



**NATIONAL INSTITUTES OF HEALTH
STATE-OF-THE-SCIENCE CONFERENCE STATEMENT**

NIH State-of-the-Science Conference:
Enhancing Use and Quality of Colorectal Screening
February 2–4, 2010

National Institutes of Health (NIH) consensus and state-of-the-science statements are prepared by independent panels of health professionals and public representatives on the basis of (1) the results of a systematic literature review prepared under contract with the Agency for Healthcare Research and Quality (AHRQ), (2) presentations by investigators working in areas relevant to the conference questions during a 2-day public session, (3) questions and statements from conference attendees during open discussion periods that are part of the public session, and (4) closed deliberations by the panel during the remainder of the second day and morning of the third. This statement is an independent report of the panel and is not a policy statement of NIH or the Federal Government.

The statement reflects the panel's assessment of medical knowledge available at the time the statement was written. Thus, it provides a "snapshot in time" of the state of knowledge on the conference topic. When reading the statement, keep in mind that new knowledge is inevitably accumulating through medical research.

Introduction

Colorectal cancer is the third most common cancer, and the second leading cause of cancer deaths, in the United States. Each year, nearly 150,000 people are newly diagnosed with colorectal cancer and 50,000 die. Polyps are abnormal growths of tissue along the lining of the colon. Many polyps are harmless, but a common type of polyp, the adenoma, can develop over time into a colorectal cancer. An effective way to reduce mortality from colorectal cancer is to screen for it and its precursor, the adenoma. Although screening methods have been available for decades and new methods continue to develop, screening rates remain low. The purpose of this conference was to analyze national screening rates for colorectal cancer, identify the barriers to screening, and propose solutions to increase screening rates. Evaluating or establishing the comparative effectiveness of the various colorectal cancer screening options was beyond the scope of this conference and not part of the charge to this panel. Nonetheless, the panel recognized that high-quality evidence about the comparative effectiveness of the various current and emerging screening modalities is needed and must be a scientific priority.

Screening is defined as the testing of individuals for a disease prior to the onset of any symptoms. The goal of colorectal cancer screening is to reduce disease-specific mortality through prevention and early detection.

Colorectal cancer screening, as with any screening test, is most effective when it is applied to a large percentage of eligible people and utilized appropriately. Major published guidelines describe the eligible target population for colorectal cancer population-based screening as persons over age 50 at average risk of colorectal cancer (i.e., those who do not have

family history, genetic predisposition, or underlying disease that predisposes to colorectal cancer). When a polyp is detected by any method, subsequent follow-up by colonoscopy is referred to as surveillance.

To provide health care providers, public health practitioners, policymakers, and the general public with a comprehensive assessment of how colorectal cancer screening and surveillance are most appropriately implemented, monitored, and evaluated for U.S. populations at average risk, the National Cancer Institute and the Office of Medical Applications of Research of the National Institutes of Health convened a State-of-the-Science Conference on February 2-4, 2010, to assess the available scientific evidence. The key questions that the panel were asked to address were the following:

- What are the recent trends in the use and quality of colorectal cancer screening?
- What factors influence the use of colorectal cancer screening?
- Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?
- What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?
- What are the effective approaches for monitoring the use and quality of colorectal cancer screening?
- 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?

During the first 2 days of the conference, experts presented information on each of the key questions. After weighing the scientific evidence—including the data presented by the speakers, input from attendees, and a formal evidence report commissioned through the Agency for Healthcare Research and Quality (AHRQ)—an independent panel prepared and presented a draft of this State-of-the-Science Statement addressing the conference questions. The evidence report prepared for the conference is available at: <http://www.ahrq.gov/clinic/tp/crcprotp.htm>.

1. What are the recent trends in the use and quality of colorectal cancer screening?

In the United States, colorectal cancer screening is underused. (Underuse is defined as the circumstances in which people are not screened or are screened at a lower rate than recommended by applicable guidelines.) Data regarding colorectal cancer screening rates arise from multiple sources including patient and population surveys, administrative data, and chart reviews from health systems and medical practices. Unfortunately, a central registry with uniform data guidelines is lacking, thus limiting more detailed analysis. In general, there has been a slow, steady upward trend in colorectal cancer screening rates within the target population (adults age 50 and older), with overall screening rates increasing from 20 to 30 percent in 1997

to nearly 55 percent in 2008. Despite this positive trend, millions of eligible people are not screened by any method.

Table 1. Colorectal cancer screening recommendations from the U.S. Preventive Services Task Force and the American Cancer Society-U.S. Multisociety Task Force

Screening Test	Description	United States Preventive Services Task Force (USPSTF)	American Cancer Society–U.S. Multi-Society Task Force (ACS-USMSTF)
Fecal occult blood test (FOBT)* and fecal immunochemical test (FIT)*	Examination of the stool for traces of blood not visible to the naked eye	Recommends high-sensitivity FOBT and FIT annually for ages 50-75	Recommends high-sensitivity FOBT and FIT annually for ages ≥ 50
Sigmoidoscopy*	Internal examination of the lower part of the large intestine	Recommends every 5 years with high-sensitivity FOBT and every 3 years for ages 50 - 75	Age ≥ 50 , every 5 years
Double-contrast barium enema*	X-ray examination of the colon	--	Age ≥ 50 , every 5 years
Colonoscopy	Internal examination of the entire large intestine	Recommends every 10 years for ages 50-75	Age ≥ 50 , every 10 years
Computed tomography colonography*	Examination of the colon and rectum using pictures obtained using a computed tomography scanner	--	Age ≥ 50 , every 5 years
Fecal DNA*	Examination of the stool for traces of colorectal cancer DNA	--	Age ≥ 50 , interval uncertain

* *Positive findings require follow-up colonoscopy.*

Major national guideline-making bodies, including the USPSTF and ACS-MSTF, recommend various efficacious tests for colorectal cancer screening (see Table 1). These include annual high sensitivity fecal occult blood testing (FOBT) including immunochemical tests, flexible sigmoidoscopy or double-contrast barium enema every 5 years, and colonoscopy every 10 years. The ACS-MSTF also includes computed tomography colonography every 5 years as a screening option. A positive result of an FOBT, flexible sigmoidoscopy, double-contrast barium enema, or computed tomography colonography should be followed by a colonoscopy.

