Cancer Screening in the United States, 2009: A Review of Current American Cancer Society Guidelines and Issues in Cancer Screening

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Abstract

Each year, the American Cancer Society (ACS) publishes a report summarizing its recommendations for early cancer detection, data and trends in cancer screening rates, and select issues related to cancer screening. In 2008, the ACS, the American Gastroenterological Association, the American College of Gastroenterology, the Society for Gastrointestinal Endoscopy, and the American College of Radiology issued a joint update of guidelines for colorectal cancer screening in average-risk adults. In this issue, the current ACS guidelines and recent issues are summarized, updates of testing guidelines for early prostate cancer detection and colorectal cancer screening by the United States Preventive Services Task Force are discussed, and the most recent data from the Centers for Disease Control and Prevention’s Behavioral Risk Factor Surveillance System and the National Health Interview Survey pertaining to participation rates in cancer screening are described. CA Cancer J Clin 2009;59:27-41. ©2009 American Cancer Society.

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Introduction

Nine years ago, the American Cancer Society (ACS) inaugurated a yearly report on its cancer screening guidelines in CA: A Cancer Journal for Clinicians. The first report included a description of the ACS process for the development or update of a cancer screening guideline. That report, and subsequent annual reports, have provided a summary of ACS cancer screening guidelines, a summary of guidance to the public about testing for early cancer detection for tests that are increasingly used by the public but not yet recommended for cancer screening due to the absence of evidence of benefit, and the most recent data regarding adult cancer screening rates and trends.1 In order for guidelines to reflect the most current scientific evidence, the literature is monitored on an ongoing basis, and guidelines are reviewed and updated at least every 5 years. However, over the past decade, some guidelines have been updated more frequently as new evidence or the emergence of new technologies have warranted more frequent updates in guidance to health professionals and the public. The annual guideline reviews, as well as the more detailed guideline updates published as stand-alone articles, are available online at http://cajournal.org. Table 1 shows the recent history of guideline updates, as well as those still in progress.2-10

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Screening for Breast Cancer

Breast cancer is the most common cancer diagnosed in women in the United States, and the second leading cause of death from cancer in US women. ACS guidelines for breast cancer screening in average-risk women were last updated in 2003, and screening guidelines for women at very high risk were last updated in 2007. Guidelines for women at very high risk are appropriate for women with a known or suspected inherited susceptibility to breast cancer, or women who have undergone mantle radiation to the chest at an early age for Hodgkin lymphoma (Table 2). Guidelines for the early detection of breast cancer in average-risk women consist of a combination of regular clinical breast examination (CBE) and counseling to raise awareness of breast symptoms beginning at age 20 years, and annual mammography beginning at age 40 years (Table 2).

Between the ages of 20 and 39 years, women should undergo CBE every 3 years, and annually after age 40 years. This examination should take place during periodic health examinations. When CBE is performed, there is an opportunity for healthcare professionals to review and update the woman's family history; discuss the importance of early breast cancer detection; and answer any questions women may have about their own risk, new technologies, or other matters related to breast disease. During these discussions, healthcare professionals should emphasize the importance of the awareness and recognition of breast changes and, if changes are perceived, the importance of contacting a physician promptly. They should also emphasize the importance of an awareness of a family history of breast and ovarian cancers in first-degree and second-degree relatives on both the maternal and paternal sides of the family. An opportunity to update family history should take place during encounters for other preventive care or screening. Approximately 8.4% of women report a family history of breast cancer in first-degree relatives, and approximately 3% of women between the ages of 20 and 29 years report a family history of breast cancer. Thus, it is important to take and regularly update a family history at a young age because some women will be candidates for more intensive breast cancer screening beginning at an earlier age. In an examination of data from the 2005 Cancer Control Module (CPM) of National Health Interview Survey (NHIS), Hall et al estimated that approximately 1.4 million US women (fewer than 1%) have a family history of breast cancer that, based on criteria established by the US Preventive Services Task Force (USPSTF), warrants a referral for genetic counseling and evaluation for genetic testing. However, fewer than 2% of respondents who would be candidates for genetic counseling report having been tested. This finding suggests the need for additional research, but one contributing factor is almost certainly suboptimal attention to family history in the primary care setting. Murff et al compared family history information gathered from a survey with information in the patient's chart and observed that more than half of the women at an increased risk of developing breast cancer due to family history had no documentation in their chart.
# American Cancer Society Recommendations for the Early Detection of Cancer in Average-risk, Asymptomatic Individuals

| CANCER SITE | POPULATION | TEST OR PROCEDURE | FREQUENCY |
|-------------|------------|-------------------|-----------|
| **Breast**  | Women, aged 20+ y | Breast self-examination (BSE) | Beginning in their early 20s, women should be told about the benefits and limitations of BSE. The importance of the prompt reporting of any new breast symptoms to a healthcare professional should be emphasized. Women who choose to do BSE should receive instructions and have their technique reviewed on the occasion of a periodic health examination. It is acceptable for women to choose not to do BSE or to do BSE irregularly. |
|             |            | Clinical breast examination (CBE) | For women in their 20s and 30s, it is recommended that CBE be part of a periodic health examination, preferably at least every 3 y. Asymptomatic women aged 40+ y should continue to undergo a CBE as part of a periodic health examination, preferably annually. |
|             |            | Mammography | Begin annual mammography at age 40 y.* |
| **Colorectal** | Men and women, aged 50+ y | Guaiac-based fecal occult blood test (gFOBT)† with greater than 50% test sensitivity for cancer, fecal immunochemical test (FIT) with greater than 50% test sensitivity for cancer, or Stool DNA test | Annual, starting at age 50 y. |
|             |            | Flexible sigmoidoscopy (FSIG) or | Interval uncertain, starting at age 50 y. |
|             |            | gFOBT or FIT† and FSIG‡ or | Every 5 y, starting at age 50 y. |
|             |            | Double-contrast barium enema or | Every 5 y, starting at age 50 y. |
|             |            | Colonoscopy | Every 10 y, starting at age 50 y. |
|             |            | Computed tomography colonography | Every 5 y, starting at age 50 y. |
| **Prostate** | Men, aged 50+ y | Digital rectal examination (DRE) and prostate-specific antigen test (PSA) | Health care providers should discuss the potential benefits and limitations of prostate cancer early detection testing with men and offer the PSA blood test and the digital rectal examination annually, beginning at age 50, to men who are at average risk of prostate cancer, and who have a life expectancy of at least 10 y.§ |
| **Cervix**  | Women, aged 18+ y | Papanicolaou (Pap) test | Cervical cancer screening should begin approximately 3 y after a woman begins having vaginal intercourse, but no later than age 21 y. Screening should be performed every y with conventional Pap tests or every 2 y using liquid-based Pap tests. At or after age 30 y, women who have had 3 normal test results in a row may get screened every 2 to 3 y with cervical cytology (either conventional or liquid-based Pap test) alone, or every 3 y with a human papillomavirus DNA test plus cervical cytology. Women aged 70+ y who have had 3 or more normal Pap tests and no abnormal Pap tests within the last 10 y and women who have undergone a total hysterectomy may choose to stop cervical cancer screening. |
| **Endometrial** | Women at menopause | At the time of menopause, women at average risk should be informed about the risks and symptoms of endometrial cancer and strongly encouraged to report any unexpected bleeding or spotting to their physicians. |
| **Cancer-related checkup** | Men and women, aged 20+ y | On the occasion of a periodic health examination, the cancer-related checkup should include examination for cancers of the thyroid, testicles, ovaries, lymph nodes, oral cavity, and skin, as well as health counseling regarding tobacco use, sun exposure, diet and nutrition, risk factors, sexual practices, and environmental and occupational exposures. |

*Beginning at age 40 y, annual CBE should be performed prior to mammography.

