79-85) Self-report to medical record review Agreement: 70 (66-74)

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY: Data sources for measuring colorectal endoscopy use among Medicare enrollees Evaluation of claims, medical records, and self-report for measuring fecal occult blood testing among Medicare enrollees in fee for service	**Authors, ref ID:** Schenck [105-106] **Year of publication:** 2007 and 2008 **Dates of data collection:** 1998-2002 **Trial name:**
	Self-report to administrative Agreement: 67 (63-71) Sensitivity analyses included: excluding claims of FOBT on day of medical visit; including all medical record review of FOBTs (likely including in-office, single card FOBTs with digital rectal exams); did not appreciably change the measures
QUALITY RATING:	Good

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			NA
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			Survey response not recorded; possibility that non respondents to survey would be different in some way to alter agreement between a survey response and medical records/chart review
Were the differential drop-out or response rates acceptable (≤ 15%)?			NA
Were intervention/exposure measures valid, reliable, and equally applied?			NA
Were the outcome assessors blinded to the intervention or exposure status of subjects?			NA
Were outcome measures valid, reliable, and equally applied?	x		
Does the analysis control for baseline differences?			NA
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			NA
Were the statistical methods used to assess the abstracted outcomes appropriate?	x		
Quality Rating (Good, Fair, or Poor): Good			

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schneider EC, et al.[107] **Year:** 2008 **Trial Name:**
RESEARCH OBJECTIVE OR AIM:	Evaluate quality measures by describing a field test of the colorectal cancer screening measure included in the Health Plan Employer Data and Information Set of the National Committee for Quality Assurance –
DESIGN:	**Setting:** 5 geographically dispersed healthcare plans that enrolled 189,193 considered eligible for CRC screening **Study design:** Observational **Duration (mean follow-up):** **Overall study size (N enrolled/N analyzed):** 1000 plus an additional random sample of 400 enrollees from the original health care plan cohort (3000 enrollees)
INTERVENTIONS: **Sample size:** **Describe intervention:**	NA
RECRUITMENT: **(population-based, clinic-based, volunteer, other)**	Each of the 5 enrolled health plans identified all enrollees > 51 y/o, sent this to RAND Corp for further analysis. Research staff at RAND Corp. randomly selected 1000 enrollees (200 per plan) who lacked evidence of CRC screening (based on administrative data). Then, medical record abstractors looked for evidence of CRC screening in these pts. Health plan also surveyed patients via mail. During a 6 week period, nonrespondents received 3 survey mailings + a reminder postcard and a final overnight mailing. Response rate was 48.1% (range 37.8% - 57.5%)
INCLUSION CRITERIA:	> or = 51 y/o continuously enrolled for at least 2 years in one of the 5 health plans
EXCLUSION CRITERIA:	NR
POPULATION CHARACTERISTICS: **Mean age & range (years):** **Sex (% female):** **Ethnicity:** **Other:**	Survey respondents older, longer enrollment Survey respondents more likely than non respondents to have evidence of CRC screening

OUTCOME ASSESSMENT:		Plan A	Plan B	Plan C	Plan D	Plan E
	Age of plan, y	53	19	17	17	17
	Submitted cohort aged 51-80 and enrolled continuously for 2 years	65,241	68,659	28,564	3,561	23,168
	Age, mean, y	64.2	60.9	59.7	58.8	57.4
	Female, %	54.1%	53.0	51.4	52.8	51.4
	Enrollment, mo	73.3	NA	69.1	83.1	46.8
	Survey rspndts	N=1250				
	Age, mean,y	65.9	60.4	60.9	59.4	56.8
	Female, %	58.9	51.7	50.2	54.7	51.3
	Enrollment, mo	76.5	NA	75.5	86.4	48.3

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schneider EC, et al.[107] **Year:** 2008 **Trial Name:**

Survey nonrespondents	N=1349				
Age, mean, y	64.6	60.3	59.9	58.8	56.7
Female, %	54.2	50.7	52.0	51.8	49.3
Enrollment,	81.8	NA	72.0	82.6	48.5

The authors defined, for each data source (administrative, medical record, and survey results), the data elements needed to implement all of the measure specifications. The authors developed a list of outpatient diagnosis codes that represent a prior diagnosis of colorectal cancer, *CPT* codes related to an acceptable screening procedure, and historical *CPT* codes used within the previous 10 years. For the medical record method, the authors designed an abstraction tool to collect data on screening tests, clinical risk factors for colorectal cancer, and evidence of limited life expectancy and trained experienced nurses from each health care plan during a pilot test of the abstraction protocol using a common set of records. For the enrollee survey, the authors developed a sequence of questions (based on the Behavioral Risk Factor Surveillance System) that addressed each of the screening tests, the time frames in which they occurred, and a measure of risk status based on report of a family history of colorectal cancer.

