Cancer Screening in the United States, 2012
A Review of Current American Cancer Society Guidelines and Current Issues in Cancer Screening

Robert A. Smith, PhD1; Vilma Cokkinides, PhD2; Otis W. Brawley, MD3

Each year the American Cancer Society (ACS) publishes a summary of its recommendations for early cancer detection, a report on data and trends in cancer screening rates, and select issues related to cancer screening. In this issue of the journal, current ACS cancer screening guidelines are summarized, as are the latest data on the use of cancer screening from the National Health Interview Survey. CA Cancer J Clin 2012;62:129-142. © 2012 American Cancer Society.

Introduction

On November 4, 2011, Dr. Harold Varmus, Director of the National Cancer Institute (NCI), announced that an early evaluation of the National Lung Screening Trial (NLST) data had shown a statistically significant 20% reduction in lung cancer mortality in a group of high-risk current and former smokers randomized to receive 3 annual low-dose computed tomography (LDCT) lung cancer screening examinations compared with an equivalent-risk group randomized to receive 3 annual chest x-rays (CXR).1 Equally important, the LDCT group had not experienced a rate of unforeseen, adverse screening effects that would lead to uncertainty about the balance of benefits and harms in the study population. On June 30, 2011, the first detailed results of the NLST were published in the New England Journal of Medicine.2

For decades there has been broad consensus that lung cancer screening was not effective, when in fact the evidence, as judged by both the American Cancer Society (ACS) and the US Preventive Services Task Force (USPSTF), ultimately was determined to be insufficient to recommend for or against lung cancer screening.3,4 Nevertheless, despite the large burden of disease and the appearance of more favorable survival for lung cancers diagnosed earlier in their natural history,5 the absence of definitive evidence of the efficacy of screening with either CXR or newer technology meant that screening for lung cancer could not be recommended.4 Despite the lack of supporting evidence for lung cancer screening, interest in the potential to detect lung cancer earlier, and encouraging performance of new technologies led to calls for new prospective trials.6 While the results of the NLST have demonstrated that lung cancer screening can be added to the armamentarium of strategies to fight the deleterious effects of exposure to tobacco smoke, the potential to reduce lung cancer deaths through screening is uncertain at this time. As described by Wilson and Junger,7 evidence of screening test efficacy is only one among a list of criteria that must be considered before recommending screening to an asymptomatic population. In 2012, the ACS will issue a lung cancer screening guideline to help guide health care professionals and support informed decisions for adults at high risk for lung cancer. This new guideline largely will be based on the results of the NLST, and likely will evolve as further scientific evidence becomes available.

Since 1980, the ACS has introduced and periodically updated cancer screening guidelines or guidance related to screening and/or informed decision-making for cancers of the breast, cervix, colon and rectum, endometrium, lung, and prostate. During this period, other organizations also have issued guidelines, which have at times been identical, but in other instances have differed subtly or entirely regarding key elements related to the use of a particular technology, ages to begin and cease screening, and the periodicity of testing. Often, guideline differences have been due to nothing other than that data available at the time the guideline was issued, but in other instances the differences have been due to fundamentally different approaches to the interpretation of evidence and perspectives on various measures of effectiveness. Differences in the screening recommendations from respected organizations warrant clear explanations rather than supposition or speculation.

1Senior Director, Cancer Control Science Department, American Cancer Society, Atlanta, GA; 2Program Director for Risk Factor Surveillance, Department of Epidemiology and Research Surveillance, American Cancer Society, Atlanta, GA; 3Executive Vice President for Research and Medical Affairs, American Cancer Society, Atlanta, GA, and Editor-in-Chief of CA.

Corresponding author: Robert A. Smith, PhD, Cancer Control Science Department, American Cancer Society, 250 Williams St, NW, Suite 600, GA 30303; robert.smith@cancer.org

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about the rigor of the review and whether professional or intellectual biases influenced the final outcome. In 2010, the ACS initiated a review and update of the process by which it establishes and updates cancer screening guidelines. Outside experts were invited to assist the ACS in this process, and its conclusion was delayed to benefit from the input of 2 recently published reports from the Institute of Medicine focused on the quality and credibility of clinical practice guidelines. A report describing the new ACS guidelines development process was published in 2011.

In this yearly report, we provide a summary of the current ACS cancer screening guidelines, a summary of guidance to the public related to early detection tests that are increasingly used by the public but not yet recommended due to the lack of consensus on their value for cancer screening, and the most recent data on adult cancer screening rates and trends.

In order for guidelines to reflect the most current scientific evidence, the medical and scientific literature are monitored on an ongoing basis, and generally guidelines are reviewed and updated at least every 5 years, or sooner if new evidence warrants an immediate update in recommendations. The annual guideline reviews, as well as the more detailed cancer screening guideline updates, are published in this journal as stand-alone articles and are available online at the journal’s Web site (www.cacancerjournal.com). Table 1 shows the recent history of guidelines updates, as well as those currently in progress.

### Screening For Breast Cancer

Breast cancer is the most common cancer and the second most common 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 (Table 2). The 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.