†FOBT as it is sometimes performed in physicians’ offices, with the single stool sample collected on a fingertip during a DRE, is not an adequate substitute for the recommended at-home procedure of collecting two samples from three consecutive specimens. Toilet bowl FOBT tests also are not recommended. In comparison with guaiac-based tests for the detection of occult blood, immunochemical tests are more patient-friendly, and are likely to be equal or better in sensitivity and specificity. There is no justification for repeating FOBT in response to an initial positive finding.

‡FSIG together with FOBT is preferred compared with FOBT or FSIG alone.

§Information should be provided to men regarding the benefits and limitations of testing so that an informed decision concerning testing can be made with the clinician’s assistance.
and among women considered to be at elevated risk with chart documentation, information regarding age at diagnosis of affected relatives was often missing.\textsuperscript{15}

Although the ACS no longer recommends monthly breast self-examination (BSE), women should be informed about the potential benefits, limitations, and harms (principally the possibility of a false-positive result) associated with BSE. Women may then choose to do BSE regularly, occasionally, or not at all. If a woman chooses to perform periodic BSE, she should receive instructions in the technique and periodically have her technique reviewed.

The ACS recommends that average-risk women should begin annual mammography at age 40 years. Women also should be informed of the scientific evidence demonstrating the value of detecting breast cancer before symptoms develop, and that the balance of benefits to possible harms strongly supports the value of screening and the importance of adhering to a schedule of regular mammograms.\textsuperscript{16,17} The benefits of mammography include a reduction in the risk of dying from breast cancer and, if breast cancer is detected early, less aggressive surgery (ie, lumpectomy vs mastectomy), less aggressive adjuvant therapy, and a greater range of treatment options. Women also should be told about the limitations of mammography, specifically that mammography will not detect all breast cancers, and that some breast cancers detected with mammography may still have poor prognosis. Furthermore, women should be informed about the potential harms associated with mammographic screening, including false-positive results, and the possibility of undergoing a biopsy for abnormalities that prove to be benign.

There is no specific upper age at which mammography screening should be discontinued. Rather, the decision to stop regular mammography screening should be made on an individual basis based on the potential benefits and risks of screening within the context of a patient’s overall health status and estimated longevity.\textsuperscript{18} As long as a woman is in good health and would be a candidate for breast cancer treatment, she should continue to be screened with mammography.

In 2007, the ACS issued new guidelines for women who were known or likely carriers of a BRCA mutation and other rarer high-risk genetic syndromes, or who had been treated with radiation to the chest for Hodgkin disease.\textsuperscript{3} Annual screening mammography and magnetic resonance imaging (MRI) beginning at age 30 years are recommended for women with a known BRCA mutation, women who are untested but have a first-degree relative with a BRCA mutation, or women with an approximately 20\% to 25\% or greater lifetime risk of breast cancer based on specialized breast cancer risk estimation models capable of pedigree analysis of first-degree and second-degree relatives on both the maternal and paternal sides. Although the Breast Cancer Risk Assessment Tool, more popularly known as the Gail model, provides a good, generalized measure of short-term and long-term risk based on a woman’s age, ethnicity, history of breast biopsy and breast cancer, age at menarche, parity, and age at first live birth, it does not have the capacity to analyze detailed family histories including first-degree and second-degree relatives on both the maternal and paternal sides.\textsuperscript{19} Thus, although individual lifetime risk estimates generated from the Gail model can exceed the threshold of approximately 20\% or greater, the elevated risk may be due to risk factors other than family history. To estimate the risk of breast cancer in women with a significant family history who have not undergone genetic testing and do not have an affected relative who has tested positive, health professionals should use specialized software that can address family history in first-degree and second-degree relatives on both the maternal and paternal sides. There are several models that can estimate risk based on complex family histories and assist clinicians in estimating breast cancer risk or the likelihood that a BRCA mutation is present, including the models of Claus et al,\textsuperscript{20} Tyrer et al,\textsuperscript{21} BRCAPRO, and the Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm (BOADICEA).\textsuperscript{22} Some of these models also can accommodate complex family histories and conventional risk factors, such as reproductive history or a history of prior breast biopsy. A link to supplemental material related to these models is included in the online publication (available at: http://caonline.amcancersoc.org/cgi/data/57/2/75/DC1/1).\textsuperscript{3}

Although MRI may eventually prove to be cost-effective and advantageous for women at an elevated risk of breast cancer due to other combinations of risk factors, at the current time screening recommendations for annual screening mammography and MRI are based strictly on known or estimated high-risk mutation carrier status or a history of high-dose radiotherapy at a young age. The expert panel concluded that there was insufficient evidence to recom-
mend for or against MRI screening in women with a 15% to 20% lifetime risk as defined by these same family history-based risk estimation models, or women with a history of ductal or lobular carcinoma in situ, a history of biopsy-proven proliferative lesions, or extremely dense breasts. MRI is not recommended for women considered to be at average risk.3

Screening for Cervical Cancer

ACS guidelines for cervical cancer screening were last updated in 2002 (Table 2),4 and recommendations for the use of prophylactic human papillomavirus (HPV) vaccines, including policy and implementation issues, were published in January 2007.5

The screening guidelines recommend different surveillance strategies and options based on a woman’s age, her screening history, other risk factors, and the choice of screening tests. Screening for cervical cancer should begin approximately 3 years after first vaginal intercourse, but no later than age 21 years. Until age 30 years, women at average risk should receive either annual screening with conventional cervical cytology smears or biennial screening using liquid-based cytology. After age 30 years, a woman who has had 3 consecutive technically satisfactory Papanicolaou (Pap) tests with normal/negative results may choose to either undergo screening every 2 to 3 years using either conventional or liquid-based cytology, or undergo screening every 3 years with the combination of HPV DNA testing and conventional or liquid-based cytology. Women who choose to undergo HPV DNA testing should be informed of the following: 1) HPV infection usually is not detectable or harmful; 2) nearly everyone who has had sexual intercourse has been exposed to HPV and infection is very common; 3) a positive HPV test result does not reflect the presence of a sexually transmitted disease (STD), but rather a sexually acquired infection; and 4) a positive HPV test result does not indicate the presence of cancer, nor will the large majority of women who test positive for an HPV infection develop advanced cervical neoplasia.

