Cancer Screening in the United States, 2010
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 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 2010, the ACS updated its guidelines for testing for early prostate cancer detection, and during 2009 there were several newsworthy updates in the cancer screening guidelines from other organizations. In this article, the current ACS guidelines and recent issues are summarized, updates of guidelines for testing for early breast cancer detection by the US Preventive Services Task Force and for prevention and early detection of cervical cancer from the American College of Obstetricians and Gynecologists are addressed, and the most recent data from the National Health Interview Survey pertaining to participation rates in cancer screening are described. CA Cancer J Clin 2010; 60:99–119. ©2010 American Cancer Society, Inc.

Introduction
This year is the 10th anniversary of yearly reports by the American Cancer Society (ACS) in CA: A Cancer Journal for Clinicians on its cancer screening guidelines and trends and issues in cancer screening. 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 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.¹

For guidelines to reflect the most current scientific evidence, the medical and scientific literature are monitored on an ongoing basis, and guidelines are reviewed and updated at least every 5 years, or sooner if new evidence warrants an earlier update in recommendations. The annual guideline reviews, as well as the more detailed cancer screening guideline updates, are published as stand-alone articles, and are available online at http://cajournal.org and http://cacancerjournal.org. Table 1 shows the recent history of guideline updates, as well as those in progress.²⁻¹¹

Screening for Breast Cancer
Breast cancer is the most common cancer diagnosed in US women, and the second leading cause of death from cancer in US women.¹² ACS guidelines for breast cancer screening in average-risk women were last updated in

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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 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), counseling to raise awareness of breast symptoms beginning at age 20 years, and annual mammography beginning at age 40 years (Table 2).

Women should undergo CBE every 3 years between the ages of 20 and 39 years, and annually after age 40 years. This exam should take place during periodic health examinations. When CBE is performed, it is an opportunity for health care professionals to review and update the woman’s family history, discuss the importance of early breast cancer detection, and answer any questions she may have about her own risk, new technologies, or other matters related to breast disease. During these discussions, health care professionals should emphasize the importance of awareness and recognition of breast changes, and of contacting their physician promptly if changes are perceived. They should also emphasize the importance of awareness of a family history of breast and ovarian cancers in first- 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 all women report a family history of breast cancer in first-degree relatives, and approximately 2.7% of women between the ages of 20 and 29 years report a family history of breast cancer in first-degree relatives. Thus, it is important to take and regularly update a family history at a young age, because some younger women will be candidates for beginning breast cancer screening before age 40 years. In an examination of data from the 2005 Cancer Control Module of the National Health Interview Survey (NHIS), Hall and colleagues estimated that approximately 1.4 million US women (<1%) had 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, <2% of respondents who would be candidates for genetic counseling reported having been tested. This low rate of testing should be taken as a clear indication for additional research to better understand both the opportunity structure for counseling and barriers to testing, but almost certainly one factor associated with low rates of testing is suboptimal attention to family history in the primary care setting. Research on the degree to which family history data are gathered, gathered completely, and then used indicated that this simple, initial step in risk assessment generally is not done or is not done competently.

Although the ACS no longer recommends monthly breast self-examination (BSE), women should be informed about the potential benefits, limitations, and harm (principally the possibility of a false-positive result) associated with BSE. Women may then choose to perform 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. Although the elimination of the direct recommendation for monthly BSE has seemed counterintuitive, there is little direct evidence to

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

| CANCER SITE | YEAR | DESCRIPTION |
|-------------|------|-------------|
| Breast cancer | 2003, Complete update | |
| | 2007, Guidelines for MRI use in high-risk women | |
| | 2011, Update anticipated | |
| Cervical cancer | 2002, Complete update | |
| | 2007, Guidelines for HPV vaccine use | |
| | 2011, Update anticipated | |
| Colorectal cancer | 2001, Complete update | |
| | 2003, Technology update | |
| | 2006, Update for postpylectomy and postcolorectal cancer resection surveillance | |
| | 2008, Complete update | |
| Endometrial cancer | 2001, Guidance for counseling, shared decision making, and high-risk women | |
| Lung cancer | 2001, Guidance for shared decision making | |
| Prostate cancer | 2001, Guidance for shared decision making related to testing for early detection, and screening recommendations for higher-risk men | |
| | 2010, Complete update | |
| Skin cancer | 2010, Update anticipated | |

MRI indicates magnetic resonance imaging; HPV, human papillomavirus.
### TABLE 2. American Cancer Society Recommendations for the Early Detection of Cancer in Average-Risk Asymptomatic People

| CANCER SITE | POPULATION | TEST OR PROCEDURE | FREQUENCY |
|-------------|------------|-------------------|-----------|
| Breast      | Women aged ≥20 years | BSE | Beginning in their early 20s, women should be told about the benefits and limitations of BSE. The importance of prompt reporting of any new breast symptoms to a health professional should be emphasized. Women who choose to perform BSE should receive instruction and have their technique reviewed on the occasion of a periodic health examination. It is acceptable for women to choose not to perform BSE or to perform BSE irregularly. |
|             |            | 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 years. Asymptomatic women aged ≥40 years should continue to receive a CBE as part of a periodic health examination, preferably annually. |
| Mammography |            |      | Begin annual mammography at age 40 years. |
| Colorectal  | Men and women aged ≥50 years | FOBT\(^a\) with at least 50% test sensitivity for cancer, or FIT with at least 50% test sensitivity for cancer, or FOBT\(^b\) and flexible sigmoidoscopy, or DCBE, or Every 5 years, starting at age 50 years. |
|            |            | CTC | Every 5 years, starting at age 50 years. |
|            |            | Colonoscopy | Every 10 years, starting at age 50 years. |
| Prostate    | Men aged ≥50 years | DRE and PSA | 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, after receiving information about the benefits, risks, and uncertainties associated with prostate cancer screening. Prostate cancer screening should not occur without an informed decision-making process. |
| Cervix      | Women aged ≥18 years | Pap test | Cervical cancer screening should begin approximately 3 years after a woman begins having vaginal intercourse, but no later than 21 years of age. Screening should be done every year with conventional Pap tests or every 2 years using liquid-based Pap tests. At or after age 30 years, women who have had 3 normal test results in a row may get screened every 2 to 3 years with cervical cytology (either conventional or liquid-based Pap test) alone, or every 3 years with an HPV DNA test plus cervical cytology. Women ≥70 years of age who have had ≥3 normal Pap tests and no abnormal Pap tests in the last 10 years and women who have had 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 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 years | 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, sun exposure, diet and nutrition, risk factors, sexual practices, and environmental and occupational exposures. |

BSE, breast self-examination; CBE, clinical breast examination; FOBT, fecal occult blood test; FIT, fecal immunochemical test; DCBE, double contrast barium enema; CTC, computed tomography colonography; DRE, digital rectal examination; PSA, prostate-specific antigen test; Pap, Papanicolaou; HPV, human papillomavirus.