Data from all sources (administrative, survey, and medical record) were linked at the enrollee level to create a single analytic file. For each of the 4 colorectal screening tests, the authors compared across health care plans the percentage of sampled enrollees identified as screened based on administrative data and the percentage based on survey data. The authors could not determine the percentage screened by each test under the hybrid method because medical record abstractors were instructed to stop after identifying the occurrence of 1 of the tests. For the single measure that combined all tests, the authors calculated colorectal cancer screening performance scores based on administrative data only, survey data only, and combined administrative and medical record data (the hybrid method), weighing the medical record sample to represent the population from which they were drawn (unscreened based on administrative data).. Among the survey respondents, the authors assessed agreement of the sampled enrollees' screening status according to the survey data and the hybrid data. The authors compared the rate of screening among survey respondents and nonrespondents using the hybrid estimation procedure.

RESULTS:	
KQ4 - What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?	NA
KQ5 - What are the effective approaches for monitoring the use and quality of colorectal cancer screening?	Compared with survey non-respondents, respondents were older (60.4 vs. 59.4 years; *P*_.001) and had longer enrollment (73.3 vs. 67.6 months; *P* = .001), but the 2 groups had similar percentages of female participants (53.3% vs. 51.1%; *P* = .28). Survey respondents were more likely than non-respondents to have evidence of CRC screening (62.7% vs. 46.5%; p<0.001) The percentage of enrollees having specific tests varied between the administrative and survey data methods. In

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

STUDY:	**Authors, ref ID:** Schneider EC, et al.[107] **Year:** 2008 **Trial Name:**

health care plans A and E, the percentages of enrollees screened by FOBT according to the 2 methods were similar; in health care plan B, the percentage based on survey data was nearly twice that based on administrative data; and in health care plan C, the percentage based on administrative data exceeded that based on survey data. For the procedural tests (flexible sigmoidoscopy, doublecontrast barium enema, and colonoscopy), the rates based on survey data were 2 to 3 times higher than the rates based on administrative data.

Method	Plan A	Plan B	Plan C	Plan D	Plan E
FOBT					
Administrative	23.6	15.0	31.1	NA	24.7
Survey	25.4	26.3	20.5	21.8	25.1
Flex Sig					
Administrative	14.2	17.9	18.4	15.3	15.4
Survey	29.7	39.6	33.9	33.6	30.6
COLON					
Administrative	12.8	12.1	9.4	10.5	14.2
Survey	19.9	39.0	33.6	33.7	40.7

Using the single measure of screening (based on any 1 of the 4 tests), the percentage of enrollees with evidence of colorectal cancer screening varied substantially depending on the data sources used. For 4 of the 5 health care plans, the hybrid method produced a higher screening rate than the administrative data method. The difference ranged from 0 (health care plan A) to 14.9 (health care plan B) percentage points. For all 5 health care plans, the survey data method produced a higher calculated screening rate than the other 2 methods.

Method	Plan A	Plan B	Plan C	Plan D	Plan E
Administrative	41.5 (41.1-41.9)	38.6 (38.2-38.9)	47.1 (46.5-47.6)	27.3 (25.8-28.7)	44.4 (43.8-45.1)
Survey	53.2 (42.1-64.4)	69.7 (60.3-79.2)	55.0 (41.1-68.8)	62.1 (53.8-70.4)	66.2 (57.1-75.2)
Hybrid	41.5 (41.1-41.9)	53.5 (48.5-56.8)	52.6 (48.3-56.8)	38.8 (34.3-43.4)	45.6 (44.0-47.2)