Women who have an intact cervix and who are in good health should continue screening until age 70 years, and afterward may elect to stop screening if they have had no abnormal/positive cytologic tests within the 10-year period prior to age 70 years, and if there is documentation that the 3 most recent Pap tests were technically satisfactory and interpreted as normal. However, screening after age 70 years is recommended for women in good health who have not been previously screened, women for whom information regarding previous screening is unavailable, and women for whom there is a low likelihood of past screening.

Women with a history of cervical cancer or in utero exposure to diethylstilbestrol (DES) should follow the same guidelines as average-risk women before age 30 years, and should continue with that protocol after age 30 years. Women who are immunocompromised by organ transplantation, chemotherapy, or chronic corticosteroid treatment or those who are positive for the human immunodeficiency virus (HIV) should be tested twice during the first year after diagnosis, and annually thereafter, according to guidelines from the US Public Health Service (USPHS) and Infectious Disease Society of America (IDSA).23 There is no specific age at which to stop screening for women with a history of cervical cancer, those with in utero exposure to DES, and women who are immunocompromised (including HIV-positive women). As with women at average risk, women in these risk groups should continue cervical cancer screening for as long as they are in reasonably good health and would benefit from early detection and treatment.

Cervical cancer screening is not indicated for women who have undergone a total hysterectomy or those who have undergone removal of the cervix for benign gynecologic disease. However, women with a history of cervical intraepithelial neoplasia of type 2/3 (CIN2/3) or women for whom it is not possible to document the absence of CIN2/3 prior to or as the indication for the hysterectomy should continue to be screened until they have a 10-year history of no abnormal/positive cytology tests, including documentation that the 3 most recent consecutive tests were technically satisfactory and interpreted as normal/negative. Women who have undergone a hysterectomy and who also have a history of in utero DES exposure and/or a history of cervical carcinoma should continue screening after hysterectomy for as long as they are in reasonably good health and would benefit from early detection and treatment. Average-risk women who have undergone a subtotal (supracervical) hysterectomy should be screened following the recommendations for average-risk women who have not undergone hysterectomy.

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The ACS recommends routine HPV vaccination principally for females ages 11 to 12 years, but also for females ages 13 to 18 years to “catch up” those who missed the opportunity to be vaccinated, or who need to complete the vaccination series. The guidelines state that there are insufficient data to recommend for or against the universal vaccination of females ages 19 to 26 years. Women in this age group who are interested in undergoing vaccination should talk with a healthcare professional about their risk of previous HPV exposure and the potential benefit of vaccination. Screening for CIN and cancer should continue in both vaccinated and unvaccinated women according to current ACS early detection guidelines for cervical cancer. According to the 2007 National Immunization Survey of Teens, 25.1% of US female adolescents ages 13 to 17 years initiated the HPV vaccination series (ie, had at least 1 of 3 shots as recommended for the HPV vaccine).24

Screening and Surveillance for the Early Detection of Adenomatous Polyps and Colorectal Cancer

Guidelines for screening and surveillance for the early detection of adenomatous polyps and colorectal cancer (CRC) in average-risk adults were updated in 2008 in an evidence-based consensus process that included the ACS, the US Multi-Society Task Force (USMSTF) on Colorectal Cancer (which comprises representatives of the American College of Gastroenterology, American Gastroenterological Association, and American Society for Gastrointestinal Endoscopy), and the American College of Radiology (ACR) (Table 2).10 Recommendations for adults at increased and high risk were last updated in 2001,6 and in 2006, the ACS and the USMSTF issued a joint guideline update for postpolypectomy and post-CRC resection surveillance.8,9

Recommended CRC screening tests are grouped into two categories: 1) tests that primarily detect cancer, which include both guaiac-based fecal occult blood testing (gFOBT) and immunochemical-based FOBT (FIT) and testing stool for exfoliated DNA (sDNA); and 2) tests that can detect cancer and advanced lesions, which include endoscopic examinations and radiologic examinations (ie, flexible sigmoidoscopy [FSIG], colonoscopy, double-contrast barium enema [DCBE], and computed tomography [CT] colonography [CT colonography, or virtual colonoscopy]). This distinction is intended to help primary care physicians support informed decision making and to help the public understand the features, advantages, and disadvantages that distinguish these two groups of screening tests. Furthermore, the guidelines state that although all recommended tests are acceptable options, the prevention of CRC is the greater priority in screening. Although there have been calls to state a preference for colonoscopy above all other options,25 studies have shown that even after a process of shared decision making, adults demonstrate considerable variation in the test they choose.26 Furthermore, in addition to variable preferences, access to all testing options also is variable due to institutional policies, insurance coverage, time to appointment, and geographic distance.

Screening options may be chosen based on individual risk, personal preference, and access. Average-risk adults should begin CRC screening at age 50 years, with 1 of the following options: 1) annual gFOBT or FIT, following the manufacturer’s recommendations for specimen collection; 2) sDNA, for which, currently, there is uncertainty with regard to the screening interval; 3) FSIG every 5 years; 4) colonoscopy every 10 years; 5) DCBE every 5 years; or 6) CT colonography every 5 years. Single-panel gFOBT in the medical office using a stool sample collected during a digital rectal examination (DRE) is not a recommended option for CRC screening, due to its very low sensitivity for advanced adenomas and cancer.27 An additional option for regular screening is annual stool blood testing (gFOBT or FIT) with FSIG performed every 5 years. Healthcare professionals should provide guidance to adults regarding the benefits, limitations, and potential harms associated with screening for CRC, including information regarding test characteristics and requirements for successful testing. For example, when advising patients about gFOBT or FIT, it is important to stress that unless there is a commitment to annual at-home testing with adherence to the manufacturer’s instructions, the limited sensitivity observed with one-time testing would make stool testing a poor choice.