\(^a\)Beginning at age 40 years, annual clinical breast examination should be performed before mammography.

\(^b\)FOBT as it is sometimes done in physicians’ offices, with the single stool sample collected on a fingertip during a digital rectal examination, is not an adequate substitute for the recommended at-home procedure of collecting 2 samples from 3 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.

\(^c\)Information should be provided to men about the benefits and limitations of testing so that an informed decision about testing can be made with the clinician’s assistance.
indicate that monthly BSE has a distinct advantage over a heightened sense of breast awareness, i.e., an attentiveness to changes in the breast that are noticed while engaging in normal, daily activities or simply perceiving a change.\textsuperscript{17} 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 harm strongly supports the value of screening and the importance of adhering to a schedule of regular mammograms.\textsuperscript{18} 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 (i.e., lumpectomy vs. mastectomy), less aggressive adjuvant therapy, and a greater range of treatment options. Women should also 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 for false positives, some of which may not be resolved with additional imaging, and that if not, a biopsy will be required to rule out the possibility of breast cancer.

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{19} 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{3} Annual screening mammography and magnetic resonance imaging (MRI) starting at age 30 years are recommended for women with a known \textit{BRCA} mutation, women who are untested but have a first-degree relative with a \textit{BRCA} mutation, and 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- 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- 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 sides.\textsuperscript{20} Thus, although individual lifetime risk estimates generated from the Gail model can exceed the threshold of approximately 20\% or greater risk to age 90 years, the elevated risk may be due to risk factors other than family history. To estimate 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 sides. There are several models that can estimate risk based on complex family histories and assist clinicians to estimate breast cancer risk or the likelihood that a \textit{BRCA} mutation is present, including the Claus,\textsuperscript{21} Tirer-Cusick,\textsuperscript{22} BRCAPRO,\textsuperscript{23} and Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm\textsuperscript{24} models. 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 (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 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. The expert panel concluded that there was insufficient evidence to recommend 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, a prior history of breast cancer, or extremely dense breasts. MRI is not recommended
for women at average risk, although investigations are underway to determine whether MRI should be considered for other higher-risk groups.3,25

Commentary on Updated Breast Cancer Screening Guidelines From the USPSTF

In late 2009, the USPSTF updated their guidelines for breast cancer screening,26 sparking enormous controversy based on several changes from the previous recommendation.27-29 Whereas the Task Force previously had endorsed mammography screening for women aged 40 to 49 years,29 the new guidelines downgraded mammography screening in the 40s to a C rating, stating, “The USPSTF recommends against routine screening mammography in women aged 40 to 49 years.”26 (The USPSTF uses a rating system for preventive services: A, recommendation for the service, with expectation of high net benefit; B, recommendation for the service, with expectation that the net benefit is moderate; C, recommendation against routinely providing the service; D, recommendation against the service; and I, insufficient evidence to recommend for or against the service.)30

For women in their 40s, the Task Force concluded that “the decision to start regular, biennial screening mammography before the age of 50 years should be an individual one and take into account patient context, including the patient’s values regarding specific benefits and harms.”26 (The magnitude of the controversy led the USPSTF subsequently to amend their recommendation for women in their 40s by dropping the statement recommending against routine screening, and emphasizing only the value of individual, informed decision making.)31) The USPSTF also changed the recommended screening interval for women aged 50 to 74 years from 1 to 2 years to biennial screening, and concluded that there was insufficient evidence (I rating) for or against screening women aged ≥75 years and use of digital mammography or MRI for breast imaging. Finally, the USPSTF concluded that there was insufficient evidence (I rating) to recommend for or against CBE in women aged ≥40 years, and recommended against physicians teaching BSE (D rating).26

These changes in the recommendations were unanticipated. Based on prior evidence reviews, the only new data that the USPSTF was likely to consider was from the results of the UK Age Trial, which randomized women aged 40 to 41 years to a group invited to screening versus usual care to measure the effect of mammography in a group of women in their 40s without any age migration past age 50 years.32 The Age Trial observed a 17% reduction in breast cancer mortality in the group invited to screening compared with the control group (relative risk [RR], 0.83; 95% confidence interval [CI], 0.66-1.04; \( P = .11 \)), a result that was consistent with results from earlier trials, and also consistent with the less sensitive screening protocol applied in this study,33 ie, double-view mammography on the first exam and single-view mammography on subsequent exams. The USPSTF updated the meta-analysis of all trials excluding the Edinburgh trial, and concluded that an invitation to mammography was associated with a 15% reduction in the risk of dying from breast cancer among women screened in their 40s, and a 14% reduction in risk for women screened in their 50s.34 However, based on the rate of false-positive results experienced in routine screening, and an updated estimate of the number needed to invite to screening to save 1 life, the USPSTF concluded that the additional benefit from beginning screening at age 40 years versus age 50 years was small, and did not sufficiently outweigh the harm associated with screening.26 In their analysis, it was estimated that 1904 women aged 40 to 49 years would have to be invited to mammography to save 1 life, versus 1339 women aged 50 to 59 years. The decision to give mammography for women in their 40s a C rating was principally influenced by a decision analysis concluding that the majority of the benefit from screening women aged 40 to 74 years was due to screening between the ages of 50 and 74 years (17% mortality reduction), and that beginning screening at age 40 years only increased the mortality reduction an additional 3%.35 Extending the screening interval from 1 to 2 years to biennial screening also was unexpected, and was based on statistical modeling. In the decision analysis, screening women aged 50 to 74 years biennially was estimated in the decision analysis to achieve between 70% and 99% of the benefit, and to reduce harm by 50%.26,35

Although the controversy over the guidelines change was commonly interpreted as either a step toward health care rationing, or an example of the public’s distrust of science and expert groups, there was little questioning of whether the USPSTF’s methodology actually had provided a sound estimate
of the balance of benefits and harm from mammography for women in their 40s. The ACS argued that even without disputing the underlying methodology, the difference between the number needed to invite for women in their 40s and in their 50s (1904 vs 1339) was still acceptable because of the greater years of life gained by preventing a death from a breast cancer diagnosed before age 50 years.36 Furthermore, due to the USPSTF’s decision to limit the evidence review to the randomized trials of breast cancer screening,37 the underlying data and methodology used to estimate the benefit of screening underestimate the true value of mammography for women of all ages. In comparison, the ACS includes a broader body of evidence in formulating its own guideline for breast cancer screening, and thus has reached different conclusions about the value of screening women in their 40s, annual versus biennial screening, CBE, and BSE.2 The ACS has not taken a position on digital mammography, other than to regard it as an acceptable alternative to screen-film mammography, and probably superior to screen-film for younger women with heterogeneously dense or very dense breasts.38,39 The ACS’s current position on screening with MRI was noted above.