ANALYSIS:	
ARE GROUPS COMPARABLE AT BASELINE:	
ASCERTAINMENT METHODS ADEQUATE AND EQUALLY APPLIED:	
STATISTICAL ANALYIS ADEQUATE:	
ATTRITION:	NA
Dropout (not available for endpoint measurement): **Adherence in control group:** **Contamination in control group:**	
Differential dropouts:	
QUALITY RATING:	Fair

Evidence Table 4. KQ5: Effective approaches for monitoring use and quality of colorectal cancer screening (continued)

Quality Assessment-Internal Validity for Observational Studies

	Yes	No	Other (CD, NR, NA)
Were the groups similar at baseline regarding the most important prognostic indicators?			
Were the drop-out or response rates acceptable (≤ 20%)? [If between 20% and 60%, check other and explain.]			RR varied among plans from 38% to 58%
Were the differential drop-out or response rates acceptable (≤ 15%)?			
Were intervention/exposure measures valid, reliable, and equally applied?	X		
Were the outcome assessors blinded to the intervention or exposure status of subjects?			
Were outcome measures valid, reliable, and equally applied?	X		Questions Based on BRFSS
Does the analysis control for baseline differences?			
Were important potential confounding and modifying variables taken into account in the design and analysis (e.g., through matching, stratification, or statistical adjustment)?			
Were the statistical methods used to assess the abstracted outcomes appropriate?			Very specific purpose to this study to compare results of 3 different methods of estimating overall screening rates. Hence outcomes not directly comparable to other studies.
Quality Rating (Good, Fair, or Poor): Fair			

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Appendix D

Appendix D. Excluded Studies

Study not conducted in US

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Wrong outcomes

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Wrong study design

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Does not address/answer a Key Question

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Appendix E

Appendix E: Colorectal Cancer Screening Technical Expert Panel (TEP) Members

TEP Member	Affiliation
David Ahlquist, M.D.	Mayo Clinic
James Allison, M.D.	University of California at San Francisco Kaiser Permanente Division of Research
Durado Brooks, M.D., M.P.H.	American Cancer Society
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Colorectal Cancer Screening Peer Reviewers

Peer Reviewers	Affiliation
Dennis Ahnen, M.D.	Denver Department of Veterans Affairs Medical Center and University of Colorado Denver School of Medicine
James Allison, M.D.	University of California at San Francisco Kaiser Permanente Division of Research
Durado Brooks, M.D., M.P.H.	American Cancer Society
Deborah Fisher, M.D., M.H.S.	Durham Veterans Affairs Medical Center Duke University
Robert Fletcher, M.D., M.Sc.	Harvard Medical School
Sujha Subramanian, Ph.D.	RTI International
Judith Walsh, M.D.	University of California at San Francisco
Evelyn Whitlock, M.D., M.P.H.	Kaiser Permanente Northwest

Appendix F

Appendix F: Characteristics of Studies with Poor Internal Validity

To assess the quality (internal validity or risk of bias) of studies, we used predefined criteria based on those described in the AHRQ Methods Guide for Comparative Effectiveness Reviews (ratings: good, fair, poor).[1] Elements of quality assessment for trials included, among others, the methods used for randomization, allocation concealment, and blinding; the similarity of compared groups at baseline; maintenance of comparable groups; overall and differential loss to followup; and the use of intention-to-treat analysis. We assessed observational studies based on the potential for selection bias (methods of selection of subjects and loss to followup), potential for measurement bias (equality, validity, and reliability of ascertainment of outcomes), adjustment for potential confounders, and statistical analysis.
In general terms, a "good" study has the least bias and results are considered to be valid. A "fair" study is susceptible to some bias but probably not sufficient to invalidate its results. The fair-quality category is likely to be broad, so studies with this rating will vary in their strengths and weaknesses. A "poor" rating indicates significant bias (stemming from, e.g., serious errors in design, analysis reporting large amounts of missing information, or discrepancies in reporting) that may invalidate the study's results.

To systematically rate studies, we designed and used a structured data abstraction form. Trained reviewers abstracted data from each study and assigned an initial quality rating. A second reviewer read each abstracted article, evaluated the accuracy, completeness, and consistency of the data abstraction, and confirmed the quality rating. If differences in quality ratings could not be resolved by discussion, a third senior reviewer was involved. The full research team met regularly during the article abstraction period to discuss global issues related to the data abstraction process. The following lists all the studies reviewed and rated as poor quality, with their design and primary reasons for the final rating.