The ACS and other organizations recommend more intensive surveillance for individuals at higher risk for CRC.6,9,28,29 Individuals at higher risk for CRC include 1) individuals with a history of ade-
nomatous polyps; 2) individuals with a personal history of curative-intent resection of CRC; 3) individuals with a family history of either CRC or colorectal adenomas diagnosed in a first-degree relative before age 60 years; 4) individuals at significantly higher risk due to a history of inflammatory bowel disease of significant duration; or (5) individuals at significantly higher risk due to the known or suspected presence of 1 of 2 hereditary syndromes, specifically, hereditary nonpolyposis colon cancer (HNPCC) or familial adenomatous polyposis (FAP). For these individuals, increased surveillance generally means a specific recommendation for colonoscopy if available, and may include more frequent examinations and examinations beginning at an earlier age. As noted earlier, an update in recommendations for follow-up colonoscopy for individuals with a history of adenomatous polyps or a personal history of curative-intent CRC was issued in 2006 jointly by the ACS and the USMSTF.8,9

At the time the updated guidelines were published, only preliminary results from the American College of Radiology Imaging Network (ACRIN) National CT Colonography Trial were available. Since then, final results have been published.30 The trial was conducted in 15 centers and compared the accuracy of CT colonography with optical colonoscopy in the detection of colorectal adenomas and cancers measuring ≥10 mm in dimension. Investigators recruited 2600 asymptomatic adults aged 50 years or older who were scheduled for routine screening optical colonoscopy. All examinations were performed with multidetector-row CT scanners (minimum of 16 rows), with images reconstructed to slice thicknesses of 1.0 to 1.25 mm, with a reconstruction interval of 0.8 mm. Images were randomly assigned to be interpreted on two-dimensional display, or in three-dimensionals, in which the CT images are reconstructed to display a virtual image of the colon. Optical colonoscopy was performed according to the standard protocol at each participating center. Radiologists were instructed to record only lesions measuring ≥5 mm in greatest dimension, and exams were interpreted without knowledge of the colonscopic results. The final results were consistent with early results that had been available at the time the new guidelines were finalized, that is, CT colonography detected 90% of patients with large (≥9 mm) adenomas and cancers, with 86% specificity.30

The per-polyp sensitivity for large adenomas and cancers was 84%, and the per-patient sensitivity for all colorectal lesions measuring ≥6 mm in greatest dimension was 78%. Patients who had a lesion measuring ≥10 mm in greatest dimension detected on CT colonography but not on colonoscopy were advised to return for repeat colonoscopy in 90 days. Thirty lesions measuring ≥10 mm in greatest dimension were detected by CT colonography in 27 patients that were not detected during the initial colonoscopy. Among 15 patients (with 18 reported lesions) who returned for follow-up colonoscopy, 5 lesions measuring ≥10 mm were confirmed as true-positive results on the second colonoscopy.

The findings from the ACRIN National CT Colonography trial are consistent with more recent investigations demonstrating that high-quality CT colonography is effective at detecting a majority of large adenomas and cancers.31 Sensitivity for smaller lesions is lower, but although there is general agreement that lesions measuring ≥1 cm in size should be removed, there is uncertainty and controversy regarding the significance of polyps measuring between 5 mm and 9 mm, a debate that takes on new importance with a screening test that can detect these lesions but cannot remove them.32 At this time, the recommendation of the ACS-USMSTF-ACR guidelines is that any patient with a lesion measuring ≥6 mm in greatest dimension observed on CT colonography should be referred for colonoscopy. Insofar as some lesions that were initially detected by CT colonography in this study were not detected by optical colonoscopy, the overall sensitivity for CT colonography may be slightly underestimated. It is likely that the publication of these results will further contribute to the growth of CT colonography for screening. However, against the backdrop of the strong performance of the test in the detection of large adenomas and cancer, there are concerns about thresholds for referral, extracolonic findings, radiation exposure from multiple tests over time, and the pace of the growth of experience and expertise.32 These issues warrant systematic attention to ensure that growth in the use of CT colonography for CRC screening can proceed with the confidence of referring physicians and the public. It also is imperative that local systems work to establish protocols and capacity to insure that patients with positive findings
on CT colonography can undergo same-day colonoscopy.

In October 2008 the USPSTF also updated guidelines for the early detection of CRC.33 The previous guidelines of the ACS and USPSTF were, for all practical purposes, the same and for the most part that similarity remains for the major elements of the two recommendations. Similar to the 2008 ACS-USMSTF-ACR consensus guidelines, the USPSTF recommends that average-risk adults should begin screening at age 50 years; that CRC screening with gFOBT should be limited to testing with newer, more sensitive forms of the guaiac test (ie, Hemocult Sensa [Beckman Coulter, Fullerton, California]); and that FIT is now an acceptable stool testing technology. FIT was first included in ACS guidelines in 2003.7 The USPSTF also recommends sigmoidoscopy every 5 years (combined with high-sensitivity FOBT every 3 years), and screening colonoscopy at intervals of 10 years. However, the guidelines differ in several key areas. The USPSTF did not prioritize screening tests or state a preference for tests that held greater potential for CRC prevention through the detection and removal of adenomas, although it does acknowledge the greater advantage of endoscopic tests over stool tests for the detection of precursor lesions. The new recommendation for FSIG every 5 years now includes the addition of a highly sensitive FOBT every 3 years. Both CT colonography and sDNA testing were considered, but were given a “C” recommendation, which means that there is insufficient evidence to recommend for or against either test. The USPSTF did not include the DCBE in their guidelines review. Finally, the USPSTF also set an age threshold at which to stop screening, recommending against routine screening in adults ages 76 to 85 years, and recommending against any screening in adults aged 85 years and older.

Overall, these guidelines are more similar than different and, given the complexity of CRC guidelines (ie, the number of tests, age groups, and intervals), it is important not to place too much emphasis on the item-to-item comparison. Both guidelines recommend screening beginning at age 50 years at the same intervals with high-sensitivity FOBTs, FSIG, or colonoscopy. The USPSTF gave sDNA and CT colonography a “C” recommendation, which means that the Task Force believed there was insufficient data with which to assess the balance of benefits and harms—the guidelines do not state that these tests should not be used.

Perhaps the most noteworthy difference is the recommendation against routine screening in adults ages 76 to 85 years, and against any screening in adults aged 85 years and older. This recommendation is based on new modeling data that take into consideration a lifetime of screening, polyp growth time, and expected longevity. The recommendation against routine screening does not assert that an adult with no history of screening should not be screened, or that a person with a history of screening should not be screened, only that routine screening in this population may not produce benefits that exceed harms. Although the guidelines allow for individualized decisions, on a population basis, the modeling suggests that, in persons with a history of screening, benefits may not exceed harms after age 75 years. Recent research has shown that the highest rate of serious complications during and after colonoscopy occur in older adults. In contrast, the ACS-USMSTF-ACR guidelines simply state that as long as an adult is in good health, they should continue screening to be protected against the diagnosis of advanced stage CRC. At the point at which an adult’s health is poor and they have limited longevity, screening is not advised. Thus, there is considerable overlap in the intent of these two recommendations. Both sets of guidelines take into account that there is considerable heterogeneity in the health status of adults aged 76 years and older. Many adults in this age group are healthy and have a life expectancy of 20 years or more, and may benefit from continued CRC screening. In addition to the individual’s underlying health status, screening history should also be taken into account. A 76-year-old who has had normal screening tests for CRC on a regular basis for a number of years may reasonably consider, in consultation with their physician, to discontinue screening. Conversely, screening a relatively healthy 76-year-old who has never been screened for CRC may lead to significant benefit. The USPSTF recommendation states that the decision to screen patients ages 76 to 85 years should be individualized (which is equivalent to the ACS-USMSTF-ACR guidelines). Although the opening statement concerning screening patients ages 76 to 85 years may appear to discourage any screening in this age group, patients and physicians should be steered toward the USPSTF narrative for
guidance, which emphasizes the need to take a patient’s individual circumstances into account.