Before the emergence of colonoscopy, FOBT and flexible sigmoidoscopy were the most widely used screening tests for the general population. Colonoscopy soon replaced these tests as the most used screening method, and its use increased rapidly after Medicare initiated coverage for screening colonoscopies in July 2001; it continues to be the most widely used test today. Conversely, since 2001, a nearly reciprocal decrease has occurred in the number of flexible sigmoidoscopies (see Figure 1). Double-contrast barium enema has fallen out of favor over the same time, and fewer radiologists now perform this exam. Overall use of FOBT has declined

more gradually, and immunochemical testing has increased relative to guaiac testing. These stool tests remain widely utilized in the U.S. Department of Veterans Affairs (VA) system and some managed care systems nationwide.

Because the federally funded clinical trial demonstrating the accuracy of computed tomography colonography for the detection of large adenomas and cancers was only recently completed, the use of computed tomography colonography is rapidly changing. Therefore, national usage trend data for that screening test are not yet available.

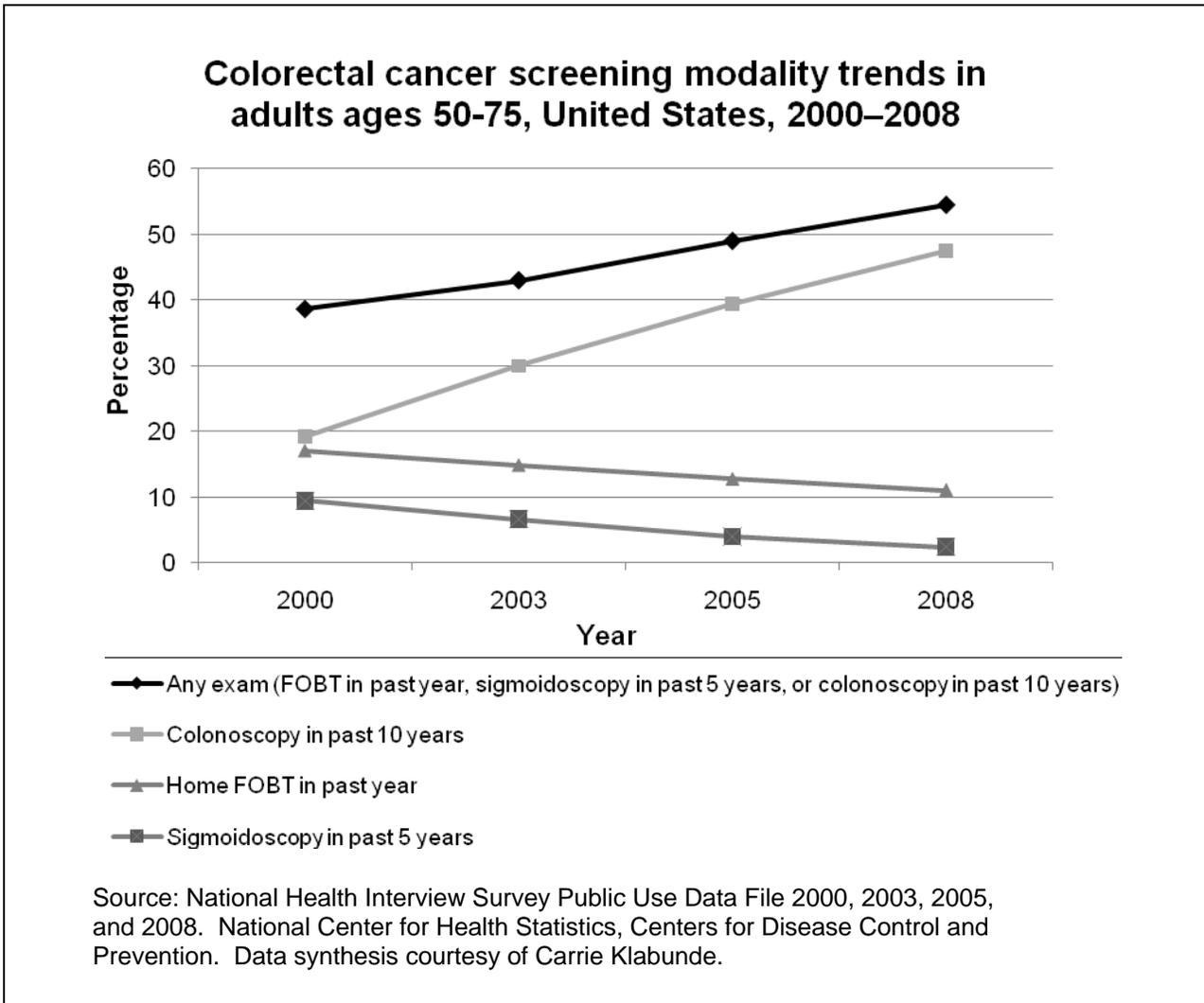


Figure 1. Testing options vary in the amount of preparation and effort required by patients. For example, colonoscopy and computed tomography colonography require preparation to cleanse the colon completely, which takes time and is inconvenient and unpleasant. FOBT requires patients to collect stool samples at home and return them to their provider. Testing costs also vary among testing options.