Between the ages of 20 and 39 years, average-risk women should undergo CBE every 3 years, and annually after age 40 years. CBE should take place during periodic health examinations. When CBE is performed, it is an opportunity to discuss the importance of early breast cancer detection and answer any questions a woman may have about her own risk, new technologies, or other matters related to breast disease. Clinicians should emphasize the importance of awareness of a family history of breast and ovarian cancers in first-degree and second-degree relatives on both the maternal and paternal side of the family. An opportunity to update the family history should take place during encounters for preventive care or screening. During these discussions, clinicians should emphasize the importance of awareness and recognition of breast changes and, if changes are perceived, the importance of seeking consultation promptly. Women should be informed about the potential benefits, limitations, and harms (principally the possibility of a false-positive result) associated with breast self-examination (BSE). Women may 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 the age of 40 years. Women also should be informed about 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. 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

### Table 1. History of Recent Updates to American Cancer Society Cancer Early Detection Guidelines

| CANCER SITE                | YEAR                                      |
|----------------------------|-------------------------------------------|
| Breast cancer              | 2003, Complete update<sup>11</sup>         |
|                            | 2007, Guidelines for MRI use in high-risk women<sup>12</sup> |
|                            | 2012, Update anticipated                  |
| Cervical cancer            | 2002, Complete update<sup>13</sup>         |
|                            | 2007, Guidelines for HPV vaccine use<sup>14</sup> |
|                            | 2012, Update anticipated                  |
| Colorectal cancer          | 2001, Complete update<sup>4</sup>          |
|                            | 2003, Technology update<sup>15</sup>       |
|                            | 2006, Update for postpolypectomy and post-colorectal cancer resection surveillance<sup>16,17</sup> |
|                            | 2008, Complete update<sup>18</sup>         |
|                            | 2013, Update anticipated                  |
| Endometrial cancer         | 2001, Guidance for counseling, shared decision-making, and high-risk women<sup>6</sup> |
| Lung cancer                | 2001, Guidance for shared decision-making<sup>4</sup> |
|                            | 2011, Guidance for shared decision making<sup>19</sup> |
|                            | 2012, Guidelines for lung cancer screening |
| Prostate cancer            | 2001, Guidance for shared decision-making related to testing for early detection and screening recommendations for higher risk men<sup>20</sup> |
|                            | 2010, Complete update<sup>20</sup>        |

MRI indicates magnetic resonance imaging; HPV, human papillomavirus.
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 a poor prognosis. The harms associated with breast cancer screening include the potential for false-positive results, which can result in anxiety, and when abnormal findings can not be resolved with additional imaging, a biopsy will be required to rule out the possibility of breast cancer. Finally, a small percentage of breast cancers detected by mammography may not be progressive (ie, they would not have been detected in a woman’s

## TABLE 2. ACS Recommendations for the Early Detection of Cancer in Average-Risk, Asymptomatic Individuals

| CANCER SITE | POPULATION | TEST OR PROCEDURE | FREQUENCY |
|-------------|------------|------------------|-----------|
| Breast      | Women ages ≥20 y | BSE           | It is acceptable for women to choose not to do BSE or to do BSE regularly (monthly) or irregularly. Beginning in their early 20s, women should be told about the benefits and limitations of BSE. Regardless of whether a woman ever performs BSE, the importance of prompt reporting of any new breast symptoms to a health professional should be emphasized. Women who choose to do BSE should receive instruction and have their technique reviewed on the occasion of a periodic health 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 receive a CBE as part of a periodic health examination, preferably annually. |
| Mammography | Begin annual mammography at age 40 y.* |
| Cervix      | Women, ages ≥21 y | Pap test HPV DNA test | Cervical cancer screening should begin approximately 3 y after a woman begins having vaginal intercourse, but no later than aged 21 y. Screening should be done 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 undergo screening every 2 to 3 y with cervical cytology (either conventional or liquid-based Pap test) alone, or every 3 y with an HPV DNA test plus cervical cytology. Women aged ≥70 y who have had ≥3 normal Pap tests and no abnormal Pap tests within the last 10 y and women who have had a total hysterectomy may choose to stop cervical cancer screening. |
| Colorectal  | Men and women, ages ≥50 y | FOBT with at least 50% test sensitivity for cancer, or FIT with at least 50% test sensitivity for cancer, or | Annual, starting at age 50 y. Testing at home with adherence to manufacturer’s recommendation for collection techniques and number of samples is recommended. FOBT with the single stool sample collected on the clinician’s fingertip during a DRE in the health care setting is not recommended. 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 with regard to sensitivity and specificity. There is no justification for repeating FOBT in response to an initial positive finding. |
|             | Stool DNA test, or | Interval uncertain, starting at age 50 y. |
|             | FSIG, or | Every 5 y, starting at age 50 y. FSIG can be performed alone, or consideration can be given to combining FSIG performed every 5 y with a highly sensitive gFOBT or FIT performed annually. |
|             | DCBE, or | Every 5 y, starting at age 50 y. |
|             | Colonoscopy | Every 10 y, starting at age 50 y. |
|             | CT colonoscopy | Every 5 y, starting at age 50 y. |
| 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. |
| Prostate    | Men, ages ≥50 y | DRE and PSA | Men who have at least a 10-y life expectancy should have an opportunity to make an informed decision with their health care provider about whether to be screened for prostate cancer, after receiving information about the potential benefits, risks, and uncertainties associated with prostate cancer screening. Prostate cancer screening should not occur without an informed decision-making process. |
| Cancer-related checkup | Men and women, age ≥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 about tobacco use, sun exposure, diet and nutrition, risk factors, sexual practices, and environmental and occupational exposures. |

ACS indicates American Cancer Society; BSE, breast self-examination; CBE, clinical breast examination; Pap, Papanicolaou; HPV, human papillomavirus; FOBT, fecal occult blood test; FIT, fecal immunochemical test; DRE, digital rectal examination; gFOBT, guaiac-based toilet bowl FOBT tests; FSIG, flexible sigmoidoscopy; DCBE, double-contrast barium enema; CT, computed tomography; PSA, prostate-specific antigen.