**Screening for Endometrial Cancer**

In 2001, the ACS concluded that there was insufficient evidence to recommend screening for endometrial cancer in women at average risk, or those who were at an increased risk due to a history of unopposed estrogen therapy, tamoxifen therapy, late menopause, nulliparity, infertility or failure to ovulate, obesity, diabetes, or hypertension.6 The ACS recommends that women at average and increased risk should be informed about the risks and symptoms (in particular, unexpected bleeding and spotting) of endometrial cancer at the onset of menopause, and should be strongly encouraged to immediately report these symptoms to their physician (Table 2). Women at very high risk for endometrial cancer due to 1) known HNPCC genetic mutation carrier status; 2) a substantial likelihood of being a mutation carrier (ie, a mutation is known to be present in the family); or 3) the absence of genetic testing results in families with a suspected autosomal dominant predisposition to colon cancer should consider beginning annual testing for the detection of early endometrial cancer at age 35 years. The evaluation of endometrial histology with the endometrial biopsy is still the standard for determining the status of the endometrium.34 Women at high risk should be informed that the recommendation for screening is based on expert opinion, and they also should be informed about potential benefits, risks, and limitations of testing for the detection of early endometrial cancer.

**Testing for Early Prostate Cancer Detection**

The ACS recommendation for the early detection of prostate cancer was last updated in 2001 and a review and update of the current guidelines is currently underway.6 Because the current evidence regarding the value of testing for early prostate cancer detection is insufficient to recommend that average-risk men undergo regular screening, the ACS recommendations have emphasized the importance of shared decision making regarding testing, stating that prostate-specific antigen (PSA) testing and DREs should be offered annually beginning at age 50 years to men with a life expectancy of at least 10 years. Information concerning the benefits and limitations of testing should be provided to all patients; specifically, prior to testing, men should have an opportunity to learn about the benefits and limitations of testing for the detection and treatment of early prostate cancer. Unfortunately, these guidelines are frequently misstated or misinterpreted outside of the ACS. Therefore, in 2008, a decision was made to refine the language of the guidelines. The goal of this revised language is to clearly emphasize the informed decision-making requirements that have always been the core of our recommendations, but are often not included when our guidelines are discussed by other entities. To clarify the intent of the 2001 guidelines, an editorial change was made to the ACS recommendations for the early detection of prostate cancer. The recommendation now states: “The American Cancer Society recommends that health care providers discuss the potential benefits and limitations of prostate cancer early detection testing with men and offer the PSA blood test and the digital rectal examination annually, beginning at age 50, to men who are at average risk of prostate cancer and who have a life expectancy of at least 10 years. Those men who indicate a preference for testing following this discussion should be tested. Men at high risk of developing prostate cancer (African Americans or men with a close relative diagnosed with prostate cancer before age 65) should have this discussion with their provider beginning at age 45. Men at even higher risk (because they have several close relatives diagnosed with prostate cancer at an early age) should have this discussion with their provider at age 40.”

The ACS Prostate Cancer Advisory Committee placed strong emphasis on shared decision making between clinicians and patients, and also emphasized that clinical policies that avoid discussing testing, discourage testing, or recommend testing to all men were inappropriate. In addition, the Advisory Committee concluded that if men ask the clinician to make the testing decision on their behalf after a discussion regarding the benefits, limitations, and risks associated with prostate cancer testing, they should be tested unless other circumstances (eg, limited longevity or other considerations) would discourage testing.

The USPSTF recently completed a systematic review of the benefits and harms associated with
screening for prostate cancer, updating guidelines previously issued in 2002. The report concludes, as it has previously, that the current evidence is insufficient to assess the balance of the benefits and harms of prostate cancer screening in men aged younger than 75 years. Although the USPSTF found convincing evidence that testing for early prostate cancer with PSA can detect some cases of prostate cancer, it also found there is not adequate evidence in men aged younger than 75 years to determine whether treatment for prostate cancer detected by screening improves health outcomes compared with treatment initiated for symptomatic disease. In men aged 75 years or older, the USPSTF concluded that the incremental benefits of treatment of prostate cancer detected by screening are small to none, and therefore the USPSTF now recommends against testing for early prostate cancer in men aged 75 years or older.

At the center of the uncertainty concerning the balance of benefits and harms related to testing for early prostate cancer detection is the fact that treatment for prostate cancer can cause moderate to substantial harms, including erectile dysfunction, urinary incontinence, bowel dysfunction, and death. Although some prostate cancers are aggressive and life-threatening, others grow so slowly that they may never produce symptoms, or may not progress to a point at which they are life-threatening before a man dies from other causes. Because aggressive therapy can measurably reduce a patient’s quality of life, there are serious and yet unanswered questions regarding the balance of benefits to harm related to the treatment of screen-detected disease when that disease may be indolent or so slow-growing that it may pose a low risk of death.

The new USPSTF recommendation against screening for prostate cancer after age 75 years is somewhat consistent with the current ACS recommendations against testing in men with an estimated longevity of fewer than 10 years. In 2005, the estimated average longevity for a 75-year-old man in the United States was 10.8 years, meaning that approximately half of men at the age of 75 years do not have an expected longevity of greater than 10 years. Although the ACS does not set an upper age at which to stop discussing the option of testing, the guidelines do state that men with a life expectancy of fewer than 10 years should not be screened. Thus, on a practical level, the new USPSTF guidelines to not screen for prostate cancer after age 75 years are consistent with ACS guidelines for at least half of men in this age group. However, the ACS recommendations recognizes that there are some men aged 75 years and older who are in better than average health and with a life expectancy of more than 10 years, and it is possible that they may benefit from testing.

Testing for Early Lung Cancer Detection

At the current time, neither the ACS nor any other medical/scientific organization recommends testing for the detection of early lung cancer in asymptomatic individuals. However, the ACS historically has recognized that patients at high risk of lung cancer due to significant exposure to tobacco smoke or occupational exposures may decide to undergo testing for early lung cancer detection on an individual basis after consultation with their physician. Because of the likelihood that a growing number of individuals would seek testing for early lung cancer detection with spiral CT, the ACS issued a narrative in 2001 emphasizing the importance of shared decision making with regard to testing for early lung cancer detection. The narrative not only emphasized the importance of discussing potential benefits and harms, but also the importance of testing in settings with multidisciplinary expertise in diagnostic workup and treatment. Currently, prospective trials to evaluate the efficacy of lung cancer screening are underway in the United States and Europe, with results expected before the end of the decade. An update to the current narrative concerning shared decision making related to testing for early lung cancer detection is not anticipated until results from prospective clinical trials currently underway are available.