Study	Design	Primary Reasons for Poor Quality Rating
Chan and Vernon, 2008[2]	RCT	High potential for bias. Study had high overall attrition and high differential attrition between the control and intervention groups.
Cronan et al., 2008 #2836}	Cross-sectional	High potential for selection bias. Reporting of enrollment was inadequate and distinguishing between screening and diagnostic testing was not possible.
Erban et al., 2001[3]	Cross-sectional	High potential for confounding bias. Baseline differences were not accounted for and reporting of statistical analysis was inadequate.
Farmer et al., 2008[4]	Cross-sectional	High potential for selection bias. Study had low response rates and high refusal rates. Screening behaviors and frequency of routine check-ups differed between responders and nonresponders
Fisher et al., 2006[5]	Modeling study	High potential that the model assumptions were invalid. Indirect costs were not included, future increased costs for use of fecal occult blood tests were not included.
Fitzgibbon et al., 2007[6]; Ferreira et al., 2005[7]; Wolf et al., 2005[8]	RCT	Cointerventions were not avoided and not assessed, making it difficult to determine the actual effect of either intervention. Reporting of randomization and blinding was inadequate.
Friedman et al., 2001[9]	RCT	High potential for selection bias. Study failed to randomize subjects adequately. Serious baseline differences between the groups were highly likely but difficult to assess with information provided.
Friedman and Borum, 2007[10]	Uncontrolled Experimental study	High potential for selection and confounding biases. Selection methods were inadequate. Study failed to control for confounding in the statistical analysis.
Ganz et al., 2005[11]	RCT	Reporting was inadequate for method of randomization and whether outcome assessors were blinded. Article does not report baseline screening status or change over time. Statistical

Study	Design	Primary Reasons for Poor Quality Rating
		methods were inadequate and included no adjustment for baseline screening status.
Goldberg et al., 2004[12]	RCT	Unable to determine potential for selection bias. Major elements of the study were not reported, including information on randomization process and allocation concealment, blinding of outcome assessors, and comparability of the groups at followup.
Green and Kelly, 2004[13]	Descriptive/ Correlational	High potential for selection bias. Results were potentially biased because the statistical analysis did not include important potential confounders.
Greiner et al., 2005[14]	Prospective observational	High potential for selection bias. Attrition rate was high, measures were not validated, and the statistical analysis did not include important potential confounders. Comparability of the groups at followup was not reported.
Harewood et al, 2002[15]	Case-control	High potential for selection and confounding biases. Reporting of baseline differences between the groups was inadequate and inadequate controlling for confounding in the analysis.
Honda, 2004[16]	Cross-sectional	High potential for selection bias. Response rate was low and the statistical analysis did not include important potential confounders.
James et al., 2002[17]	Cross-sectional	High potential for selection bias. Statistical methods inadequate to determine which factors are related to CRC screening adherence. Reporting inadequate.
James et al., 2008 #1369}	Prospective cohort	High potential for selection bias. Reporting of response rates and baseline differences was inadequate. Statistical methods were inadequate to determine which factors are related to outcomes.
Juon et al., 2003[18]	Retrospective cohort	High potential for bias. Reporting was inadequate such that determining whether sample characteristics met inclusion criteria was not possible.
Lane et al., 2008[19]	RCT	High potential for selection bias. Baseline differences of groups were not reported adequately and the statistical methods used to control for potential differences at baseline were inadequate. The attrition rate was high.
Lawsin et al., 2007[20]	Cross-sectional	High potential for selection bias. Outcomes measures were not validated. Reporting of statistical methods was inadequate to determine which factors were related to outcomes.
Marcus et al., 2005[21]	RCT	High potential for selection bias. Reporting was inadequate for numerous elements: randomization process, allocation concealment, blinding, and baseline characteristics of sample. Attrition rate was high.
Matthews et al., 2005[22]	Cross-sectional	High potential for selection bias. Reporting was inadequate and outcomes were not validated.
Miller et al., 2005[23]	RCT	High potential for selection bias. Reporting was inadequate. Attrition rate was high.
Patel, 2004[24]	Cross-sectional	High potential for selection bias. Reporting was inadequate. Potential bias at baseline but difficult to assess with information provided. Outcomes not validated and statistical methods did not adequately control for potential confounders. Attrition rate was high.
Powe et al., 2004[25]; Powe, 2002[26]	RCT	High potential for selection bias. Numerous elements were not reported, including randomization method and attrition rate.
Samuel et al., 2009[27]	Cross-sectional	High potential for selection bias. Reporting was inadequate on issues such as characteristics of sample population.
Sarfaty and Feng[28]	Prospective cohort	High potential for selection bias. Study had no comparison group. Reporting of measures and statistical methods was inadequate. Important potential confounders were not considered.
Teng et al., 2006[29]	Observational, cross-sectional	High potential for selection bias. Statistical analysis did not include important potential confounders. Outcomes measures (scales) were not validated in Chinese Americans and have not