*Beginning at age 40 y, annual CBE should be performed prior to mammography.
lifetime had she not undergone mammography screening). The most credible estimates indicate that the magnitude of overdiagnosis is small and mostly confined to ductal carcinoma in situ.\textsuperscript{26,27}

There is no specific upper age at which mammography screening should be discontinued. Rather, the decision to stop regular mammography screening should be individualized based on the potential benefits and risks of screening in the context of overall health status and estimated longevity.\textsuperscript{28}

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 \textit{BRCA} mutation and other rarer high-risk genetic syndromes, or who had been treated with radiation to the chest for Hodgkin disease.\textsuperscript{12} Annual screening mammography and magnetic resonance imaging (MRI) starting at age 30 years is recommended for women with a known \textit{BRCA} mutation, women who are untested but have a first-degree relative with a \textit{BRCA} mutation, or women with an approximately 20% to 25% or greater lifetime risk of developing breast cancer based upon specialized breast cancer risk estimation models capable of pedigree analysis of first- and second-degree relatives on both the maternal and paternal side of the family. While MRI may eventually prove to be cost-effective and advantageous for women at elevated risk due to other combinations of risk factors, at this time recommendations for annual screening mammography and MRI are based strictly on known or estimated high-risk mutation carrier status or history of high-dose radiation therapy at a young age.

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- and second-degree relatives on both the maternal and paternal side. 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 \textit{BRCA} mutation is present, including the Claus model,\textsuperscript{29} Tyrer-Cuzick model,\textsuperscript{30} BRCAPRO model,\textsuperscript{31} and the Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm (BOADICEA)\textsuperscript{32} model. While the Breast Cancer Risk Assessment Tool (ie, the Gail model) provides a good, generalized measure of short- 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- and second-degree relatives on both the maternal and paternal side.\textsuperscript{33} A link to supplemental material related to these models is included in the online publication (available at: http://onlinelibrary.wiley.com/doi/10.3322/canjclin.57.2.75/suppinfo).\textsuperscript{12}

### Screening For Cervical Cancer

ACS guidelines for cervical cancer screening were last updated in 2002 (Table 2)\textsuperscript{13} and recommendations for the use of prophylactic human papillomavirus (HPV) vaccines, including policy and implementation issues, were published in January 2007.\textsuperscript{14}

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. Specifically:

- **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 chose to undergo HPV DNA testing should be informed that HPV infection usually is not detectable or harmful; that almost everyone who has had sexual intercourse has been exposed to HPV and that infection is very common; that a positive HPV test result does not reflect the presence of a sexually transmitted disease but rather a sexually acquired infection; and 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 cytology 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 about previous screening is unavailable, and women for whom there is a low likelihood of past screening.**

### Special Considerations

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, chronic corticosteroid treatment, or 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 and Infectious Disease Society of America. There is no specific age at which to stop screening for women with a history of cervical cancer or 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 removal of the cervix or the entire uterus for benign gynecologic disease. However, women with a history of cervical intraepithelial neoplasia (CIN) 2/3, or women for whom it is not possible to document the absence of CIN 2/3 prior to or as the indication for either trachelectomy or 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 had 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 had a subtotal (supracervical) hysterectomy should be screened following the recommendations for average-risk women who have not undergone a hysterectomy.

Vaccination Against HPV

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 universal vaccination of females ages 19 to 26 years. Women in this age group who are interested in undergoing vaccination should talk with a health care 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 2009 National Immunization Survey of Teens, 44.3% 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), and 26.7% had completed 3 doses.

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 on Colorectal Cancer (USMSTF; representing the American College of Gastroenterology, American Gastroenterological Association, and American Society for Gastrointestinal Endoscopy), and the American College of Radiology (Table 2). Recommendations for adults at increased and high risk were last updated in 2001, and in 2006, the ACS and the USMSTF issued a joint guideline update for postpolypectomy and post-CRC resection surveillance.

Recommended CRC screening tests are grouped into 2 categories: 1) tests that primarily detect cancer, which include both guaiac fecal occult blood testing (gFOBT) and fecal immunochemical testing (FIT) and testing stool for exfoliated cell DNA (sDNA); and 2) tests that can detect cancer and advanced adenomas, which include the endoscopic examinations and radiological examinations (ie, flexible sigmoidoscopy [FSIG], colonoscopy [CSPY], double-contrast barium enema [DCBE], and CT colonography [or virtual CSPY]). 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 2 groups of screening tests. Furthermore, the guidelines state that while all recommended tests are acceptable options, the prevention of CRC is the greater priority in screening.