The Cancer-related Checkup

Periodic encounters with clinicians, either for acute care or checkups, offer the potential for health counseling, cancer screening, and case finding. When individuals see a healthcare professional for a preventive health examination, there is an opportunity for more comprehensive counseling and testing. These encounters should include the performance or referral for conventional cancer screening tests as appropriate by age and gender, as described earlier, but...
such visits also are an opportunity for case-finding examinations of the thyroid, testicles, ovaries, lymph nodes, oral region, and skin. In addition, self-examination techniques or an increased awareness of the signs and symptoms of skin cancer, breast cancer, or testicular cancer can be discussed. Health counseling may include guidance concerning smoking cessation, diet, physical activity, and shared decision making about cancer screening, or testing for early cancer detection for cancer sites at which population-based screening is not yet recommended. Whereas in the past the ACS recommended a “cancer-related checkup” in a manner that implied a stand-alone examination, the recommendation now stresses that the occasion of a general periodic health examination provides a good opportunity to address examinations and counseling that could lead to the prevention and early detection of cancer (Table 2).

Surveillance of Cancer Screening: Colorectal, Breast, Cervical, and Prostate Cancers

Data Sources
The most current estimates of national trends in cancer screening for the period between 1987 and 2005 are based on the 2005 NHIS and the Behavioral Risk Factor Surveillance System (BRFSS) conducted in 2006, and were reported in detail in the last update of the ACS guidelines.44 No new data with which to update cancer screening trends are currently available, and the reader is referred to the previously published guidelines for a more detailed description of the underlying methodologies of the two sources of national estimates of the prevalence of cancer screening and trends over time by age, gender, and other demographic factors. However, for convenience, a summary of trends and the current estimates of screening utilization are reproduced here.

Cancer Screening Trends: Evidence from the NHIS, 2000 Through 2005
In 2005, 79.6% of women reported undergoing a Pap test within the past 3 years. However, from 2000 through 2005, among all racial/ethnic groups, there was a slight decline in the proportion of women reporting having had a recent Pap test, with an overall drop of 1.7 percentage points. In 2005, 66.9% of women reported having had a mammogram within the past 2 years, which was a decline of 3.4% from the rate reported in 2000. In contrast to the rates for cervical and breast cancer screening, screening rates for CRC increased from 2000 through 2005 from 37.6% to 44.2% in adults ages 50 to 64 years and from 48.7% to 56.4% in adults aged 65 years and older.

Prevalence of Cancer Screening—BRFSS, 2006
In 2006, 83.3% of women aged 18 years and older with an intact uterus reported having had a Pap test within the preceding 3 years. The proportion of women aged 40 years and older who reported having had a mammogram within the last year was 60.8%, whereas 53% of women reported having had both a mammogram and a CBE within the last year. In 2006, among adults aged 50 years and older, the prevalence of CRC screening with endoscopic procedures within the past 10 years was 56.3% and the prevalence of having done an at-home FOBT within the past year was 16.4%. Among adults aged 50 years and older, the prevalence of having had recent screening with either FOBT or endoscopy was 60.4%. The proportion of men aged 50 years and older without a prior diagnosis of prostate cancer who reported having been tested for early prostate cancer detection within the past year with a PSA blood test was 55.4%, and that with a DRE was 51.1%. Current guidelines stress the importance of opportunities for shared decision making in men at average risk rather than a direct endorsement of screening. In the 2000 NHIS, approximately two-thirds of men who reported that they had been tested with PSA also reported that they had a discussion with their physician concerning the advantages and disadvantages of PSA testing.45

Among the most important factors in determining whether adults have had recent cancer screening is a recommendation from a healthcare provider.46,47 Data from the 2005 NHIS regarding self-reported physician recommendations for cancer screening for CRC and mammography are shown in Table 3. Overall, the rates for referral for CRC screening with endoscopy are lower for adults ages 50 to 64 years (50.6%) compared with adults aged 65 years and older (57.6%), but the rates of recommendation for FOBT are less than half those for endoscopy for adults ages 50 to 64 years and those aged 65 years and older. Women ages 50 to 64 years are more likely to report a referral for
CRC screening with either endoscopy or FOBT compared with men, whereas men aged 65 years and older are more likely to report a referral for either test compared with women. Physician recommendations for both tests increase with increasing education, and are considerably greater for those who report having a usual source of care. Non-Hispanic whites are much more likely to report a physician recommendation for endoscopy or FOBT compared with any other ethnic groups. Women ages 40 to 64 years and those aged 65 years and older report similar rates of physician recommendation for mammography. As with CRC screening, women with a lower educational level are less likely to report having had a recommendation for screening compared with women who are college graduates, and women with insurance coverage and a usual source of care are more likely to report that a physician recommended that they have a mammogram compared with women without insurance or a usual source of care. Non-Hispanic white women ages 50 to 64 years are more likely to report a recommendation for a mammogram than other ethnic groups, whereas differences in physician recommendations for breast cancer screening are much smaller among women of different ethnic groups who are aged 65 years and older.

Discussion

At the national level, the prevalence of breast and cervical cancer screening has remained relatively stable since 2000, whereas the rate of CRC screening (particularly colonoscopy testing) has improved.
Trends indicate that much of the steady increase in CRC screening is due to a greater uptake of colonoscopy; the utilization of colonoscopy by adults aged 50 years and older increased from 20% in 2000 to 39.2% in 2005, whereas the use of other test options (at-home FOBT and sigmoidoscopy) declined during this same period. It is interesting to observe in the data regarding recent physician advice to be screened that the rate of reporting physician recommendation to utilize an at-home FOBT is less than half the rate of referral for endoscopy for every category of gender, education, ethnicity, insurance status, and access to care.

With regard to cancer screening rates overall, in each instance rates are lower than what is both feasible and optimal to have the potential to realize the fullest contribution of early detection to the control of breast, cervical, and colorectal cancer. Furthermore, cancer screening rates from population-based surveys overestimate the true rate of screening, so the need to improve participation rates in screening is even greater than indicated by current estimates from the NHIS and BRFSS. Thus, greater and perhaps more creative approaches are needed to 1) improve and sustain increases in public awareness of the importance of regular screening; 2) increase incentives for healthcare professionals to refer their patients to cancer screening; 3) support the implementation of reminder and other systems that are supportive of regular screening; and 4) expand community programs and financing systems that can increase access to screening in medically underserved populations.

An example of a strategy to increase screening in the primary care setting is the National Colorectal Cancer Roundtable, which provides practice essentials and tools to assist clinicians in ensuring that each and every appropriate patient undergoes screening for CRC. This source is currently being updated to include summary best practices to improve cancer screening rates for breast and cervical cancer, as well to improve the taking of cancer family histories and the use of that information for patient care.