Although it is common to observe that experts can disagree on the interpretation of data, the USPSTF’s new guidelines are the result of relying on older, limited data, using efficacy estimates from meta-analyses as a measure of effectiveness, and then making a judgment call on the relative value of screening in different age groups based on the balance of benefits and harm. Furthermore, some measures of disease burden were chosen over others, and there was a reliance on modeling over empirical data. Together, these methodological decisions applied to limited data resulted in an underestimate of benefit and an overestimate of harm, and then a judgment call that mammography was not recommended before age 50 years, and should only be done every 2 years after age 50 years.

The USPSTF addressed disease burden for all women in terms of incidence and mortality, and noted that incidence increases with increasing age. The decade risk of being diagnosed with breast cancer is 1 in 69 (1.5%) between the ages of 40 and 49 years, 1 in 42 (2.2%) between the ages of 50 and 59 years, and 1 in 29 (3.4%) between the ages of 60 and 69 years.40 It is also worth noting that the risk between ages 45 and 50 years is 1 in 114, and for ages 50 to 55 years it is 1 in 92, more similar over that 10-year period than the contrast between 40 to 49 years versus 50 to 59 years, which also is not very dissimilar.40 Women in their 40s have about two-thirds of the decade risk experienced by women in their 50s. Although the USPSTF focused primarily on the absolute risk of developing breast cancer and the meta-analysis estimate of the reduction in the risk of death, 2 other measures of disease burden are equally if not more relevant, ie, incidence-based mortality and premature mortality.

Breast cancer is the leading cause of premature mortality among women due to death from cancer, and a leading cause of premature mortality from all causes of death.41 In the first trial of breast cancer screening (the Health Plan of New York trial), Shapiro and colleagues showed great insight in choosing the age range 40 to 69 years for the study group, because they observed that it included about 75% of the years of potential life lost (YPLL) due to a death from breast cancer before age 80 years. A diagnosis between ages 40 and 49 years accounted for 34% of the YPLL before age 80 years, and a diagnosis between ages 50 and 64 years accounted for 38%.42 Between 2004 and 2006, 18% of deaths from breast cancer were attributable to a diagnosis between ages 40 and 49 years, compared with 22% for women diagnosed between ages 50 and 59 years, a level of disease burden that is not dissimilar.43 Ironically, in the decision analysis, Mandelblatt and colleagues noted that if the goal of the screening program were to efficiently maximize life years gained, then the preferred strategy would be to screen every 2 years beginning at age 40 years.35

As the case can be made that breast cancer is an important health problem for women in their 40s, is the evidence of benefit so small and the magnitude of harm so great that their previous recommendation for screening women in their 40s should be rescinded? With respect to benefit, the randomized trials provided convincing evidence that mammography screening saves lives principally by advancing the lead time and reducing the incidence of advanced disease.18 However, the summary RR from meta-analysis of all the trials is not a good measure of effectiveness for several reasons. First, the trials measured the effectiveness of an invitation to screening, not actually being screened. Second, in a meta-anal-
ysis, trials with ineffective protocols are combined with trials that had effective protocols. It is well established that in some of the early trials, women were screened with protocols that were especially limited for women under age 50 years. These ineffective protocols are characterized by long screening intervals (≥24 months) and single-view mammography. It is also evident from examining the RR of being diagnosed with an advanced breast cancer in the different trials why some trials showed significant mortality reductions and some did not, because there is a strong association between the magnitude of the risk reduction of being diagnosed with an advanced breast cancer and the eventual observed mortality reduction. This was especially the case with 2 second-generation trials, the Gothenburg Trial and the Malmo trial, which screened women at a shorter interval (12 to 18 months) with double-view mammography and observed 44% and 36% mortality reduction, respectively. Although meta-analysis has consistently shown a modest mortality reduction, the magnitude of the mortality reduction from meta-analysis for women of all age groups is reduced by intention-to-treat estimates and the influence of less effective trials. Because individual trials and meta-analysis have shown that mammography is efficacious for women aged 40 to 69 years, large, long-term observational studies of modern mammography are better sources of data on the effectiveness of mammography screening, including age-specific effects, and they should be used to shape health policy today.

In 2005, Gabe and Duffy described the recent history of evaluating mammography service screening in Annals of Oncology. They examined studies published between 1990 and 2004 that compared breast cancer mortality trends before and after the introduction of screening, or in screened and unscreened cohorts. They identified 38 nonrandomized studies, including case series, case-control studies, cohort studies, nonrandomized clinical trial (non-RCT) comparison studies, and studies that attempted to measure time/trend descriptive epidemiologic results. These studies were carried out in Australia, Italy, the Netherlands, Finland, Denmark, Sweden, the United Kingdom, and the United States. Many more studies have been published since their review of the literature, and although many were captured in the USPSTF’s search of the literature, all were excluded from consideration in favor of examining only the randomized trials.

Compared with the results of individual RCTs and meta-analyses, there was a range of estimated benefits observed in the service screening programs associated with an invitation to screening and actual exposure to screening, some that significantly exceeded the results from the RCTs and some that showed weaker benefits. Results from case-control studies showed mortality reductions associated with exposure to screening ranging from 25% to 58%. A wider range of breast cancer mortality reductions was observed in cohort studies and non-RCT comparative studies, depending on whether the analysis was based on an invitation to screening or actual exposure to screening. Cohort study breast cancer mortality reductions associated with an invitation to screening ranged from 8% to 41%, whereas mortality reductions associated with actual exposure to screening ranged from 37% to 44%. In general, however, the results are at least as good, or better, when compared with the trials that demonstrated the largest reductions in breast cancer mortality. For example, Coldman et al evaluated outcomes in the Screening Mammography Program of British Columbia, comparing outcomes among participants who had at least 1 mammogram with the expected incidence and survival rates among British Columbian women who had not participated in the program. During the period of evaluation (1988–2003), 598,690 women underwent 2,196,441 mammograms (average 3.7 screening exams per woman), and 14,247 program participants were diagnosed with invasive breast cancer. Among nonparticipants, 19,913 invasive breast cancers were diagnosed. A breast cancer mortality ratio was calculated as the ratio of observed to expected mortality. The results for women of all ages showed a mortality ratio of 0.60 (95% CI, 0.55–0.65; P < .0001); the mortality ratio was 0.61 (95% CI, 0.52–0.71) for women aged 40 to 49 years, and 0.63 (95% CI, 0.52–0.77) when cases diagnosed after age 50 years were censored. There was no significant difference between the mortality ratios for women aged 40 to 49 years versus ≥50 years. In another example, an analysis of service screening in 2 Swedish counties (Dalarna and Ostergotland) compared the mortality rates from breast cancer in the 20 years after the introduction of screening (the screening
epoch) with the corresponding rates in the 20 years preceding the introduction (the prescreening epoch). After adjustment for changes in incidence, among women aged 40 to 69 years exposed to screening, there was a statistically significant 44% (RR, 0.56; 95% CI, 0.49–0.64) reduction in mortality in the screening epoch compared with the prescreening epoch, and 16% (RR, 0.84; 95% CI, 0.71–0.99) fewer deaths in women not exposed to screening, which can be attributed to improvements in therapy and awareness. Among women aged 40 to 49 years at the time of diagnosis, the investigators observed a statistically significant 48% (RR, 0.52; 95% CI, 0.40–0.67) breast cancer mortality reduction among women exposed to screening, and a nonsignificant 19% reduction in women who were not screened. For women aged 40 to 49 years, the number needed to screen 5 to 6 times over a 10-year period to prevent 1 breast cancer death after 20 years of follow-up was 726.52