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 one of the following options: 1) annual high sensitivity gFOBT or FIT, following manufacturer’s recommendations for specimen collection; 2) sDNA, for which at this time there is uncertainty with regard to the screening interval; 3) FSIG every 5 years; 4) CSPY 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. For similar reasons, the guideline recommends discontinuing the use of older, lower sensitivity versions of the guaiac test (such as Hemoccult II; Beckman Coulter, Brea, Calif) in favor of newer, high sensitivity gFOBT (such as Hemoccult SENSA; Beckman Coulter) or FIT. An additional option for regular screening is annual stool blood testing (gFOBT or FIT) with FSIG performed every 5 years.
Health professionals should provide guidance to adults about the benefits, limitations, and potential harms associated with screening for CRC, including information on 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 manufacturer’s instructions, the limited sensitivity observed with one-time testing would make stool testing a poor choice. In contrast, evidence from randomized clinical trials and modeling have shown that a commitment to annual testing with high sensitivity can result in a reduced risk of developing CRC and a reduced risk of dying from CRC that rivals CSPY.38

The ACS and other organizations recommend more intensive surveillance for individuals at higher risk for CRC.4,16,17,39 Individuals at higher risk for CRC include: 1) individuals with a history of adenomatous 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, with differing recommendations based on the relative’s age at diagnosis; 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 a known or suspected presence of 1 of 2 hereditary syndromes, specifically, hereditary nonpolyposis colon cancer (HNPCC) or familial adenomatous polyposis. For these individuals, increased surveillance generally means a specific recommendation for CSPY 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 CSPY for individuals with a history of adenomatous polyps or a personal history of curative-intent resection of CRC was issued in 2006 jointly by the ACS and the USMSTF.16,17

**Testing For Early Prostate Cancer Detection**

In 2010, the ACS updated its 2001 guideline for the early detection of prostate cancer.4,20 The guideline states that men who have at least a 10-year life expectancy should have an opportunity to make an informed decision with their health care provider about whether to be screened for prostate cancer with DRE and serum prostate-specific antigen (PSA), after receiving information about the benefits, risks, and uncertainties associated with prostate cancer screening (Table 3). Prostate cancer screening should not occur without an informed decision-making process. Men at average risk should receive this information beginning at age 50 years. Men at higher risk, including African American men and men with a family member (father or brother) diagnosed with prostate cancer before age 65 years, should receive this information beginning at age 45 years. Men at appreciably higher risk (multiple family members diagnosed with prostate cancer before age 65 years) should receive this information beginning at age 40 years. Men should either receive this information directly from their health care providers or be
Screening For Lung Cancer

The recent publication of the findings from the NCI’s NLST demonstrated that lung cancer mortality can be reduced by annual screening with LDCT. This finding creates the possibility that the adoption of widespread lung cancer screening could prevent many premature deaths due to lung cancer. Because cancer screening tests commonly are associated with both benefits and harms, the ACS and other organizations are now engaged in a process of carefully reviewing the evidence to determine the potential benefits and harms associated with LDCT screening. In the interim, given the high interest in LDCT screening for lung cancer, the ACS has issued interim guidance for the general public and for health care professionals (the Lung Cancer Guideline Workgroup members were: Elizabeth T. H. Fontham, MPH, DrPH (Co-Chair); Richard C. Wender, MD (Co-Chair); Ermilo Barrera Jr, MD; Tim E. Byers, MD, MPH; Graham A. Colditz, MD, DrPH; David S. Ettinger, MD; G. Scott Gazelle, MD, MPH, PhD; Dan C. Sullivan, MD; William Travis, MD; Otis W. Brawley, MD; and Robert A. Smith, PhD). In 2012, the ACS will issue a lung cancer screening guideline, which will replace interim guidance that was posted on the ACS website.

Testing For Early Ovarian Cancer Detection

Although the annual incidence of ovarian cancer is low compared with breast cancer and precursor lesions of the cervix, it is the most lethal of the gynecologic cancers.

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. 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 physicians (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 early endometrial cancer detection at age 35 years. The evaluation of endometrial histology with the endometrial biopsy is still the standard for determining the status of the endometrium. Women at high risk should be informed that the recommendation for screening is based on expert opinion, and they also should be informed about the potential benefits, risks, and limitations of testing for early endometrial cancer detection.

Methods are available that merge this information to achieve an estimate of a man’s overall risk of prostate cancer and, more specifically, of his risk of high-grade prostate cancer. Factors that increase the risk of prostate cancer include African American race, family history of prostate cancer, increasing age, and abnormal DRE. A prior negative biopsy lowers risk. The importance of informed and shared decision-making has been a central element of ACS recommendations on prostate cancer early detection since 2001, and is a cross-cutting theme in the recent guidelines from medical and public health organizations, including the USPSTF and the American Urological Association. Despite this consensus on the importance of informed and shared decision-making, studies have shown that informed and shared decision-making measures are inconsistently used in many clinical practices and that, when such discussions take place, the content varies widely and frequently falls short of accepted standards. In an effort to address these shortcomings, the 2010 ACS guideline for the first time provides detailed recommendations to clinicians concerning the core factors related to prostate cancer screening and treatment that should be shared with men to enable them to make a truly informed decision regarding whether to be screened.
Fewer than one-half of women diagnosed with ovarian cancer survive longer than 5 years, and although the 5-year survival rate for patients with localized ovarian cancer is greater than 90%, only 15% of all patients are diagnosed with localized disease.5

Screening and diagnostic methods for ovarian cancer include pelvic examination, CA 125 antigen as a tumor marker, transvaginal ultrasound (TVU), and, potentially, multimarker panels and bioinformatic analysis of proteomic patterns. The sensitivity and specificity of pelvic examination for the detection of symptomatic ovarian cancer are not well established, but are poor and do not support physical examination as a screening method. CA 125 has limited sensitivity and specificity (ie, while CA 125 levels are increased in many women with ovarian cancer, only approximately one-half of early ovarian cancers produce enough CA 125 to cause a positive test, and noncancerous diseases of the ovaries and other cancers, as well as other noncancerous influences, also can increase the blood levels of CA 125).45-47 TVU is capable of detecting small ovarian masses and may distinguish some benign masses from some malignant adnexal masses, although it still only poorly predicts which masses are cancers and which are due to benign diseases of the ovary. As an independent test, ultrasound has shown poor performance in the detection of ovarian cancer in women at average or high risk.48 There have been research and attempts to develop a blood test for ovarian cancer based on measuring genes, proteins, or multiple marker assays that may be present in higher or lower amounts in women with ovarian cancer compared with women who do not have ovarian cancer. This is a relatively new area of investigation that is accumulating promising results, but still requires prospective studies for validation.49 Thus, at this time, the lack of supporting evidence indicating that any one or a combination of these strategies is efficacious has prevented recommendations for ovarian cancer screening, although several prospective randomized trials have been underway.