Although a primary emphasis of this conference involved analyzing and exploring ways to increase colorectal cancer screening rates, some problematic issues with the use of colorectal cancer screening are not to be overlooked.

For example, screening is overused when patients with severe comorbidities and limited life expectancy who are unlikely to benefit from prevention or early detection are screened, or when colonoscopies are performed more frequently than most guidelines recommend.

Misuse involves screening that is conducted in a suboptimal way such that the potential benefits are not achieved—for example, an FOBT test conducted using in-office stool samples rather than the recommended home technique. Methods to address these quality issues are discussed later in this report.

Finally, some of the most sensitive techniques for colorectal cancer and polyp detection carry risks for adverse events. For example, colonoscopy requires sedation and carries the risk of colon perforation, which, although uncommon, is potentially serious. Computed tomography colonography carries a theoretical risk from radiation exposure. Optimal performance of these procedures requires adequate training and should be monitored.

2. What factors influence the use of colorectal cancer screening?

For the purposes of this report, the factors associated with the use of colorectal cancer screening are characterized as patient-related factors, physician-related factors, and system-related factors.

What Is Known

Patient Factors. The most important factors related to being screened for colorectal cancer are having insurance coverage, access to a usual source of health care, or both. In addition, two socioeconomic characteristics—income and education level—are important correlates of screening. These factors are all highly correlated; for example, compared to the average person, one who is more educated is likely to be more knowledgeable about the risks and benefits of colorectal cancer screening, to have a higher income, to have health insurance, and to have a usual source of care. Nevertheless, each of these factors has an independent effect on screening rates.

There are differences in screening rates across racial and ethnic groups. Relative to non-Hispanic whites, blacks and Hispanics are less likely to be screened. Once socioeconomic characteristics are taken into account, the differences in screening rates are attenuated. Within given racial or ethnic groups, differences occur in screening across subgroups. For example, among Asians, Koreans have lower rates of screening, and among whites, those living in Appalachia have lower rates of screening.

People who were born abroad and have shorter residency in the United States or who do not speak English as their primary language (less acculturated) are less likely to be screened. Gender has a complex relationship to colorectal cancer screening. Overall there is no difference

between genders, however, in some ethnic/age subgroups, men have lower screening rates; in other subgroups women have lower rates. Older patients (age 60-75 years) are more likely to be screened than younger patients (age 50-59 years). People who have had more contact with the health care system are more likely to be screened. People who have been screened for other types of cancer (breast, cervical, or prostate cancer) are more likely to be screened for colorectal cancer.

Additional patient factors positively associated with being screened are a person's knowledge about the test, a perceived risk of developing colorectal cancer, a positive attitude about screening tests in general, and a belief that the test is safe. Those attitudes associated with not being screened include the invasiveness of endoscopy, anxiety about test outcomes, and a belief that healthy people do not need to have the test.

Physician Factors. A recommendation from a physician is the only physician-related factor consistently predicting colorectal cancer screening. The relationship between physician characteristics such as age, gender, years of training, and specialty and screening rates in populations has not been well established.

Systems Organization. Only a limited number of studies have looked at whether the way a practice is organized has an effect on whether patients are screened. However, some research suggests that those practices that have electronic medical record reminder systems, ancillary personnel who can facilitate follow-up arrangements, and patient navigators have had the most success.

Establishing a screening program is difficult because it has many components. However, the data suggest a number of effective programs. One set of examples exists within integrated systems of care: for example, Kaiser Permanente has screening rates of 75 percent in the Medicare population, and the VA has screening rates of 80 percent. These programs were based on FOBT that incorporated direct mailing, focused reminders, and careful follow-up of positive results with colonoscopy.

What Needs To Be Learned

As noted above, colonoscopy use has increased substantially since 2001, while use of FOBT has declined. It is important to know more about the factors that lead physicians to recommend, or patients to choose, one test over another. Financial considerations, such as differential reimbursement rates for different tests, may affect physicians' decisions to recommend lower endoscopy. A likely factor affecting patient choices is cost sharing. Another factor affecting both groups is a perception that colonoscopy is the gold standard, despite the absence of randomized clinical trial evidence supporting the test's relationship to morbidity and mortality. Studies of screening usually characterize the population as insured or uninsured. However, the structure of health insurance is highly variable. When studying insurance, it would be better to have a more detailed characterization. For example, among persons with Medicare, those with supplemental policies are more likely to be screened.

Since the National Committee for Quality Assurance (NCQA) implemented Healthcare Effectiveness Data and Information Set (HEDIS) measures for colorectal cancer screening, screening rates have increased for enrollees of commercial managed care plans, but not for those of the Medicare managed care plans. More information is needed about the potential of public reporting to affect use and quality.

Based on the Centers for Disease Control and Prevention's (CDC) experience with the National Breast Cancer and Cervical Cancer Early Detection Program (BCCEDP), the CDC has launched a new program to expand colorectal cancer screening for uninsured and underinsured persons in certain states. It is too early to assess the impact of this new program.

Although race/ethnicity, socioeconomic factors, awareness, and insurance are associated with colorectal cancer screening, the specific reasons for these associations are little understood. What drives the association between race, gender, and screening rates? How do we determine the components necessary for informed and preference concordant decision-making (e.g., awareness of the prevalence of colorectal cancer, harms and benefits of screening, pros and cons of each test)?

3. Which strategies are effective in increasing the appropriate use of colorectal cancer screening and follow-up?

What Is Known

The literature documents three broad areas that show some evidence of effective interventions at the patient, provider, and health system level. However, a limited number of studies have examined the effectiveness of health care provider-based interventions.