Numerous factors alone and together account for the considerable underutilization of cancer screening in the United States. Having health insurance, a regular physician, and a regular source of usual care all are associated with the receipt of preventive health care and higher cancer screening rates. In particular, a recommendation for cancer screening from a healthcare professional is among the strongest factors influencing recent screening; conversely, when adults who have not been screened are asked why they have not had a recent screening test, the most common answers are that they “did not think they needed it,” “had not thought about it,” or “the doctor did not order it.” Each of these three “accounts” is an indicator that a conversation between a patient and healthcare professional regarding cancer screening did not take place. When these relational and other structural supports are absent, cancer screening rates are considerably lower.

Regular preventive health examinations provide opportunities for counseling, screening, and even case finding. On the occasion of a periodic health examination, there is a greater opportunity for healthcare professionals to recommend cancer screening, and these recommendations have been shown to be a key predictor of screening utilization. The likelihood that patients will receive this recommendation is higher if they visit a healthcare professional for a regular checkup as opposed to episodic care for other reasons. Although it is important to take advantage of opportunities for prevention during encounters for acute and chronic care, relying mostly on opportunistic preventive care is inefficient and to date has demonstrated weak overall performance in the delivery of recommended preventive services.

As the nation begins to consider the importance of healthcare reform more seriously, we should hope that the lessons learned and the evidence assembled to date will influence new models for the delivery of preventive care that will improve on current performance. With a broad understanding among the majority of the public of the importance of regular cancer screening, regular encounters with healthcare services and/or the support of high-performance reminder systems, and adequate incentives to primary care providers, the potential exists to achieve further reductions in the mortality rates of cervical cancer, breast cancer, and CRC. It is revealing that rates of CRC screening have moved upward at a slower rate than was ever anticipated. It is very likely that the main contributing factor was the challenge of “fitting” an additional preventive service into an already crowded list of services to be addressed during encounters for chronic conditions and sickness. If on-
References

1. Smith RA, Mettlin CJ, Davis KJ, Eyre H. American Cancer Society guidelines for the early detection of cancer. CA Cancer J Clin. 2000;50:34-49.

2. Smith RA, Saslow D, Sawyer KA, et al. American Cancer Society guidelines for breast cancer screening: update 2003. CA Cancer J Clin. 2003;53:141-169.

3. Saslow D, Boetes C, Burke W, et al. American Cancer Society guidelines for the early detection of cervical neoplasia and cancer. CA Cancer J Clin. 2002;52:343-362.

4. Ramsey SD, Yoon P, Moonesinghe R, et al. The rapid application of life-saving technology, we going studies indicate that screening for other can-
cers is beneficial, without systems in place to insure the rapid application of life-saving technology, we likely will face similarly slow adoptions of popula-
tion-based screening that scientific evidence has demonstrated could save lives.

5. Smith RA, Mettlin CJ, Davis KJ, Eyre H. American Cancer Society guidelines for the early detection of cancer. CA Cancer J Clin. 2000;50:34-49.

6. Smith RA, von Eschenbach AC, Wender R, et al. American Cancer Society guidelines for the early detection of cervical neoplasia and cancer. CA Cancer J Clin. 2002;52:343-362.

7. Levin B, Brooks D, Smith RA, Stone A. Emerging technologies in screening for colorectal cancer: CT colonography, immuno-
chemical fecal occult blood tests, and stool screening using molecular markers. CA Cancer J Clin. 2003;53:44-55.

8. Rex DK, Kahi CJ, Levin B, et al. Guidelines for colonoscopy surveillance after cancer resection: a consensus update by the American Cancer Society and the US Multi-Society Task Force on Colorectal Cancer. Gas-
troenterology. 2006;130:1865-1871.

9. Winawer SJ, Zauber AG, Fletcher RH, et al. Guidelines for colonoscopy surveillance after polypectomy: a consensus update by the US Multi-Society Task Force on Colorectal Cancer and the American Cancer Society. CA Cancer J Clin. 2006;56:143-159; quiz 184-185.

10. Levin B, Lieberman DA, McFarland B, et al. Screening and surveillance for the early detec-
tion of colorectal cancer and adenoma-
tous polyps, 2008: a joint guideline from the American Cancer Society, the US Multi-
Society Task Force on Colorectal Cancer, and the American College of Radiology. CA Cancer J Clin. 2008;58:130-160.

11. Jemal A, Siegel R, Ward E, et al. Cancer statistics, 2008. CA Cancer J Clin. 2008;58:71-96.

12. Ramsey SD, Yoon P, Moonesinghe R, Khoury MJ. Population-based study of the prevalence of family history of cancer: im-
implications for cancer screening and preven-
tion. Genet Med. 2006;8:571-575.

13. U.S. Preventive Services Task Force. Gen-
etic risk assessment and BRCA mutation testing for breast and ovarian cancer sus-
ceptibility: recommendation statement. Ann Intern Med. 2005;143:355-361.

14. Hall JJ, Middlebrooks A, Coughlin SS. Pop-
ulation prevalence of first-degree family his-
tory of breast and ovarian cancer in the United States: implications for genetic test-
ing. Open Heart Serv Policy J. 2008;1:34-47.

15. Murff HJ, Greer EV, Syngal S. The com-
prehensiveness of family cancer history as-
sessments in primary care. Community Genet. 2007;10:174-180.

16. Tabar L, Duffy SW, Vitak B, Chen HH, Pre-
vest TC. The natural history of breast car-
cinoma: what have we learned from screen-
ing? Cancer. 1999;86:449-462.

17. Humphrey LL, Helfand M, Chan BK, Woolf SH. Breast cancer screening: a summary of the evidence for the U.S. Preventive Ser-
tices Task Force. Ann Intern Med. 2002;137:347-360.

18. Walter LC, Covinsky KE. Cancer screening in elderly patients: a framework for indi-
vidualized decision making. JAMA. 2001;
285:2750-2756.

19. Gail MH, Brinton LA, Byar DP, et al. Pro-
jecting individualized probabilities of de-
developing breast cancer for white females who are being examined annually. J Natl Cancer Inst. 1989;81:1879-1886.

20. Claus EB, Risch N, Thompson WD. Autosomal dominant inheritance of early-onset breast cancer. Implications for risk predic-
tion. Cancer. 1994;73:643-651.

21. Tyrer J, Duffy SW, Cuzick J. A breast can-
cer prediction model incorporating family and personal risk factors. Stat Med. 2004;
23:1111-1130.

22. Antoniou AC, Pharaoh PP, Smith P, Easton DF. The BOADICEA model of genetic sus-
cceptibility to breast and ovarian cancer. Br J Cancer. 2004;91:1580-1590.

23. USPSTF/IDSA guidelines for the prevention of opportunistic infections in persons in-
fectected with human immunodeficiency vi-
rus: a summary. MMWR Recom Rep. 1995;
44:1-34.

24. National vaccination coverage among ado-
lescents aged 13-17 years—United States, 2007. J Pediatr. 2008;152:180-185.

25. Allison JE, Lawson M. Screening tests for colorectal cancer: a menu of options remains relevant. Curr Oncol Rep. 2006;8:492-498.