Two large, prospective, randomized trials, one in the United States and the other in the United Kingdom, have been studying screening average-risk women with a combination of CA 125 and TVU. The US trial, the Prostate, Lung, Colorectal and Ovarian (PLCO) cancer screening trial,50 reported results in 2011.51 In the PLCO trial, 78,216 women ages 55 to 74 years were randomized to a group that was offered 6 annual rounds of screening with CA 125, and TVU for 4 years (n = 39,105) or a group that received usual care (n = 39,111). Participants were followed for a maximum of 13 years, with mortality from ovarian cancer as the main study outcome. At the conclusion of the study, the number of deaths from ovarian cancer was similar in each group (ie, there were 3.1 ovarian cancer deaths per 10,000 women-years in the group invited to screening vs 2.6 deaths per 10,000 women-years in the control group [relative risk, 1.18; 95% confidence interval, 0.82-1.71]). The authors concluded that simultaneous screening with CA 125 and TVU was not associated with a reduction in ovarian cancer mortality compared with usual care.51 However, the authors also noted that the absence of a stage shift in the group invited to screening compared with the control group suggests that the screening protocol in the PLCO study may not have been sensitive enough to diagnose ovarian cancer sufficiently early to alter its natural history. Nonetheless, for each of the 2 tests under evaluation, lower cutoff values would result in higher false-positive rates. An alternative approach, which is currently under evaluation in the UK Collaborative Trial of Ovarian Cancer Screening, is assessing the efficacy of multimodal screening including annual CA 125 screening with a risk of ovarian cancer algorithm and TVU as a second-line test versus annual screening with TVU only.52 The risk of ovarian cancer algorithm measures changes in CA 125 over time rather than with a single cutoff point, and is believed to improve sensitivity for smaller tumors without measurably increasing the false-positive rate.

While no organization recommends screening average-risk women for ovarian cancer, in 1994, a National Institutes of Health Consensus Panel concluded that women with 2 or more first-degree relatives diagnosed with ovarian cancer should be offered counseling about their ovarian cancer risk by a gynecologic oncologist (or another specialist qualified to evaluate family history and discuss hereditary cancer risks) since these women have a 3% chance of being positive for an ovarian cancer hereditary syndrome.53 The panel further advised that women with a known hereditary ovarian cancer syndrome, such as mutations on BRCA1 and BRCA2 (including breast-ovarian cancer syndrome, site-specific ovarian cancer syndrome, and HNPCC), should receive annual rectovaginal pelvic examinations, CA 125 determinations, and TVU until childbearing is completed or at least until age 35 years, at which time prophylactic bilateral oophorectomy is recommended. Although women with these hereditary syndromes are estimated to represent only 0.05% of the female population, they have a 40% estimated lifetime risk of ovarian cancer.

The Cancer-Related Checkup

Periodic encounters with clinicians, either for acute care or for checkups, offer the potential for health counseling, cancer screening, and case finding.54,55 However, when individuals see a clinician for a preventive health examination, there is an opportunity for more comprehensive counseling and testing and indeed, it has been consistently observed that individuals who have had a recent preventive health examination are more likely to have undergone
cancer screening. A preventive health examination is an opportunity to provide a referral for screening or to perform the test in the office, as appropriate, and it is 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 based on the patient’s interest. Health counseling may include guidance about smoking cessation, diet, physical activity, and shared decision-making about cancer screening, or testing for early cancer detection for cancer sites for which population-based screening is not yet recommended and there is insufficient evidence to recommend for or against screening. 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

In a previous report, we detailed national trends in cancer screening for the period between 1987 and 2005 based on the National Health Interview Survey (NHIS). Newer national cancer screening estimates based on the 2010 NHIS are presented in Table 4, which shows the extent of change (percentage increases or decreases) in cancer screening prevalence for 2 time periods (2005–2008 and 2008–2010); in addition, using the most recent survey data (2010), we describe differences in cancer screening by race and ethnicity and 2 socioeconomic indicators (having health care coverage or educational attainment) strongly associated with access to and use of medical/preventive services.

Pap Tests

In 2010, 76.4% of women reported undergoing a Pap test within the past 3 years (Table 4). In 2008, this prevalence was 78.3%, indicating a small decrease of 1.9% over the 2-year period, and a larger 3.2% decline since 2005. Non-Hispanic white (77.7%) and non–Hispanic black women (77.8%) were more likely to report having had a Pap test within the past 3 years compared with Hispanic (73.4%) or Asian American women (66.1%). With regard to the 2 measures of socioeconomic status, women with health care coverage were much more likely to report receipt of a Pap test within the past 3 years (80%) compared with uninsured women (55.8%), and women with more than 12 years of education (more than a high school diploma) are more likely to have had a Pap test within the past 3 years than those with a high school degree or less.