Effective patient-level interventions include reducing structural barriers (e.g., direct-mailing of FOBT kits), one-on-one interaction with a health care provider or health educator, and patient reminders (e.g., telephone calls, postcards). For some other patient-level interventions, such as group education and small-scale media campaigns, there is insufficient evidence to determine effectiveness.

Although few studies have assessed the effectiveness of provider interventions, the VA system has successfully increased colorectal cancer screening with a multimodality approach that includes provider trainer, computerized reminders, audit and feedback, as well as coordinated care between primary care physicians and gastroenterologists.

Effective interventions at the health care system level refer to the implementation of system-based changes to increase the number of referrals for screening. Studies conducted within integrated health care systems—such as VA, Kaiser Permanente, and the National Health Service in the United Kingdom—have found that organized approaches to screening dramatically increased colorectal cancer screening rates. In addition, some studies have documented the effectiveness of patient navigators (or similar approaches) when used as part of a health care system's intervention.

What Needs To Be Learned

There is limited knowledge regarding the effectiveness of colorectal cancer screening interventions across racial/ethnic, socioeconomic, and geographic groups. Moreover, it is unclear whether interventions targeting one group can be implemented successfully in other groups or whether various cultural groups require specially tailored interventions.

The scientific evidence is mixed regarding the effectiveness of community-based interventions for increasing colorectal cancer screening. In most cases, these interventions are a constellation of multiple efforts—for example, multimedia educational campaigns (e.g., billboards, radio ads), town hall-type meetings, and community health workers. However, the design of these studies often makes it challenging to identify which of these components (or which combination) is effective.

There is also a need to understand more about what health education or mass media messaging strategies would be most effective in motivating patients to participate in screening efforts. It is unclear how the effectiveness of these messages may differ among screening modalities.

The effect of patient preferences on colorectal cancer screening rates has not been well studied. We know very little about how preferences for screening modalities are formed; how they are related to knowledge, beliefs, and cultural norms; and whether these preferences vary across sociodemographic groups. It is also unknown whether patient preferences change over time; it is also unknown what factors may influence that change. Given the multiple options for colorectal cancer screening, interventions that provide decision support and incorporate patient preferences may be effective at increasing colorectal cancer screening rates across diverse populations.

Financial incentives have been shown to influence patient and provider behavior in other diseases; yet little research is available on the impact of financial incentives on colorectal cancer screening rates. In the era of pay for performance, it is important to understand how financial incentives to providers or practices affect colorectal cancer screening rates. Similarly, more information is needed on how incentives directed at patients are likely to impact screening rates. In addition, more information is needed on optimal levels of incentives at both patient and provider levels as well as on effective implementation and monitoring strategies.

There are multiple screening options for colorectal cancer, unlike for other cancers. This increases complexity for both patients and providers. It is unknown how the complexity of colorectal cancer screening affects screening rates.

Some of the gaps in knowledge regarding effective interventions for increasing colorectal cancer screening rates—especially in ethnic minority, underserved, and uninsured populations—are partly due to limitations of existing research methodology. Randomized clinical trials have been adopted as the “gold standard” for assessing the effectiveness of interventions; yet in some instances, these trials may be impractical or unethical. Therefore, well-designed interventions

that propose alternative methods (e.g., quasi-experimental designs, community-based participatory research, times series) should be encouraged.

4. What are the current and projected capacities to deliver colorectal cancer screening and surveillance at the population level?

In planning the implementation of population-based screening programs, the current and future capacity to provide the various recommended screening modalities must be considered. Capacity involves not only laboratory and endoscopic facilities and providers, but also support for informed decision-making as well as the primary care resources needed to coordinate screening services, to communicate results effectively, and to track and follow up positive screening findings.

What Is Known

Few studies, primarily conducted in the early 2000s, have addressed the topic of capacity to deliver colorectal cancer screening. Furthermore, the available data focus on endoscopic capacity. These data are limited by the uncertain validity of self-reported data from provider or facility endoscopists on current practice volume and available capacity, the lack of standard definitions, and the lack of distinction between screening and surveillance colonoscopy. Notably, these studies have produced widely variable results, likely reflecting differences in assumptions about uptake, the size of the eligible population, and the available workforce and facilities. In addition, they fail to account for the resources needed to reach the large numbers of individuals who are currently unscreened.

Different resources are needed for different screening modalities. Although sampling for FOBT is self-administered, laboratory facilities are needed to analyze and interpret results; endoscopy requires dedicated facilities with highly trained providers and staff and expensive equipment. It is important to note that although multiple screening strategies are available, positive results of FOBT, flexible sigmoidoscopy, flexible sigmoidoscopy/FOBT, and computed tomography colonography all require subsequent colonoscopy. If FOBT were used as the primary screening strategy, estimates suggest that there is currently sufficient colonoscopy capacity to follow up positive FOBT results. If flexible sigmoidoscopy or flexible sigmoidoscopy/FOBT were used as the primary screening strategy, it is unlikely that current flexible sigmoidoscopy capacity is sufficient; however, current colonoscopy capacity may be sufficient to follow up positive flexible sigmoidoscopy results. If colonoscopy were the primary screening strategy, there is substantial uncertainty that current colonoscopy capacity would be sufficient. Some modeling estimates suggest that colonoscopy capacity may be sufficient if screening targets are achieved over a 5- to 10-year period.