It is worth noting that the mortality reductions observed in these service screening evaluations are similar for women aged 40 to 49 years compared with women aged ≥50 years, and significantly greater than what is estimated by a meta-analysis of the randomized trials. Furthermore, as shown in another Swedish study that examined the impact of screening on the risk of being diagnosed with an advanced breast cancer, a similar pattern is observed between the magnitude of the rate of reduction in the risk of being diagnosed with advanced disease and the observed mortality reduction. Based on a total of 10,177,113 person-years of observation and 23,092 breast cancers among women aged 40 to 49 years exposed to screening, there was a significant 45% reduction in the risk of being diagnosed with a tumor >2 cm compared with tumor sizes in the prescreening epoch (RR, 0.55; 95% CI, 0.46–0.66), and among women aged 50 to 69 years, there was a 33% reduction in being diagnosed with a tumor >2 cm in the population exposed to screening compared with the population in the prescreening epoch (RR, 0.67; 95% CI, 0.62–0.72).53

What about the harm of screening? The harm of mammography includes radiation risk, short- and long-term anxiety associated with false-positive results, biopsy for benign lesions, and the possibility that some breast neoplasms detected on mammography are nonprogressive and thus overtreated. The risk of a radiation-induced cancer from low-dose mammography is so low that although theoretically possible, it would be impossible to measure empirically.54,55 The possibility that some breast cancers are nonprogressive has been a source of considerable interest, but the weight of evidence from long-term studies suggests that it is a small problem and mostly confined to ductal carcinoma in situ.56,57 Studies that have concluded that the magnitude of overdiagnosis is large have commonly examined population data over a period of limited duration and confused overdiagnosis with background increases in incidence and increased incidence associated with the lead time gained from screening.58 The more common and more directly measurable harm associated with mammography includes the inconvenience from additional imaging resulting from false positives, benign biopsy for abnormal findings, and short- and long-term anxiety resulting from false-positive results. The USPSTF cited modern US data from the Breast Cancer Surveillance Consortium (BCSC), observing that for every breast cancer detected in women in their 40s, there will be 556 screening mammograms, 47 diagnostic mammograms, and 5 biopsies.26 Data from the BCSC also demonstrate what has been observed for years, ie, that the accuracy and effectiveness of mammography increases incrementally with increasing age, and is not measurably different between 5- and 10-year age groups.59 With respect to short- and long-term anxiety, most studies observe that there is some anxiety associated with screening, and as would be expected, greater anxiety associated with false-positive results.60,61 However, for most women, anxiety is of limited duration and without lasing effects, and it also has been shown that clear communication about imaging results is associated with reduced anxiety.62 Clearly, methods for improved communication and strategies to reduce avoidable anxiety are a priority area for applied research, and a priority area for adoption of successful strategies. However, it is misleading in these discussions to describe the totality of negative aspects of screening mammography as harm, because they do not all constitute injury, and some are clearly amenable to interventions that can reduce the adverse experiences and consequences. Moreover, a study by Schwartz et al63 revealed that women are aware of the likelihood of a false-positive result, accept false-positive results as a part of screening, and do not regard
false positives as significant harm in the context of the underlying goal of early breast cancer detection.

The USPSTF’s guideline update was informed by 6 models of breast cancer incidence and mortality that were applied to estimate outcomes of different screening scenarios for specific age groups.35 Although each of the models shares some common inputs, other inputs such as assumptions about age-specific benefits of screening, the duration of the potential lead time, overdiagnosis, and mammography performance may vary between models. The models examined the estimated difference in mortality reduction, life years saved, and harm with annual and biennial screening for different combinations of age groups of women. The models predicted that biennial screening achieved an average of 81% of the benefits of annual screening, with individual model estimates ranging from 67% to 99%.35 Starting screening at age 40 years versus age 50 years resulted in only an estimated median 3% improvement in the reduction in breast cancer mortality, with no difference in the additional reduction in deaths based on annual or biennial screening. However, if life years gained was the outcome measure of interest versus lives saved, half of the models favored extending annual screening to women in their 40s versus extending annual screening to women up to age 79 years. The authors also observed that the rate of false positives was approximately twice as high with annual screening compared with biennial screening. The latter outcome is at variance with evidence from screening programs, and likely is due to the linear nature of the models.64

It has been clear since the earliest analyses of the randomized trials that the duration of the detectable preclinical period is shorter in younger women compared with older women, and increases as a woman ages.18,65 The early indication that screening intervals of 24+ months were inefficient for women younger than 50 years was apparent from an interval cancer rate that was twice that of women aged ≥50 years.65 Moreover, randomized trial data and more recent evaluations of service screening46,47,66 have shown better outcomes associated with 12- to 18-month screening intervals for women in their 40s, and recent observational studies have shown better outcomes from annual versus biennial screening in both women aged 40 to 49 years and those aged ≥50 years.53,67,68

Although modeling has many advantages for shaping health policy when large prospective studies are not feasible, it is not a substitute for empirical data. Furthermore, the logic for combining all model outcomes into a meta-analysis to produce the best summary endpoint, as described by Mandelblatt et al,35 is even less persuasive than the idea that a meta-analysis of existing randomized trial data provides the best and most unbiased estimate of the true benefit of mammography, or constitutes a sufficient systematic review of the evidence.69 However, although the importance of annual screening is especially evident for women younger than 50 years, the advantages of annual versus biennial screening diminish as a woman ages,67,68 and in a program of high quality, the potential for identifying an age after menopause when some women could be screened at a longer than annual interval is an important area for continued research. Whether it is reasonable to ask postmenopausal women to forgo as much as 33% of the benefit that would be achieved with annual screening on the basis of the estimate that biennial screening would reduce the rate of false positives by half35 is not self-evident.