Mammography

In a report using data from the NHIS, Breen et al observed a small age-adjusted decline of 3.7% in the reported use of mammography within the past 2 years between 2000 and 2005 among women aged 40 years and older. By 2008, prevalence estimates of mammography use were up slightly (0.5%) from 2005, but the overall rate in 2008 still was 3.2% lower than it had been in 2000. In 2008, 66.9% of women reported having had a mammogram within the past 2 years.

Table 4 shows recent mammography use from the NHIS according to ACS screening guidelines (within the past year) for 2005, 2008, and 2010. In 2008, 53% of women reported having had a mammogram within the past year, up slightly from 51.2% in 2005. However, in 2010, the percentage of women reporting having had a mammogram within the past year (51%) returned to 2005 levels, indicating a decrease in recent breast cancer screening of nearly 2 percentage points.

In 2010, lower levels of recent mammography were reported by Hispanic (46.5%) and Asian American women (47.7%), while non–Hispanic white and black women had almost similar rates (approximately 50%). Uninsured women were less than one-half as likely to report having had a mammogram within the past year compared with insured women (16.9% vs 55.0%); likewise, mammography use within the past year was higher with an increasing level of educational attainment.

Stool Testing and Endoscopy

As in a previous report, it had been noted that screening rates for CRC were increasing from 2000 through 2008, a trend that has continued through 2010. Table 4 shows data for the following CRC screening modalities: use of an FOBT home test kit within the past year, use of either CRC endoscopy tests (FSIG within the past 5 years or CSPY within the past 10 years), and an aggregate rate reflecting any recent screening according to ACS screening guidelines. In 2010, the prevalence of having had recent screening with either FOBT or endoscopy was 59.1%. In 2008, this prevalence was 53.2%, indicating a 5.9% increase. The increasing trend in the use of CRC testing appears to be largely driven by the increasing percentage of age-eligible individuals reporting having a CSPY examination, a trend that within the last decade has been influenced by celebrity endorsement and shifting patterns of physician referral. Consistent with the trend observed from 2005 through 2008, recent use of an FOBT home test kit continues to decline.

Despite improvement in overall screening rates, recent data show that factors such as race and ethnicity and socioeconomic status (either having health care coverage or educational attainment), are related to the likelihood of having had recent CRC testing (either an FOBT or endoscopy).
### TABLE 4. Prevalence (%) of Recent Cancer Screening Examinations Among US Adults by Race and Ethnicity, Health Insurance Coverage, and Educational Level: NHIS, 2010

| US ADULTS | RACE AND ETHNICITY | HEALTH INSURANCE | EDUCATIONAL LEVEL (NO. OF YEARS OF EDUCATION) |
|-----------|--------------------|------------------|-----------------------------------------------|
|           | YEAR 2005, \(^a\) | YEAR 2008, \(^b\) | ABSOLUTE % CHANGE | YEAR 2010, | ABSOLUTE % CHANGE | WHITE, NON-HISPANIC | BLACK, NON-HISPANIC | HISPANIC | ASIAN AMERICAN | HAVE HEALTH INSURANCE | NO HEALTH INSURANCE | \(\leq 11\) YEARS | 12 YEARS | 13 TO 15 YEARS | \(\geq 16\) YEARS |
|           | %                  | %                | (2008-2005) | %          | %              | %                  | %                  | %          | %              | %                  | %              | %                  | %          | %                  | %                  |
| Colorectal cancer (adults aged \(\geq 50\) y) | | | | | | | | | | | | | | | |
| FOBT or endoscopy\(^c\) | 46.8 0.6 | 53.2 0.6 | 6.4 | 59.1 0.6 | 5.9 | 61.5 0.7 | 55.5 1.7 | 47.0 1.8 | 45.9 2.3 | 62.2 0.6 | 18.8 2.5 | 43.9 1.3 | 54.2 1.0 | 63.1 1.1 | 69.2 1.0 |
| FOBT (home kit test)\(^c\) | 12.1 0.4 | 10.0 0.4 | −2.1 | 8.8 0.3 | −1.2 | 9.2 0.4 | 8.4 0.9 | 5.6 0.7 | 7.0 1.4 | 9.2 0.4 | 1.6 0.3 | 5.8 0.6 | 6.8 0.5 | 11.0 0.7 | 10.4 0.7 |
| Either a FSIG or colonoscopy\(^d\) | 43.1 0.6 | 50.2 0.6 | 7.1 | 56.4 0.6 | 6.2 | 58.5 0.7 | 53.0 1.6 | 45.3 1.8 | 44.5 2.2 | 59.4 0.6 | 17.8 2.5 | 42.1 1.3 | 51.9 1.0 | 59.5 1.1 | 66.7 1.0 |
| Breast cancer (women aged \(\geq 40\) y) | | | | | | | | | | | | | | | |
| Mammogram\(^e\) | 51.2 0.6 | 53.0 0.7 | 1.8 | 51.0 0.7 | −2.0 | 51.5 0.9 | 50.6 1.6 | 46.5 1.7 | 47.7 2.8 | 55.0 0.8 | 16.9 2.4 | 37.7 1.7 | 48.5 1.3 | 53.3 1.3 | 57.0 1.5 |
| Cervical cancer (women aged \(\geq 18\) y) | | | | | | | | | | | | | | | |
| Pap test\(^f\) | 79.6 0.4 | 78.3 0.5 | −1.3 | 76.4 0.5 | −1.9 | 77.7 0.6 | 77.8 1.1 | 73.4 1.1 | 66.1 2.0 | 80.0 0.5 | 55.8 2.2 | 62.5 1.6 | 71.6 1.1 | 81.0 0.9 | 85.5 0.8 |
| Prostate cancer (men aged \(\geq 50\) y) | | | | | | | | | | | | | | | |
| PSA\(^g\) | 40.7 0.9 | 44.1 1.0 | 3.4 | 41.3 0.9 | −2.8 | 44.4 1.0 | 35.2 2.4 | 24.3 2.3 | 34.4 4.7 | 49.5 1.0 | 13.9 3.6 | 26.2 1.9 | 34.8 1.6 | 43.0 1.8 | 53.9 1.7 |