What Needs To Be Learned

Given the uncertainty of the available evidence and the wide variability across studies, additional data are needed to generate more precise estimates of the current and projected endoscopic capacity, the projected demand, and the impact of overuse and misuse on capacity estimates. Also needed is a better understanding of other aspects of capacity, including provider

training, required personnel, and other resources needed to maximize appropriate use of screening and surveillance and to monitor quality. One aspect of this involves developing strategies to ensure that individuals have the resources and support necessary to make informed choices about screening modalities that are most consistent with their preferences.

Because it is unlikely that current capacity is sufficient for strategies other than universal FOBT screening, expansion of endoscopic capacity may be needed. A first step may be to examine the feasibility of increasing productivity or efficiency of existing facilities. Expanding high-quality endoscopy training to more providers, including non-physicians, may also be warranted. Such expansion would require careful consideration of quality and patient satisfaction. Also needed is evaluation of the role of incentives, disincentives, and third-party payment policies for performing endoscopy.

It is clear that capacity varies widely by geographic region and urban/rural location, and therefore, national capacity may not reflect local capacity. The needs of communities vary; identifying strategies to match capacity with need is critical. For example, evaluation is needed to understand whether incentives for providing screening services in underserved areas will ameliorate the uneven distribution of resources.

As additional screening strategies are developed and become more widely adopted, their role in the delivery of population-based colorectal cancer screening and the impact on overall capacity must be considered. Capacity estimates must be responsive to new evidence about the comparative effectiveness of screening strategies, changes in screening recommendations, and shifts in preferences for various tests.

5. What are the effective approaches for monitoring the use and quality of colorectal cancer screening?

At present, no comprehensive system in the United States effectively monitors the use or quality of colorectal cancer screening across a range of populations and for all approved modalities. Effective monitoring of screening is complicated by the variety of screening methods and the varying intervals for screening among methods (e.g., 10 years for colonoscopy vs. annually for FOBT). This variety of modalities also complicates monitoring because some approaches (e.g., colonoscopy) require more resources than others (e.g., FOBT). Ultimately, a robust system should be usable for setting and monitoring population-based goals and should contribute to improved understanding of the relative benefits of different screening strategies as well as factors associated with optimal use of each approach. The system should be of a sufficient scale to provide accurate estimates of underuse, overuse, misuse, and quality, and it should be timely, flexible, and affordable.

Current sources of population-based data that are available for monitoring colorectal cancer screening in the United States are inadequate for estimating rates and essentially nonexistent for assessing appropriate use. Assessment of quality on a population level is limited to a few measures, such as frequency of major complications, polyp detection rate, and missed cancers following colonoscopy. Other measures—such as the percentage of patients undergoing colonoscopy with adequate bowel preparation, colonoscopic withdrawal times, and the

percentage of FOBT cards with an adequate sample—are not widely available on a population basis. Ideally, both use and quality should be measured in the same population; however, most available data address one or the other, but not both.

What Is Currently Done

Population-based surveys, such as the National Health Interview Survey (NHIS) and the Behavioral Risk Factor Surveillance System (BRFSS), include questions about colorectal cancer screening modality and timing and are the major source of information about trends in colorectal cancer screening rates. Compared with reviews of patient records, however, such surveys may not accurately distinguish colonoscopy from sigmoidoscopy and may overestimate the rate of screening. The surveys do not include questions about overuse, misuse, or outcomes of screening.

The HEDIS measures for colorectal cancer screening are based on the experience of persons enrolled in selected managed care plans and are reported in aggregate by plan. Current reporting does not permit the assessment of screening rates by age, race, or gender. The measures do not specify which screening modality was used, and they include no information about quality, complication rates, or follow-up.

Administrative data sets, such as Medicare data or data from health plans, can be used to measure rates of screening and follow-up medical care. The data are most accurate for assessing use of colonoscopy or flexible sigmoidoscopy and least accurate for measuring use of FOBT. The long period of coverage needed (10 years) to determine that someone is nonadherent to screening recommendations is a limiting factor. Administrative data are a good source of information on the rate and nature of complications related to colorectal cancer screening (e.g., colon perforation) that require specific treatment (e.g., hospitalization, surgery).

Electronic medical records provide detail that is not available in administrative databases, but these records rarely cover an entire population. Few electronic medical record systems are designed for population monitoring, and their use for these purposes generally relies on text fields and complex algorithms that draw information from clinical notes and laboratory reports. Electronic medical records have the potential for assessing the indication for a test, results, time to follow-up, and complications.

What Could Be Done

Given the reported link between increased rates of colorectal cancer screening and both decreased incidence of colorectal cancer and earlier stage at diagnosis, cancer registries might be used to monitor the incidence and stage of colorectal cancer in population subgroups to identify regions with relatively low rates of colorectal cancer screening. The value of cancer registries could be extended if they were to collect information on whether a tumor was detected as a result of screening or evaluation of symptoms.

Data on use and quality should be collected by state and local programs to monitor the rate and quality of colorectal cancer screening.

A colorectal cancer screening registry analogous to the Breast Cancer Surveillance Consortium should be established to monitor rates of colorectal cancer screening, overuse, quality, and complications.

Expansion and analysis of existing data sources and collaborative databases relating to colorectal cancer screening and quality should be supported. These sources include the Clinical Outcomes Research Initiative (CORI) endoscopy database, the Cancer Research Network (CRN), and the Computed Tomography Colonography Registry.

An ideal monitoring system should be able to estimate rates of screening regardless of a patient's insurance status and demographic characteristics and to assess use, appropriateness, and outcomes. A variety of strategies will likely need to be combined to obtain a relatively complete picture of colorectal cancer screening and quality.

6. 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?