Screening for Cervical Cancer

ACS guidelines for cervical cancer screening were last updated in 2002 (Table 2).70 Recommendations for the use of prophylactic human papilloma virus (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 either to undergo screening every 2 to 3 years using either conventional or liquid-based cytology, or to undergo screening every 3 years with the combination of human papillomavirus (HPV) DNA testing and conventional or liquid-based cytol-
ogy. Women who choose to undergo HPV DNA testing should be informed that: 1) HPV infection usually is not detectable or harmful; 2) almost everyone who has had sexual intercourse has been exposed to HPV, and that infection is very common; 3) a positive HPV test result does not reflect the presence of a sexually transmitted disease, but rather a sexually acquired infection; and 4) a positive HPV test result does not indicate the presence of cancer, and the large majority of women who test positive for an HPV infection will not 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.

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 who are human immunodeficiency virus (HIV) positive 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 to stop screening for women with a history of cervical cancer, with in utero exposure to DES, and who are immunocompromised (including HIV+). 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 had a total hysterectomy, or who have undergone removal of the cervix 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 before 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 had a hysterectomy 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 hysterectomy.

The ACS recommends routine HPV vaccination principally for girls aged 11 to 12 years, but also for females aged 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 women aged 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 cervical intraepithelial neoplasia and cancer should continue in both vaccinated and unvaccinated women according to current ACS early detection guidelines for cervical cancer. According to the 2008 National Immunization Survey-Teen, 37.2% of US adolescent girls aged 13 to 17 years initiated the HPV vaccination series (ie, had at least 1 of 3 shots as recommended for the HPV vaccine). Data from the 2007 National Immunization Survey-Adult revealed lower rates (10%) of vaccination initiation (≥1 dose) among women aged 18 to 26 years.

In November 2009, the American College of Obstetricians and Gynecologists (ACOG) announced updated guidelines for cervical cancer screening that endorsed beginning screening at an older age and longer screening intervals for women in all age groups. Specifically, the new ACOG guidelines recommend that screening for cervical cancer be initiated at age 21 years; that women younger than 30 years be screened every 2 years; that women aged...
30 years be screened every 3 years once they have a history of 3 previous, consecutive, normal Pap tests; and that women aged 65 to 70 years can stop screening if they have a history of 3 negative tests in the past 10 years. A comparison of current ACS guidelines for cervical cancer screening, previous ACOG guidelines, and the new ACOG guidelines is shown in Table 3. The major changes in the new ACOG guidelines are a set age to begin screening regardless of age of onset of vaginal intercourse, a lengthening of the screening interval by 1 year for both women younger and those older than 30 years, and the establishment of an age to stop screening if there is a 10-year history of normal screening tests. The recommendation to begin screening at age 21 years is based on the very low incidence rate of cervical cancer occurring before age 21 years, and the anxiety and harm associated with positive tests. The report notes that only 0.1% of all cervical cases occur in women younger than 21 years,74 with annual incidence of 1 to 2 cases per 1,000,000 females aged 15 to 19 years.41 Furthermore, there was concern about the increase in the risk of premature births in women previously treated with excisional procedures for precursor lesions, most of which would likely regress if not treated.74 The longer screening intervals for women aged 21 to 29 years and ≥30 years are based on the accumulation of evidence showing little advantage of annual versus biennial screening, and the increasingly lower probability of a positive test in women with sequential negative Pap tests.74

### 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 (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.9,75

Recommended CRC screening tests are grouped into 2 categories: 1) tests that primarily detect cancer, which include both guaiac (guaiac fecal occult blood test [gFOBT]) and immunochemical (fecal immunochemical test [FIT]) based fecal occult blood tests.

#### TABLE 3. Comparison of ACS and ACOG Guidelines for Screening for Cervical Cancer

| AGE, SCREENING INTERVAL, AND TEST PROTOCOLS | ACS 2002∗ | ACOG 2003†† | ACOG 2009‡‡ |
|-------------------------------------------|------------|-------------|-------------|
| Age to start                               | Approximately 3 years after initiation of intercourse or by age 21 years | Approximately 3 years after initiation of intercourse or by age 21 years | Age 21 years |
| Screening interval in women aged <30 years | Annual with conventional Pap; 2 years with liquid Pap | Annual | Every 2 years |
| Screening interval in women aged ≥30 years | Every 2-3 years | Every 2-3 years | Every 3 years |
| Age to stop screening                      | Age 70 years after 3 negative tests in last 10 years | No upper age limit | Age 65-70 years after 3 negative tests in last 10 years |
| Women with prior hysterectomy             | Discontinue screening if hysterectomy for benign reason | Discontinue screening if hysterectomy for benign reason | Discontinue screening if hysterectomy for benign reason |
| Screening test options                     | Conventional Pap test or liquid cytology; option of HPV cotesting starting at age 30 years, repeated no sooner than every 3 years | Conventional Pap test or liquid cytology; option of HPV cotesting starting at age 30 years, repeated no sooner than every 3 years | Conventional Pap test or liquid cytology; option of HPV cotesting starting at age 30 years, repeated no sooner than every 3 years |

ACS indicates American Cancer Society; ACOG, American College of Obstetricians and Gynecologists; Pap, Papanicolaou; HPV, human papillomavirus.
and testing stool for exfoliated DNA (single-strand DNA [sDNA]); and 2) tests that can detect cancer and advanced lesions, which include the endoscopic and radiological exams, ie, flexible sigmoidoscopy (FSIG), colonoscopy, double-contrast barium enema (DCBE), and computed tomography colonography (CTC, 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 2 groups of screening tests. Furthermore, the guidelines state that although all recommended tests are acceptable options, prevention of CRC is the greater priority in screening. Although there have been calls to state a preference for colonoscopy above all other options, studies have shown that even after a process of shared decision making, adults show considerable variation in the test they choose. Furthermore, in addition to variable preferences, access to all testing options is also 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 high-sensitivity gFOBT or FIT, following manufacturer’s recommendations for specimen collection; 2) sDNA, for which, at this time, there is uncertainty in the screening interval; 3) FSIG every 5 years; 4) colonoscopy every 10 years; 5) DCBE every 5 years; or 6) CTC every 5 years. Single-panel gFOBT in the medical office using a stool sample collected during a digital rectal exam is not a recommended option for CRC screening, due to its very low sensitivity for advanced adenomas and cancer. For similar reasons, the updated guideline recommends discontinuing the use of older, lower-sensitivity versions of the guaiac test (such as Hemoccult II) in favor of newer, high-sensitivity gFOBT (such as Hemoccult SENSA). An additional option for regular screening is annual stool blood testing (gFOBT or FIT) with FSIG every 5 years. Health professionals should provide guidance to adults about the benefits, limitations, and potential harm 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 1-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. 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 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 colonoscopy if available, and may include more frequent exams and exams beginning at an earlier age. As noted above, an update in recommendations for follow-up colonoscopy for individuals with a history of adenomatous polyps or personal history of curative-intent resection of CRC was issued in 2006 jointly by the ACS and the USMSTF.