NHIS indicates National Health Interview Survey; SE, standard error; FOBT, fecal occult blood test; FSIG, flexible sigmoidoscopy; Pap, Papanicolaou; PSA, prostate-specific antigen.

\(^a\)Prevalence estimates for 2005 and 2008 are shown here to describe the difference in absolute percentage change in cancer screening use with respect to most recent data for 2010. Prevalence is weighted and age adjusted using the 2000 US Census.

\(^b\)Recent FOBT using a home kit test performed within the preceding y or recent sigmoidoscopy or colonoscopy within the preceding 10 y.

\(^c\)Recent FOBT using a home kit test performed within the preceding y.

\(^d\)Recent sigmoidoscopy within the preceding 5 y or colonoscopy within the preceding 10 y.

\(^e\)Women aged \(\geq 40\) y who had a mammogram within the last y.

\(^f\)Women who had a Pap test within the preceding 3 y with intact uteri.

\(^g\)A PSA test within the past y for men who have not been told they had prostate cancer.

Source: National Health Interview Survey 2005, 2008, and 2010 (National Center for Health Statistics, Centers for Disease Control and Prevention, Atlanta, GA).
Testing for Early Prostate Cancer Detection

In 2010, the prevalence of PSA test use within the past year was 41.3%, nearly 3.8% points lower than in 2008 (44.1%) but comparable to rates seen in 2005 (Table 4). Similar to CRC testing, individual characteristics such as race and ethnicity and socioeconomic factors (either having health care coverage or educational attainment) are related to the likelihood of having had a PSA test within the past year. It is important to note that the testing rates based on population surveys do not reflect adherence with ACS guidelines to track use of PSA testing conditional on the outcome of a process of shared decision-making between the patient and the health care provider.

Discussion

National guidelines for average-risk adults endorse screening for breast cancer, cervical cancer, and CRC based on clear evidence that screening reduces morbidity and mortality. At this time, informed and/or shared decision-making is recommended for adults considering prostate cancer screening based on the uncertainty of the balance of benefits and harms. Lung cancer screening guidelines are presently under development, but interim guidance has been issued for adults who would have met requirements for enrollment in the NLST. Each of these screening recommendations has different age, gender, risk, and testing interval requirements. Screening adults at high risk for these cancers requires both proper identification of high-risk status based on a detailed assessment of family history or other considerations and the application of a protocol that commonly involves beginning screening earlier and with different protocols than those recommended for average-risk adults.

Fulfilling the cancer screening needs of average- and high-risk adults requires a combination of an infrastructure, incentives, and systems that are not in place in most primary care practices. Anhang Price et al recently summarized the literature on the association between organizational factors and cancer screening rates, and observed that screening rates were highest when strategies were in place that: 1) promoted recruitment, referral, and appointment scheduling; 2) reduced the number of organizational interfaces required to complete screening; and 3) promoted continuous patient care (ie, continuity in patient information, management, and therapy).62 Some aspects of health care reform in the Patient Protection Affordable Care Act are designed to support the implementation of practice system changes that facilitate these strategies, and new models of primary care delivery, in particular the medical home, also include organizational features that enable these strategies and are associated with higher rates of preventive care.53,64 This sort of practice enhancement is sorely needed since the NCI-led National Survey of Primary Care Physicians’ Recommendations and Practice for Breast, Cervical, Colorectal, and Lung Cancer Screening (PCP survey) has revealed that less than one-half of primary care practices have a reminder system to alert patients that they are due for breast or cervical cancer screening.65,66 What also has been clear for some time is that these system features enhance and further enable the more fundamental factors that are associated with recent and regular cancer screening (ie, access to care as measured by a source of usual care and health insurance, tailored interventions, and a recommendation for screening from a health care provider).57,68 While cancer screening practices of health care providers have received considerable attention, much less attention has been focused on their knowledge and attitudes related to cancer screening.

In 1984 and 1989, the ACS conducted national surveys of practicing primary care physicians (general and family practitioners, internists, and obstetricians and gynecologists) related to the early detection of cancer in asymptomatic adults.69,70 Between 1984 and 1989, primary care physicians reported an increasing emphasis on early cancer detection, with the largest increase in emphasis being given to mammography (44%).70 In 1989, approximately 90% or more of physicians indicated that they performed screening tests for breast cancer, cervical cancer, CRC, and prostate cancer. The survey questions reflected practice in the 1980s (ie, CRC and prostate cancer screening generally were defined by DRE and FOBT). Nearly all physicians reported performing Pap tests and CBEs and referring women for mammography. Only about one-half of physicians reported the use of proctoscopic examinations for CRC screening or CXR for lung cancer screening.