Study	Design	Primary Reasons for Poor Quality Rating
		been pilot tested.
Tessaro et al., 2006[30]	Cross-sectional	High potential for selection bias. Reporting was inadequate, and baseline differences were not described adequately. Statistical methods were inadequate to determine which factors are related to CRC screening adherence.
Thompson et al ., 2006[31]	RCT	This study was included in KQ2 as a fair quality study but received a poor quality rating as a KQ3 include because there was high potential for selection bias. Reporting was inadequate, Baseline differences were not described adequately.
Walsh et al., 2005[32]	RCT	High potential for bias because of contamination. Randomization was done at the physician level not the patient level. No allocation concealment was done. Several elements were not reported, including blinding of outcome assessors, information on comparability of the groups at the patient level, and attrition.
Wong, [33]	Cross-sectional	High potential for measurement bias, selection bias and confounding. Reporting was inadequate. Important confounders were not accounted for in the statistical analysis.
Wolf et al., 2001[34]	Cross-sectional	High potential for selection bias. Analysis did not control for important potential confounding variables.
Wolf et al., 2006[35]	Observational	High potential for selection bias and confounding. High potential for measurement bias (outcome measures not valid and reliable, and outcome assessors not masked). Insufficient baseline data reported. Statistical analysis did not account for potentially important confounders.
Yepes-Rios et al., 2006[36]	Cross-sectional	Potential for selection bias. Response rate was very low.

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Appendix G

Appendix G: Additional Material for KQ 4

This Appendix provides supplemental information for KQ4. In addition to the outcomes described in Chapter 3, we found data in the included studies on current volume by provider type and geographic variation in current volume and additional available capacity. Because these measures are related to our outcomes of current volume and additional available capacity, we have completed summary tables and text for these and included here as an Appendix. We also found four additional studies that reported on current volume and additional available capacity in individual states (vs. national level-data reported in Chapter 4). Because results from these studies did not change our conclusions from the national data, we have included them also as part this Appendix rather than in the main text.

The following tables and text provide data on three types of studies: current volume by provider type; geographic variation in current volume and additional available capacity; and current volume and additional available capacity in three states.

Current Volume of Procedures, by Provider Type

Study characteristics. Three studies reported on the distribution of provider types for current volume of FS and colonoscopy (Table G-1).[1-3] No study reported projected capacities based on hypothetical scenarios of changes in workforce composition. We rated one study good quality[3] and two as fair quality.[1-2] Two studies surveyed physicians and measured current volume and provider distribution by self-report of the physician or practice;[1,3] one study used claims data from two federal insurers (Medicare and TRICARE)[2] to analyze provider type for procedures.

Overview of results. Studies varied in terms of methods (self-report of procedures vs. claims analysis) and had slightly different categorizations of providers. Not surprisingly, results were dissimilar in terms of proportion of procedures (flexible sigmoidoscopy [FS] and colonoscopy) conducted by different provider types.

Detailed assessment, FS. A study by the National Cancer Institute (NCI), which surveyed three types of endoscopic providers, found that FSs in 2003 were performed by primary care physicians (65%), gastroenterologists (25%) and surgeons (11%).[1] Seeff et al.,[3] in a survey of a national sample of endoscopic facilities, found that FSs were conducted by gastroenterologists (44 percent), primary care physicians (25 percent), surgeons (21 percent), and other providers (11 percent).