Evidence to guide colorectal cancer screening practice and policy is essential. The systematic review of available evidence reveals substantial and significant gaps. There will have to be a greater investment in research on the effectiveness of alternative approaches to engage the population in screening, to support the delivery of screening services, and to enhance systems of care to facilitate access to screening and appropriate follow-up. The recommendations for each of the key questions addressed in this document follow.

Tracking Trends in Colorectal Cancer Screening. The panel recommends the development of an infrastructure for capturing information concerning colorectal cancer screening, follow-up, and cancer outcomes. This infrastructure could be patterned on the existing Breast Cancer Surveillance Consortium. The system should include existing screening modalities and allow for adding new screening techniques. In addition, the proposed monitoring system could include expansions, extensions, and greater use of the BRFSS, the Medicare Current Beneficiary Survey, the Medical Expenditure Panel Survey, NHIS, and administrative data that will allow tracking of population screening by subgroups as well as by screening method.

Factors Influencing Use of Colorectal Cancer Screening. The panel recommends research (1) to study patient preferences and other factors influencing informed and shared decision-making regarding the choice of a colorectal cancer screening modality; (2) to better understand and reduce barriers (e.g., insurance coverage, out-of-pocket costs) to timely and appropriate colorectal cancer screening; (3) to study physician recommendations to the patient regarding the choice of screening modalities and adherence to guideline recommendations; (4) to understand how integrated systems achieve high levels of performance (e.g., electronic medical record decision support, performance incentives); and (5) to study how practices outside of integrated systems can create an infrastructure that promotes high performance.

Effective Strategies for Increasing Appropriate Use. The panel recommends research to (1) evaluate interventions aimed at patients, providers, systems of health care, and communities to increase rates of screening and appropriate follow-up; (2) eliminate racial/ethnic, socioeconomic, and geographic disparities in colorectal cancer screening; (3) assess sustainability of successful interventions that increase the rate of colorectal cancer screenings and disseminate evidence-based interventions; and (4) improve the acceptability and performance of screening techniques.

Current and Projected Colorectal Cancer Screening Capacity. The panel recommends (1) modeling and other research approaches to assess the demand and capacity for colorectal cancer screening across geographic areas; (2) research assessing various options for expanding the supply of providers, including additional specialists, and more widespread use of appropriately trained primary care physicians or non-physician providers conducting lower endoscopy; and (3) further research on what constitutes adequate training.

Effective Monitoring of Use and Quality of Colorectal Cancer Screening. In addition to the comprehensive monitoring infrastructure recommended above, the panel recommends research that (1) examines strategies for community and regional monitoring of colorectal cancer screening outcomes and the performance of methods used to screen; and (2) evaluates the performance of new colorectal cancer screening tests as they emerge.

Conclusion

The panel finds that despite substantial progress toward higher colorectal cancer screening rates nationally, screening rates fall short of desirable levels. Targeted initiatives to improve screening rates and reduce disparities in underscreened communities and population subgroups could further reduce colorectal cancer morbidity and mortality. This could be achieved by utilizing the full range of screening options and evidence-based interventions for increasing screening rates. With additional investments in quality monitoring, Americans could be assured that all screening achieves high rates of cancer prevention and early detection. To close the gap in screening, this report identifies the following priority areas for implementation and research to enhance the use and quality of colorectal cancer screening:

- Eliminate financial barriers to colorectal cancer screening and appropriate follow-up.
- Widely implement interventions that have proven effective at increasing colorectal cancer screening, including patient reminder systems and one-on-one interactions with providers, educators, or navigators.
- Conduct research to assess the effectiveness of tailoring programs to match the characteristics and preferences of target population groups to increase colorectal cancer screening.
- Implement systems to ensure appropriate follow-up of positive colorectal cancer screening results.

- Develop systems to assure high quality of colorectal cancer screening programs.
- Conduct studies to determine the comparative effectiveness of the various colorectal cancer screening methods in usual practice settings.

State-of-the-Science Panel

Donald Steinwachs, Ph.D.

Panel and Conference Chair
Professor and Interim Director
Johns Hopkins Institute for Policy Studies
Director
Health Services Research and Development
Center
Bloomberg School of Public Health
The Johns Hopkins University
Baltimore, Maryland

Jennifer Dacey Allen, D.Sc., M.P.H., R.N.

Assistant Professor
Dana-Farber Cancer Institute
Harvard Medical School
Boston, Massachusetts

William Eric Barlow, Ph.D.

Senior Biostatistician
Cancer Research and Biostatistics
Research Professor
Department of Biostatistics
University of Washington
Seattle, Washington

R. Paul Duncan, Ph.D.

Professor and Chair
Department of Health Services Research,
Management, and Policy
College of Public Health and Health Professions
University of Florida
Health Science Center
Gainesville, Florida

Leonard E. Egede, M.D., M.S.

Professor of Medicine
Department of Medicine
Director
Center for Health Disparities Research
Medical University of South Carolina
Charleston, South Carolina

Lawrence S. Friedman, M.D.

Professor of Medicine
Harvard Medical School
and Tufts University School of Medicine
Chair, Department of Medicine
Newton-Wellesley Hospital
Newton, Massachusetts

Nancy L. Keating, M.D., M.P.H.

Associate Professor of Medicine and Health
Care Policy
Department of Health Care Policy
Harvard Medical School
Boston, Massachusetts

Paula Kim

Chief Executive Officer
Translating Research Across Communities
Green Cove Springs, Florida

Judith R. Lave, Ph.D.

Professor of Health Economics
Director
Pennsylvania Medicaid Policy Center
Graduate School of Public Health
University of Pittsburgh
Pittsburgh, Pennsylvania

Thomas A. LaVeist, Ph.D.