Between 2006 and 2007, the NCI-led PCP survey gathered similar, but much more detailed, data on the knowledge, attitudes, practices, and practice characteristics of primary care physicians related to breast cancer, cervical cancer, CRC, and lung cancer screening.65,66,71,72 These reports, individually and collectively, suggest that primary care physicians are not well grounded in the underlying evidence supporting the rationale for age-specific recommendations for cancer screening, and although they regard guidelines in general and from specific organizations as very influential, their self-reported practices often deviate from the guidelines within and across practice specialties. According to the authors of these reports, these deviations may be due to a lack of awareness of the details of the guideline, concerns about medicolegal liability, or patient expectations.

Of the 4 reports, self-reported adherence with national breast cancer screening guidelines is strongest and most consistent for mammography screening.65 More than 90% of primary care physicians reported recommending screening for women aged 40 years and older. However, nearly all physicians also recommend monthly BSE, a practice that is not endorsed by the ACS or the USPSTF, the 2 organizations primary care physicians report that they rely on the
most for recommendations. Furthermore, although these 2 examinations were commonly recommended, respondents reported different levels of confidence in their effectiveness. Primary care physicians are very confident in the effectiveness of mammography screening for women aged 50 years and older (80%), but fewer are very confident about the effectiveness of mammography for women in their 40s (54%).

The one issue for which there was considerable divergence was the age at which respondents no longer recommended routine mammography screening, although 50% to 60% of primary care physicians reported stopping mammography screening between the ages of 80 and 90 years.

As described earlier, screening rates for CRC have risen over the past decade, with a growing emphasis on CSPY versus stool blood testing. In the PCP survey, Yabroff et al report that only 19% of physicians reported making guideline-consistent recommendations across all CRC screening modalities, and deviations represent both underscreening and overscreening. For example, 41% of primary care physicians report initiating CRC screening with FOBT earlier than age 50 years, which is not recommended for average risk adults, although 88% recommend annual testing, which is consistent with most guidelines from national organizations. In contrast, 94% of primary care physicians report initiating CSPY at the recommended age of 50 years, but 44% recommend testing more frequently than the recommended 10-year interval. Reported underscreening was less common than overscreening, and was mostly confined to FOBT, where 11% of primary care providers reported stool blood testing being performed less than annually. No primary care physician reported recommending screening CSPY at wider intervals than 10 years. Yabroff et al observed that 40% of primary care physicians made some recommendations for CRC screening that were guideline-consistent, but that an equal number (41%) were not guideline-consistent for any CRC screening modality.

For cervical and lung cancer screening, 2 reports from the PCP survey go beyond direct self-reports of adherence with national screening guidelines and examined self-reported screening recommendations in response to particular patient characteristics and scenarios. For cervical cancer screening, Meissner et al reported primary care physicians’ likely Pap testing recommendations for a “35-year-old woman who has had no new sexual partners in the last 5 years and 3 consecutive negative Pap tests performed by you.” The screening options were a) Pap test annually (at least for the first 3 years); b) Pap test every 2 years; c) Pap test every 3 years; d) Pap test more than every 3 years; e) no Pap test, or f) other. Among 1114 primary care physicians surveyed, only about one-third recommended Pap testing for this hypoethical patient according to current recommendations from the ACS or USPSTF (ie, 31.3% recommended annual Pap testing, 33.7% recommended Pap testing every 2 years, and 33.1% recommended Pap testing every 3 or more years). At the time the PCP survey was conducted, and at the time Klabunde et al published their analysis of lung cancer screening and beliefs among US primary care providers, the NSLT was still underway and no organization endorsed screening for early lung cancer detection; rather, at the time the survey was conducted, the position of the ACS and USPSTF was that there was insufficient evidence to recommend for or against lung cancer screening. Using data from the PCP survey, Klabunde et al reported knowledge and beliefs related to lung cancer screening and screening guidelines, and also likely recommendations related to lung cancer screening among hypothetical asymptomatic patients with varying histories of exposure to tobacco smoke among current, former, and never smokers. One in 4 primary care physicians believed that some expert groups recommended lung cancer screening, but larger percentages expressed uncertainty about the recommendations related to lung cancer screening from organizations that issue cancer screening guidelines. Most interesting against the background of there being no recommendation for regular lung cancer screening for adults at high risk for lung cancer was the likely screening recommendations in the context of various patient scenarios. Among never smokers, 17.4% of primary care providers would recommend lung cancer screening for a 50-year-old adult, and 48.3% indicated that they likely would recommend screening for a 50-year-old with a smoking spouse. More than one-half of primary care physicians indicated that they likely would recommend screening for former smokers with a 20 pack-year history, and two-thirds would recommend screening for a current smoker with a 20 pack-year history. Ironically, while the physicians in this survey indicated that they believed that LDCT was more effective than CXR, in each scenario the majority of physicians who reported that they would recommend screening recommended CXR for the hypothetical patient.

In each of these reports, the recommendations of primary care physicians differed among practice specialties and among individual characteristics such as age, gender, time since completion of medical school, practice style, and, in some instances, the indication that one organization’s guidelines were more influential than another’s. Health care professionals also feel pressure from patients for more or less testing, and also may be influenced by concerns over medicolegal liability. However, the lack of self-reported adherence to guidelines among a significant percentage of primary care providers, in general or in the context of patient scenarios, indicates that in addition to the new systems and structures proposed for primary care to facilitate increased cancer screening, tailored interventions will be needed to ensure these new tools are used to properly screen patients for cancer according to current recommendations.
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