Detailed assessment, colonoscopy. Across the three studies (which include four different samples, as one study included TRICARE and Medicare data as separate samples), the range of proportions of colonoscopies conducted by gastroenterologists was 66 to 83 percent; the range of proportions of colonoscopies conducted by surgeons was 11 to 33 percent.[1-3] In two studies that used survey data,[1,3] the proportion of colonoscopies performed by primary care providers was 1 to 2 percent. In the third study,[2] the groups were categorized slightly differently; this study found that 10 percent of colonoscopies were performed by internal medicine physicians.

Table G-1. Current volume of procedures, by provider type

Author, Year Study Design Setting	Results	Quality Rating
Brown et al., 2003[1] Cross-sectional and modeling National sample of MDs (primary care physicians, general surgeons, gastroenterologists)	Percentage of FSs conducted (in 2000) by: Gastroenterologists 25% Primary care physicians 65% Surgeons 11% Percentage of colonoscopies conducted by: Gastroenterologists 66% Primary care physicians 1% Surgeons 33%	Good
Robertson et al., 2006[2] Cross-sectional secondary data analysis Medicare and TRICARE populations	Percentage of colonoscopies conducted (in 2001) by: Gastroenterologists 66% (Medicare) and 73% (TRICARE) Internal medicine physicians 10% (Medicare) and 10% (TRICARE) Surgeons 13% (Medicare) and 11% (TRICARE) Other 11% (Medicare) and 6% (TRICARE)	Fair
Seeff et al., 2004[3] Cross-sectional National sample of endoscopy practices	Percentage of FSs conducted (in 2002) by: Gastroenterologists 44% Primary care physicians 25% Surgeons 21% Other 11% Percentage of colonoscopies conducted by: Gastroenterologists 83% Primary care physicians 2% Surgeons 11% Other 5%	Fair

FS, flexible sigmoidoscopy.

Regional Variation in Colorectal Screening Capacity

Study characteristics. Three studies[3-5] examined how capacity to deliver CRC endoscopic screening varies across geographic regions (Table G-2). One study was rated good[3] and two fair quality.[4-5] One study divided the nation into four census regions;[3] two studies examined rural and urban differences in CRC endoscopic capacity.[4-5]

Overview of results. No conclusions can be made from the very few studies available that examine how additional available capacity varies by geographic region.

Detailed assessment: The single study examining national variation in capacity for CRC screening found that additional available capacity for FS and colonoscopy is the lowest in the South.[3] In the study taking place in Montana,[4] urban hospitals had more resources in terms of facilities to conduct screening but also less additional available capacity. One-third of the population in this state lived in urban areas, where half of the total capacity was located but where only one-quarter of the unused capacity was located. In comparison, 65 percent of the population lived in rural areas, where half of the total capacity exists, but where three-quarters of unused capacity was located. In the study from Arizona,[5] the vast majority of endoscopic procedures were performed in urban areas, and were colonoscopies in both regions (91% in urban and 97% in rural areas). Estimates of additional available capacity were higher in rural than in urban areas (53.1% and 35.7% of current volume, respectively).

Table G-2. Regional variation in current volume and additional available capacity for colorectal cancer screening

Author, Year Study Design Setting	Data Collection	Results	Quality Rating
Seeff et al., 2004[3] Cross-sectional National sample of endoscopy practices	Current volume and additional available capacity estimated by survey of sample of practices performing FS or colonoscopy	Additional available capacity for FS and colonoscopy greatest in the South in terms of absolute number as well as percentage of potential volume that is additional available capacity; lowest additional available capacity in terms of absolute number is the West; in terms of percentage it is the Northeast	Good
Ballew et al., 2009[4] Cross-sectional and modeling Montana population	Current volume and additional available capacity estimated by survey of all hospitals and ambulatory surgical centers	Uneven distribution of current volume and additional available capacity in Montana, a large and primarily rural state Urban hospitals had more resources but also less additional available capacity 35% of the population lived in urban areas where 49% of the total capacity was located but where only 24% of the unused capacity was located; 65% of the population lived in rural areas where 51% of the total capacity exists but where 76% of unused capacity was located	Fair
Benuzillo, et al., 2009[5] Cross-sectional Arizona population	Current volume and additional available capacity estimated by survey of gastroenterologists and colorectal surgeons	Overall, physicians reported performing 8,717 weekly endoscopic procedures (8,312 in urban and 405 in rural areas). While only 5% of all procedures were performed in rural areas, the additional available capacity was greater for rural than urban areas (53.1% and 35.7% of current volume, respectively).	Fair

FS, flexible sigmoidoscopy.