26. Beard LE, Savides TJ, Ganiats TG. Patient preferences for colorectal cancer screening. J Fam Pract. 1997;45:211-218.

27. Collins LF, Lieberman DA, Durbin TE, Weiss DG. Accuracy of screening for fecal occult blood on a single stool sample ob-
tained by digital rectal examination: a com-
parison with recommended sampling prac-
tice. Ann Intern Med. 2005;142:81-95.

28. Winawer S, Fletcher R, Rex D, et al. Col-
orectal cancer screening and surveillance: clinical guidelines and rationale—Update based on new evidence. Gastroenterology. 2003;124:544-560.

29. Rex DK, Kahi CJ, Levin B, et al. Guidelines for colonoscopy surveillance after cancer resection: a consensus update by the American Cancer Society and US Multi-Society Task Force on Colorectal Cancer. CA Cancer J Clin. 2006;56:160-167; quiz 185-186.

30. Johnson CD, Chen MH, Toledano AY, et al. Accuracy of CT colonography for detection of large adenomas and cancers. N Engl J Med. 2008;359:1207-1217.

31. Pickhardt PJ, Choi JR, Hwang I, et al. Com-
puted tomographic virtual colonoscopy to screen for colorectal neoplasia in asympto-
tomatic adults. N Engl J Med. 2003;349:2191-2200.

32. Fletcher RH. Colorectal cancer screening on stronger footing. N Engl J Med. 2008;
359:1285-1287.

33. Screening for colorectal cancer: U.S. Pre-
ventive Services Task Force recommenda-
tion statement. Ann Intern Med. 2008;149:
627-637.

34. Walker JL, Nunez ER. Endometrial cancer. In: Kramer BS, Gohagan JK, Prorok PC, eds. Cancer Screening: Theory and Practice. New York: Marcel Dekker, Inc; 1999:531-566.

35. U.S. Preventive Services Task Force. Screening for prostate cancer: U.S. Preventive Ser-
tices Task Force recommendation statement. Ann Intern Med. 2008;149:185-191.

36. Wilt TJ, MacDonald R, Rutks I, Shamliyan TA, Taylor BC, Kane RL. Systematic review: comparative effectiveness and harms of treat-
ments for clinically localized prostate cancer. Ann Intern Med. 2008;148:435-448.

37. U.S. Department of Health and Human Ser-
VICES. Health, United States, 2007, 2nd ed. Washington, DC: US Government Printing Office; 2007.

38. Eddy D. ACS report on the cancer-related health checkup. CA Cancer J Clin. 1980;30:
240-249.

39. Henschke CI, McCauley DJ, Yankelevitz DF, et al. Early Lung Cancer Action Project: overall design and findings from baseline screening [see comments]. Lancet. 1999;354:99-105.

40. Ford LG, Minassian LM, McCaskill-Stevens W, Pisano ED, Sullivan D, Smith RA. Pre-
vention and early detection clinical trials: opportunities for primary care providers and their patients. CA Cancer J Clin. 2003;
53:82-101.

41. Pastirino U, Bellomi M, Landoni C, et al. Early lung-cancer detection with spiral CT and positron emission tomography in heavy smokers: 2-year results. Lancet. 2005;366:193-200.

42. Henschke CI, Yankelevitz DF, Libby DM, Pasmanter MW, Smith JP, Miettinen OS. Survival of patients with stage I lung cancer detected on CT screening. N Engl J Med. 2006;355:1763-1771.

43. Macias MV, Coffield AB, Edwards NM, Foremnesch TJ, Goodman MJ, Selberg LJ. Priorities among effective clinical preventive services: results of a systematic review and analysis. Ann J Prev Med. 2006;31:52-61.
44. Smith RA, Cokkinides V, Brawley OW. Cancer screening in the United States, 2008: a review of current American Cancer Society guidelines and cancer screening issues. CA Cancer J Clin. 2008;58:161-179.

45. McFall SL. US men discussing prostate-specific antigen tests with a physician. Ann Fam Med. 2006;4:433-436.

46. Levy BT, Nordin T, Sinith S, Rosenbaum M, James PA. Why hasn’t this patient been screened for colon cancer? An Iowa Research Network study. J Am Board Fam Med. 2007;20:458-468.

47. Sohl SJ, Moyer A. Tailored interventions to promote mammography screening: a meta-analytic review. Prev Med. 2007;45:252-261.

48. Hiatt RA, Perez-Stable EJ, Quesenberry C Jr, Sabogal F, Otero-Sabogal R, McPhee SJ. Agreement between self-reported early cancer detection practices and medical audits among Hispanic and non-Hispanic white health plan members in northern California. Prev Med. 1995;24:278-285.

49. Carney PA, Goodrich ME, Mackenzie T, et al. Utilization of screening mammography in New Hampshire. Cancer. 2005;104:1726-1732.

50. How to Increase Colorectal Screening in Practice: A Primary Care Clinician’s Evidence-Based Toolbox and Guide. Accessed Nov. 1, 2008. Available at: http://www.nccrt.org/.

51. Safaty M, Wender R. How to increase colorectal cancer screening rates in practice. CA Cancer J Clin. 2007;57:354-366.

52. May DS, Kiefe CI, Funkhouser E, Fouad MN. Compliance with mammography guidelines: physician recommendation and patient adherence. Prev Med. 1999;28:386-394.

53. MacDowell NM, Nitz-Weiss M, Short A. The role of physician communication in improving compliance with mammography screening among women ages 50-79 in a commercial HMO. Manag Care Q. 2000;8:11-19.

54. Shapiro JA, Seeff LC, Thompson TD, Nadel MR, Klabunde CN, Vernon SW. Colorectal cancer test use from the 2005 National Health Interview Survey. Cancer Epidemiol Biomarkers Prev. 2008;17:1623-1630.

55. Busch SH, Duchovny N. Family coverage expansions: impact on insurance coverage and health care utilization of parents. J Health Econ. 2005;24:876-890.

56. Howe HL, Wu X, Ries LA, et al. Annual report to the nation on the status of cancer, 1975-2003, featuring cancer among U.S. Hispanic/Latino populations. Cancer. 2006;107:1711-1742.

57. James TM, Greiner KA, Ellerbeck EF, Feng C, Aahuwalia JS. Disparities in colorectal cancer screening: a guideline-based analysis of adherence. Ethn Dis. 2006;16:228-233.

59. Boulware LE, Marinopoulos S, Phillips KA, et al. Association of insurance with cancer care utilization and outcomes. CA Cancer J Clin. 2008;58:9-31.

59. Boulware LE, Marinopoulos S, Phillips KA, et al. Systematic review: the value of the periodic health examination. Ann Intern Med. 2007;146:289-300.

61. Mehrotra A, Zaslavsky AM, Ayanian JZ. Preventive health examinations and preventive gynecological examinations in the United States. Arch Intern Med. 2007;167:1876-1883.