William C. and Nancy F. Richardson
Professor in Health Policy
Director, Hopkins Center for Health
Disparities Solutions
Johns Hopkins Bloomberg School
of Public Health
Baltimore, Maryland

Roberta B. Ness, M.D., M.P.H.

Dean and M. David Low Chair in Public
Health
University of Texas
School of Public Health
Houston, Texas

Robert J. Optican, M.D.

Director of Cardiothoracic Imaging
Baptist Memorial Hospitals
Memphis, Tennessee

Beth A. Virnig, Ph.D., M.P.H.

Professor
University of Minnesota School of Public Health
Division of Health Policy and Management
Minneapolis, Minnesota

Speakers

John Z. Ayanian, M.D., M.P.P.

Professor, Medicine and Health Care Policy
Harvard Medical School
Professor, Health Policy and Management
Harvard School of Public Health
Boston, Massachusetts

Mary Barton, M.D., M.P.P.

Scientific Director, U.S. Preventive Services
Task Force
Center for Primary Care, Prevention, and
Clinical Partnerships
Agency for Healthcare Research and
Quality (AHRQ)
Rockville, Maryland

Roshan Bastani, Ph.D.

Professor of Health Services
Associate Dean for Research
UCLA School of Public Health
Los Angeles, California

Allen J. Dietrich, M.D.

Associate Director of Population Sciences
Norris Cotton Cancer Center
Professor, Departments of Community and
Family Medicine
Dartmouth Medical School
Lebanon, New Hampshire

Russell Harris, M.D., M.P.H.

Professor of Medicine
University of North Carolina School of
Medicine
Cecil G. Sheps Center for Health Services
Research
Chapel Hill, North Carolina

Debra J. Holden, Ph.D.

Community Health Psychologist
Senior Director, Community Health Promotion
Research
RTI International
Research Triangle Park, North Carolina

C. Daniel Johnson, M.D.

Professor of Radiology
Mayo Clinic Arizona
Scottsdale, Arizona

Carrie N. Klabunde, Ph.D.

Epidemiologist
Health Services and Economics Branch
Applied Research Program
Division of Cancer Control and Population
Sciences
National Cancer Institute
National Institutes of Health
Bethesda, Maryland

Jennifer Elston Lafata, Ph.D.

Department of Social and Behavioral Health,
School of Medicine
Virginia Commonwealth University
Richmond, Virginia

Theodore R. Levin, M.D.

Research Scientist
Director of Colorectal Cancer Screening
Kaiser Permanente Northern California
Oakland, California

David A. Lieberman, M.D., FACP
Professor of Medicine and Chief
Division of Gastroenterology
Department of Medicine
Oregon Health and Science University/Veterans
Affairs Medical Center
Portland, Oregon

Megan C. McHugh, Ph.D.
Director of Research
Health Research & Educational Trust
American Hospital Association
Washington, DC

Electra D. Paskett, Ph.D., M.P.H.
Marion N. Rowley Professor of Cancer
Research
College of Public Health
The Ohio State University
Columbus, Ohio

Julietta Patnick, C.B.E., B.A. (Hons.)
Director
United Kingdom National Health Service
Cancer Screening Programmes
Fulwood House
Sheffield S10 3TH
United Kingdom

David F. Ransohoff, M.D.
Professor of Medicine
Clinical Professor of Epidemiology
Schools of Medicine and Public Health
University of North Carolina at Chapel Hill
Chapel Hill, North Carolina

Eric C. Schneider, M.D., M.Sc.
Senior Scientist and Director
RAND Boston
Associate Professor
Department of Health Policy and
Management
Harvard School of Public Health
Boston, Massachusetts

Laura C. Seeff, M.D.
Acting Chief
Comprehensive Cancer Control Branch
Division of Cancer Prevention and Control
Centers for Disease Control and Prevention
Atlanta, Georgia

Steven H. Woolf, M.D., M.P.H.
Professor of Medicine
Departments of Family Medicine,
Epidemiology, and Community Health
Director, VCU Center for Human Needs
Virginia Commonwealth University
Richmond, Virginia

Elizabeth M. Yano, Ph.D., M.S.P.H.
Adjunct Professor of Health Services
UCLA School of Public Health
Senior Social Scientist and Co-Director
VA Center for the Study of Healthcare
Provider Behavior
VA Greater Los Angeles Healthcare System
Sepulveda, California

Ann G. Zauber, Ph.D.
Associate Attending Biostatistician
Department of Epidemiology and
Biostatistics
Memorial Sloan-Kettering Cancer Center
New York, New York

Planning Committee

Carrie Klabunde, Ph.D.

Chairperson
Health Services and Economics Branch
Applied Research Program
Division of Cancer Control and
Population Sciences
National Cancer Institute
National Institutes of Health
Bethesda, Maryland

Lisa Ahramjian, M.S.

Communications Specialist
Office of Medical Applications of Research
Office of the Director
National Institutes of Health
Bethesda, Maryland

John Z. Ayanian, M.D., M.P.P.

Professor
Medicine and Health Care Policy
Harvard Medical School
Health Policy and Management
Harvard School of Public Health
Boston, Massachusetts

Martin L. Brown, Ph.D.

Chief
Health Services and Economics Branch
Applied Research Program
Division of Cancer Control and
Population Sciences
National Cancer Institute
National Institutes of Health
Bethesda, Maryland

Stephanie Chang, M.D., M.P.H.

Medical Officer
Evidence-Based Practice Centers Program
Center for Outcomes and Evidence
Agency for Healthcare Research and
Quality
Rockville, Maryland

Joseph Chin, M.D., M.S.

Medical Officer
Division of Medical and Surgical Services
Centers for Medicare and Medicaid
Services
Baltimore, Maryland

Jennifer Miller Crowell, M.D.