State-Level Estimates of Ability of Current Volume or Additional Available Capacity of Colonoscopy to Meet Projected Demand, By Different Demand Scenarios

Study characteristics. Four studies examined state-level current volume for colonoscopy;[4-7] three of these also reported additional available capacity for colonoscopy (Table G-3).[4-5,7] All four studies were rated fair quality and relied on self-report of surveyed providers or endoscopic screening facilities. Each study that conducted modeling of demand[4,6-7] used census data with varying types of refinements to estimate projected demand and ability of capacity to meet that demand. One study used projected changes in capacity as part of the calculations;[6] two studies[4,7] described the ability of current capacity to meet projected increased demand (under different scenarios). The studies reported data from Arizona, Montana, New Hampshire, and New Mexico.

Overview of results. Differing estimates of current volume were described by two studies; 16 or 20 colonoscopies per week per provider in New Mexico,[7] a similar number in Arizona, [5] and approximately 40 colonoscopies per month per provider in Montana.[4] Three studies found substantial levels of available, unused capacity: 41 percent of current volume in New Mexico[7] and 63 percent in Montana[4] is available but unused capacity for colonscopy. In Arizona, 36.5%

of endoscopic capacity is available but unused.[5] Three studies used simple modeling with varying assumptions and presented different scenarios of projected demand. The Montana study estimated that, using all additional available capacity, the unscreened population in Montana could be screened using colonoscopy by 2013.[4] The New Hampshire study[6] reported that if capacity (measured by current volume) were to rise by 20 percent, with 60 percent of procedures available for screening, and if compliance with CRC screening increased to 70 percent, capacity would almost meet demand. The New Mexico study concluded that the additional available capacity in New Mexico was sufficient to increase the prevalence of screening rates by 15 percent.[7]

Table G-3. State-level estimates of colonoscopy current volume, additional available capacity, and ability to meet projected demand

Author, Year Study Design Setting	Data Collection	Data Inputs/Model Description	Results	Quality Rating
Ballew et al., 2009[4] Cross-sectional and modeling Montana population	Current volume and additional available capacity estimated by survey of all hospitals and ambulatory surgical centers	Time to screen all unscreened persons with colonoscopy estimated using census data	Current volume (2008): 36,636 colonoscopies per year 54% of procedures for screening Additional available capacity of colonoscopy: 23,096 (63%) Using 100% of additional available capacity, full coverage by colonoscopy could be achieved by 2013	Fair
Butterly et al., 2007[6] Cross-sectional plus modeling New Hampshire population	Current volume estimated by surveys of all endoscopy sites	Census data used to estimate demand at varying rates of compliance of entire population with colonoscopy, percentage of procedures done for screening, and increases in capacity	Current volume (2003-2004): Average of 39-43 colonoscopies per endoscopist per month Average of 60% of colonoscopies conducted for screening If capacity increases by 20%, at the current rate of 60% of procedures for screening, and estimated 70% compliance rate, capacity would almost meet demand	Fair
Benuzillo, et al., 2009[5] Cross-sectional Arizona population	Current volume and additional available capacity estimated by survey of gastroenterologists and colorectal surgeons	Modeling not performed	Current volume (2004): Average of 20 colonoscopies per gastroenterologist and 14 per colorectal surgeon per week. Overall 8,717 endoscopic procedures/week. Additional available capacity: 3,183 (36.5%) for colonoscopy and FS combined	Fair
Hoffman et al., 2005[7] Cross-sectional plus modeling New Mexico population	Current volume and additional available capacity estimated by endoscopist survey	Census data used to model demand if prevalence of screening increased by 5%-25%	Current volume (2001): Median of 16 (group practice) or 20 (solo practice) colonoscopies per endoscopist per week Total of 832 per week Additional available capacity for colonoscopy : 342 per week (41%) Additional available capacity estimated to increase the prevalence of current colonoscopy screening by 15% above current levels	Fair

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