**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 increased risk due to a history of unopposed estrogen therapy, tamoxifen therapy, late menopause, nulliparity, infertility or failure to ovulate, obesity, diabetes, or hypertension. ACS recommends that women at average and increased risk should be informed about 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. Women at very high risk for endometrial cancer due to 1) known HNPCC genetic mutation carrier status, 2) substantial likelihood of being a mutation carrier (ie, a mutation is known to be present in the family), or 3) absence of genetic testing.
results in families with 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 potential benefits, risks, and limitations of testing for early endometrial cancer detection.

Testing for Early Prostate Cancer Detection

In 2010, the ACS updated its guideline for the early detection of prostate cancer, which was last updated in 2001. The guideline update was based on a perceived need to clarify recommendations for informed and shared decision making in average- and high-risk men, but also the publication of results from 2 long-anticipated prospective randomized controlled trials of prostate cancer screening, the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial (PLCO) and the European Randomized Study of Screening for Prostate Cancer (ERSPC). Historically, the evidence about the value of testing for early prostate cancer detection has been regarded as insufficient to recommend that men at average or high risk undergo regular screening, especially given the knowledge that some prostate cancers are not life-threatening, and treatment for prostate cancer is associated with a significant rate of adverse side effects. Although results from some observational and quasi-experimental studies have been interpreted as indicating a benefit from prostate cancer screening, other studies have concluded that screening was not beneficial, and generally there was consensus that results from the randomized trials would be the ultimate arbiter of whether or not screening could be recommended. While many anticipated that results from these randomized trials would answer the fundamental question about the efficacy of screening, the initial findings have done little to resolve the current uncertainty about the value of testing for early prostate cancer detection. Whereas the PLCO Trial did not observe a reduction in prostate cancer deaths in the group invited to screening, the ERSPC observed a statistically significant 20% reduction in prostate cancer deaths. There are important differences in study population and protocols of these trials that may explain the different outcomes.

From 1993 to 2001, the PLCO trial randomized 76,693 men aged 55 to 74 years in 10 US study centers to receive either annual screening for prostate cancer with serum prostate-specific antigen (PSA) and digital rectal examination (DRE) or usual care. Men in the screening arm were offered annual PSA testing for 6 years and digital rectal examination for 4 years. Either a positive DRE or a PSA level of 4 ng/mL prompted recommendation for a biopsy. With a minimum follow-up of 7 years, there were 13% more deaths from prostate cancer in the group offered screening compared with the control group (RR, 1.13; 95% CI, 0.75-1.70). The study investigators concluded that screening for prostate cancer with PSA and digital rectal exam was not associated with a reduced risk of dying from prostate cancer. However, there are a number of observations that limit the strength of that conclusion at this time. First, there was a very high rate of prescreening in the study groups, with 44% of men having had up to 2 PSA tests before randomization, which likely reduced the overall prevalence of disease in the study population. Second, a significantly greater than anticipated level of PSA testing occurred in the control group (contamination), estimated at 52%, which also may be an underestimate, because contamination was measured by annual surveys rather than assessment of medical records. Third, 15% of men in the experimental group did not accept the invitation to undergo screening. Furthermore, among men with a positive PSA, fewer than half underwent biopsy. Finally, at the time of publication, 10-year follow-up of study subjects was estimated to be only 67% complete. Thus, any conclusion about the degree of overdiagnosis associated with prostate cancer screening based on these data is premature.

The ERSPC was initiated around the same time as the PLCO and was conducted in 7 European countries. Approximately 182,000 men aged 50 to 74 years were identified in registries and were randomized to a group that would receive an invitation to PSA screening on average every 4 years, or a group that would not be invited to screening. A PSA level of 3 ng/mL was regarded as positive. After a median follow-up of 9 years, there were 20% fewer deaths
from prostate cancer in the group invited to screening compared with the control group (RR, 0.80; 95% CI, 0.65-0.98). Excluding men who did not comply with screening, there was a 27% reduction in the risk of dying from prostate cancer. The study investigators concluded that PSA-based screening reduced the rate of death from prostate cancer by 20%, but also was associated with a high risk of overdiagnosis.\textsuperscript{82} Unlike the PLCO, there was literally no prescreening, and contamination was estimated at 6%. The ERSPC had a similar level of noncompliance with the invitation to screening (18%) as was observed with the PLCO. For men with positive test results in the ERSPC, 85.8% underwent biopsy.

The incomplete follow-up in the PLCO trial in addition to very high rates of prescreening, contamination, and failure to undergo biopsy after a positive PSA may explain not only the lack of a protective effect of screening, but also the excess rate of death in the group invited to screening. The ERSPC trial data much more closely approach the goal of high rates of adherence with the study protocol, and thus the reduction in prostate cancer deaths associated with invitation to screening and actually being screened is consistent with a benefit from screening. However, investigators from both trials concluded that there were considerable human costs associated with preventing a death from prostate cancer. Investigators from the ERSPC trial estimated that 1068 needed to be screened twice over a 9-year period to save 1 life, and 48 men needed to be treated for prostate cancer to save 1 life. However, this estimate is likely higher than eventually will be measured due to the short period of follow-up thus far.

These new data were not regarded as sufficient to significantly modify the existing guidelines for testing for early prostate cancer detection. The new guideline continues to emphasize informed and shared decision making as the basis for decisions about prostate cancer screening.

**American Cancer Society Guideline for the Early Detection of Prostate Cancer**

The American Cancer Society recommends that asymptomatic men who have at least a 10-year life expectancy 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 uncertainties, risks, and potential benefits associated with prostate cancer screening. Prostate cancer screening should not occur without an informed decision-making process. Men at average risk should receive this information beginning at age 50. 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 referred to reliable and culturally appropriate sources. Patient decision aids are helpful in preparing men to make a decision whether to be tested. For men who are unable to decide, the screening decision can be left to the discretion of the health care provider, who should factor into the decision his or her knowledge of the patient’s general health preferences and values. Asymptomatic men who have less than a 10-year life expectancy based on age and health status should not be offered prostate cancer screening.