Senior Advisor for the Consensus
Development Program
Office of Medical Applications of Research
Office of the Director
National Institutes of Health
Bethesda, Maryland

James Everhart, M.D., M.P.H.

Director
Epidemiology and Data Systems Program
Division of Digestive Diseases and Nutrition
Digestive Diseases Programs Branch
National Institute of Diabetes and Digestive
and Kidney Diseases
National Institutes of Health
Bethesda, Maryland

Alaina K. Fournier, Ph.D.

Health Scientist Administrator
Evidence-Based Practice Centers Program
Center for Outcomes and Evidence
Agency for Healthcare Research and
Quality
Rockville, Maryland

Karen Huss, Ph.D., R.N., APRN-BC, FAAN, FAAAAI

Program Director
Cardiopulmonary and Critical Care Science
National Institute of Nursing Research
Training Coordinator
Division of Extramural Activities
National Institute of Nursing Research
National Institutes of Health
Bethesda, Maryland

Planning Committee members provided their input at a meeting held July 23–25, 2008.
The information provided here was accurate at the time of that meeting.

C. Carl Jaffe, M.D.

Chief
Diagnostic Imaging
Cancer Imaging Program
Division of Cancer Treatment and Diagnosis
National Cancer Institute
National Institutes of Health
Bethesda, Maryland

Supriya Janakiraman, M.D., M.P.H.

Staff Fellow
Evidence-Based Practice Centers Program
Center for Outcomes and Evidence
Agency for Healthcare Research and
Quality
Rockville, Maryland

Kathleen Jett, Ph.D., R.N., GNP-BC

Program Director
HIV/AIDS and Oncology
Office of Extramural Programs
National Institute of Nursing Research
National Institutes of Health
Bethesda, Maryland

David Kim, M.D.

Assistant Professor
Abdominal Imaging
Department of Radiology
University of Wisconsin School of
Medicine and Public Health, Madison
Madison, Wisconsin

Barnett S. Kramer, M.D., M.P.H.

Associate Director for Disease Prevention
Director
Office of Medical Applications of Research
Office of the Director
National Institutes of Health
Bethesda, Maryland

David Lieberman, M.D., FACP

Professor of Medicine and Chief
Division of Gastroenterology
Department of Medicine
Oregon Health and Science University
Veterans Affairs Medical Center
Portland, Oregon

Robert Madoff, M.D.

Professor of Surgery
Chief
Division of Colon and Rectal Surgery
Stanley M. Goldberg, M.D. Chair in Colon
and Rectal Surgery
University of Minnesota
Minneapolis, Minnesota

Kelli K. Marciel, M.A.

Communications Director
Office of Medical Applications of Research
Office of the Director
National Institutes of Health
Bethesda, Maryland

Helen Meissner, Ph.D., Sc.M.

Health Science Administrator
Office of Behavioral and Social
Sciences Research
Office of the Director
National Institutes of Health
Bethesda, Maryland

Marion R. Nadel, Ph.D., M.P.H.

Epidemiologist
Epidemiology and Applied Research Branch
Division of Cancer Prevention and Control
Centers for Disease Control and Prevention
Atlanta, Georgia

Paul Pinsky, Ph.D.

Early Detection Research Group
Division of Cancer Prevention
National Cancer Institute
National Institutes of Health
Bethesda, Maryland

Susan C. Rossi, Ph.D., M.P.H.

Deputy Director
Office of Medical Applications of Research
Office of the Director
National Institutes of Health
Bethesda, Maryland

Planning Committee members provided their input at a meeting held July 23–25, 2008.
The information provided here was accurate at the time of that meeting.

Beth Collins Sharp, Ph.D., R.N.

Director
Evidence-Based Practice Centers Program
Center for Outcomes and Evidence
Agency for Healthcare Research and
Quality
Rockville, Maryland

Donald M. Steinwachs, Ph.D.

Panel and Conference Chairperson
Professor and Director
Health Services Research and
Development Center
Department of Health Policy and
Management
Bloomberg School of Public Health
The Johns Hopkins University
Baltimore, Maryland

Sally W. Vernon, Ph.D.

Director
Division of Health Promotion and Behavioral
Sciences
Blair Justice, Ph.D. Professorship in Mind-
Body Medicine and Public Health
Professor of Epidemiology and Behavioral
Sciences
University of Texas–Houston
School of Public Health
Houston, Texas

Jane G. Zapka, Sc.D.

Professor
Biostatistics, Bioinformatics and
Epidemiology
Medical University of South Carolina
Charleston, South Carolina

Planning Committee members provided their input at a meeting held July 23–25, 2008.
The information provided here was accurate at the time of that meeting.

Conference Sponsors

National Cancer Institute

John E. Niederhuber, M.D.

Director

Office of Medical Applications of Research

Jennifer M. Croswell, M.D., M.P.H.

Acting Director

Conference Cosponsors

National Institute on Aging

Richard Hodes, M.D.

Director

National Institute of Nursing Research

Patricia A. Grady, Ph.D., R.N., F.A.A.N.

Director

National Institute of Diabetes and Digestive and Kidney Diseases

Griffin P. Rodgers, M.D., M.A.C.P.

Director

Office of Behavioral and Social Sciences Research

Christine A. Bachrach, Ph.D.

Acting Director

Conference Partners

Centers for Medicare & Medicaid Services

Charlene M. Frizzera

Acting Director

Health Resources & Services Administration

Mary Wakefield, Ph.D., R.N.

Administrator

Centers for Disease Control and Prevention

Thomas R. Frieden, M.D., M.P.H.

Director