Although the new guideline is similar to the previous recommendation, there are some important differences. As opposed to the prior language encouraging that men be “offered screening,”\textsuperscript{6} the new guideline recommends that men be provided sufficient information on the uncertainties, risks, and potential benefits of screening to allow them to make an informed decision, and includes greater detail about core elements of the information to be provided to men to assist with their decision.\textsuperscript{11} Recent studies reinforce the need for such guidance for providers. Hoffman et al investigated the use of shared and informed decision making among men who had undergone prostate cancer screening or discussed screening with their health care provider, and found that a provider recommendation was strongly associated with testing.\textsuperscript{85} However, although nearly 70% of survey respondents indicated that they had discussed screening with their provider prior to testing (including 14.4% of individuals who did not subsequently get tested), the reported content of these prescreening discussions fell well short of recommendations for balanced discussions. Guidelines from the ACS and other organizations recommend that men receive information about both risks and benefits of prostate...
cancer screening and use this information to make a decision about whether to be screened.\textsuperscript{11,86,87} Hoffman found that providers emphasized the potential benefits of testing in 71.4\% of discussions, but infrequently addressed limitations and the potential harm of screening and treatment (32\%) or asked men about their personal preferences (54\%).\textsuperscript{85}

Whereas the guideline previously stated that African Americans or men with a close relative diagnosed with prostate cancer before age 65 years should consider screening beginning at age 45 years, and men with several close relatives diagnosed with prostate cancer at an early age could consider testing at age 40 years, the new guideline simply stresses the importance of having discussions about screening at those ages. The ACS no longer recommends that a man should be screened if he is unable to reach a decision about testing after a process of shared decision making, and instead the decision can be left to the discretion of the physician, who should consider the patient’s general health, preferences, and values. The new recommendation also provides updated guidance for health care providers, who will need to provide guidance to men who choose to undergo screening. For men who choose to be screened for prostate cancer after a process of shared or informed decision making: 1) screening is recommended with the PSA with or without the DRE (DRE is recommended along with PSA for men with hypogonadism, due to reduced sensitivity of PSA); and 2) for men whose PSA is $< 2.5 \text{ ng/mL}$, screening intervals can be extended to every 2 years; screening should be conducted yearly for men whose PSA level is $\geq 2.5 \text{ ng/mL}$ but less than 4.0 ng/mL; and 3) a PSA level of $\geq 4.0 \text{ ng/mL}$ has historically been used to recommend referral for further evaluation or biopsy, which remains a reasonable approach for men at average risk for prostate cancer. For PSA levels between 2.5 and 4.0 ng/mL, health care providers should consider an individualized risk assessment that incorporates other risk factors for prostate cancer, particularly for high-grade cancer, which may be used for a referral recommendation.\textsuperscript{11} (Factors that increase the risk of prostate cancer include African American race, family history of prostate cancer, increasing age, and abnormal digital rectal exam. A prior negative biopsy lowers risk. 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.)

Testing for Early Lung Cancer Detection

At present, neither the ACS nor any other medical/scientific organization recommends testing for early lung cancer detection 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 physicians.\textsuperscript{88} Because of the likelihood that a growing number of individuals would seek testing for early lung cancer detection with spiral computed tomography,\textsuperscript{89-92} the ACS issued a narrative in 2001 emphasizing the importance of shared decision making regarding testing for early lung cancer detection.\textsuperscript{6} It is important that patients understand the limits of the current evidence about lung cancer screening and the possibility of a range of outcomes from screening, including nondefinitive findings, which can be associated with increased anxiety.\textsuperscript{93}

The narrative not only emphasized the importance of discussing potential benefits and harm, but also the importance of testing in settings with multidisciplinary expertise in diagnostic workup and treatment. At this time, 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.\textsuperscript{91} An update to the current narrative about 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 for checkups, offer the potential for health counseling, cancer screening, and case finding.\textsuperscript{88,94} When individuals see a health care 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 sex, as described above, but also are an opportunity for case-finding examinations of the thyroid, testicles, ovaries, lymph nodes, oral region, and skin. Also, self-examination techniques or increased awareness about signs and symptoms of
skin cancer, breast cancer, or testicular cancer can be discussed. 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 where 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 exam, 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 prevention and early detection of cancer (see Table 2).

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

In the previous report, detailed national trends in cancer screening for the period between 1987 and 2005 were described based on the NHIS.95 Newer national cancer screening estimates based on the 2008 NHIS are presented in this report in Table 3. In this narrative, we document the extent of change (percentage increases or decreases) in cancer screening prevalence between 2005 and 2008; also, using the most recent survey data (2008), we describe differences in cancer screening by race and ethnicity and 2 socioeconomic indicators (having health insurance and level of educational attainment) strongly associated with access and use of medical/preventive services.

Cancer Screening Trends

Screening for Cervical Cancer

In 2008, 78.3% of women reported undergoing a Pap test within the past 3 years. In 2005, this prevalence was 79.6%, indicating a small decrease of 1.3%.

Non-Hispanic white (79.6%) and non-Hispanic black women (81.5%) were more likely to report having had a Pap test within the past 3 years than Asian American (63.8%) or Hispanic women (75%). On the 2 measures of socioeconomic status, women with health care coverage are much more likely to report receipt of a Pap test in the past 3 years (81%) compared with uninsured women (60.6%), and women with >12 years of education (more than a high school diploma) are more likely to have had a Pap test in the past 3 years than those with a high school degree or less.

Screening for Breast Cancer

In a previous report, it was noted that during the period of 2000 and 2005 there had been a small decline of 3.4% in the reported use of mammography in the past 2 years among women aged 40 years and older. Based on the recent 2008 NHIS update, it appears that declining trends (whether screening in the past 2 years or past year) are no longer apparent, but instead screening rates are rising overall and across groups for the recent period of 2005 to 2008. We report here the prevalence of mammography use in the past year, as this measure of utilization closely reflects ACS guidelines.

In 2008, 53% of women reported having had a mammogram within the past year. In 2005, this prevalence was 51.2%, indicating an increase of nearly 2% (Table 3). All race and ethnic groups except Hispanic women (46.8%) had a prevalence of mammogram use (in the past year) ranging between 52% and 54% in 2008. Uninsured women were about half as likely to report having had a mammogram in the past year compared with insured women (26% vs 56.2%). Reporting having had a mammogram in the past year increases with increasing level of educational attainment.

Screening for CRC

As in the previous report, it was noted that screening rates for CRC were increasing from 2000 through 2005.95 This rising trend has continued for the most recent period of 2005 to 2008. Table 3 shows data for the following CRC cancer screening modalities: use of FOBT home kit test in the past year, use of either CRC endoscopy tests (flexible sigmoidoscopy in the past 5 years or colonoscopy in the past 10 years), and combinations of CRC testing (FOBT and/or endoscopy). No data from NHIS are available on other recommended modalities (eg, CTC, barium enema).

In 2008, the prevalence of having had recent screening with either FOBT or endoscopy was 53.2%. In 2005, this prevalence was 46.8%, indicating a 6.4% increase over the 3-year period. The increasing trend in the use of CRC testing appears to be largely driven by the increasing proportion of age-eligible individuals reporting having undergone a
colonoscopy examination, a trend enhanced by both aggressive attempts to motivate screening as well as increased coverage for the procedure.96,97 However, despite improvement, recent data show that factors such as race, ethnicity, and socioeconomic status (regardless of health care coverage or educational level) are related to the likelihood of having had CRC testing (either an FOBT or endoscopy).98,99

### TABLE 4. Prevalence (%) of Recent Cancer Screening Examinations Among US Adults by Race and Ethnicity, Health Insurance Coverage, and Educational Level, NHIS 2008

| CANCER TYPE | US ADULTS | RACE AND ETHNICITY | HEALTH INSURANCE | EDUCATIONAL LEVEL, YEARS OF EDUCATION |
|-------------|-----------|--------------------|------------------|---------------------------------------|
|             | YEAR 2005* (SE) | YEAR 2008 (SE) | ABSOLUTE % CHANGE (2008-2005) | WHITE, NON-HISPANIC (SE) | BLACK, NON-HISPANIC (SE) | ASIAN AMERICA (SE) | HISPANIC (SE) |
| Colorectal Cancer (men and women aged ≥50 years) |             |                    |                  |                                     |                        |                       |               |
| Either a flexible sigmoidoscopy or colonoscopyb | 43.1 (0.6) | 50.2 (0.6) | 7.1 | 52.7 (0.7) | 47.3 (1.8) | 42.6 (3.1) | 34.6 (1.9) |
| FOBT home kitc | 12.1 (0.4) | 10.0 (0.4) | −2.1 | 10.3 (0.4) | 8.9 (0.9) | 12.1 (1.6) | 7.8 (1.0) |
| FOBT or endoscopyd | 46.8 (0.6) | 53.2 (0.6) | 6.4 | 56.0 (0.7) | 48.9 (1.7) | 47.8 (3.2) | 37.2 (1.7) |
| Breast cancer (women aged ≥40 years) |             |                    |                  |                                     |                        |                       |               |
| Mammograma | 51.2 (0.6) | 53.0 (0.7) | 1.8 | 54.2 (0.9) | 52.2 (1.9) | 52.2 (3.2) | 46.8 (2.0) |
| Cervical cancer (women aged ≥18 years) |             |                    |                  |                                     |                        |                       |               |
| Pap testf | 79.6 (0.4) | 78.3 (0.5) | −1.3 | 79.6 (0.7) | 81.5 (1.3) | 63.8 (2.3) | 75.0 (1.5) |
| Prostate cancer (men aged ≥50 years) |             |                    |                  |                                     |                        |                       |               |
| PSAg | 40.7 (0.9) | 44.1 (1.0) | 3.4 | 46.6 (1.2) | 38.6 (2.9) | 34.7 (3.9) | 32.7 (2.9) |

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

*Prevalence estimates (NHIS 2005) are shown here to describe the absolute percentage change in cancer screening use during period from 2005 to 2008. Prevalence is weighted and age-adjusted using the 2000 Census.

bRecent sigmoidoscopy within the preceding 5 years or colonoscopy test within the preceding 10 years.

cRecent fecal occult blood test using a home kit test performed within the preceding year.

dRecent fecal occult blood test using a home kit test performed within the preceding year or recent sigmoidoscopy or colonoscopy test within the preceding 10 years.

aWomen aged ≥40 years who had a mammogram in the past year.

fWomen who had a Pap test within the preceding 3 years.

gA PSA within the past year for men who have not been told they have had prostate cancer.

Source: National Health Interview Survey 2005 and 2008; National Center for Health Statistics, Centers for Disease Control and Prevention.
**Testing for Early Prostate Cancer Detection**

In 2008, the prevalence of PSA test use in the past year was 44.1, 3.4% higher than in 2005 (40.7%). Similar to CRC testing, individual characteristics such as race, ethnicity, and socioeconomic factors (regardless of health care coverage or educational level) are related to the likelihood of having had a PSA test in the past year. It is important to note that the testing rate does not reflect adherence with ACS guidelines, as no population surveillance system is able to track use of PSA testing conditionally on the outcome of a process of shared decision making between the patient and the health care provider.

**Discussion**

In 2009, several publications focused on cancer screening received considerable media attention by arguing that the benefits of screening were lower and harm higher than commonly perceived, and that screening could begin later and be done less frequently with approximately the same benefit. Challenges to conventional wisdom may be newsworthy, but it is unsettling to the public and health care professionals when experts disagree on the value of preventive care, their perception of the balance of benefits to harm, and their actual recommendations.

In an article entitled “Rethinking Screening for Breast Cancer and Prostate Cancer,” Esserman and colleagues questioned the value of screening for breast and prostate cancer, citing pessimistic literature and questioning why trends in incidence and mortality were not more favorable in the presence of significant rates of screening. In particular, they noted, optimal screening should have produced a rise in incidence rates, followed by a fall in rates, and then a return to prescreening rates, which now should have a more favorable distribution of tumor stages. The theoretical scenario they described is the result of the rise in incidence during the introduction of screening due to lead time, followed by the decline in incidence due to anticipated cancers already having been detected, and then a return to prescreening incidence rates. In the United States, they observed, breast and prostate cancer screening has not produced that trend, but instead has led to an increase in localized disease, without a commensurate decline in advanced disease. Their conclusion was that modern screening is not very effective at altering the natural history of aggressive disease, and mostly detects less aggressive and indolent (ie, overdiagnosed) cases. However, it is unrealistic to expect to observe this textbook pattern in overall and stage-specific incidence rates because they have confused the entire population with the potentially screened population, the actually screened population, and the occasionally and regularly screened population. Put another way, incidence rates include cancers detected in adults not eligible for screening, adults who have no access to screening, adults who are eligible, but refuse screening, adults who are irregularly screened, adults for whom screening has failed to detect early stage disease, and adults entering the screening cohort for the first time. The conclusion that much of the alleged excess of disease represented a significant level of overdiagnosis is readily explained by the short period of observation, a trend in rising incidence rates, and the expected effect screening has on lead time. Although overdiagnosis is likely to be a significant problem in prostate cancer screening, it is most likely a small problem in breast cancer screening, and mostly limited to ductal carcinoma in situ.

Short-term evaluations of population surveillance data are not a sound basis for judging the effectiveness of screening. As described earlier, both the USPSTF and ACOG recommended beginning screening later, and screening less often, citing less harm from screening when it is done less frequently. The new ACOG recommendations for cervical cancer screening represent an additional step in the evolution of guidelines for cervical cancer screening largely brought about by better understanding of the natural history of the disease, and concerns about the risk of miscarriage and premature birth in young women treated aggressively for dysplasia, much of which would be expected to regress without treatment. The logic for the new USPSTF recommendations is less straightforward in the context of assessing a balance of benefit and harm. Setting aside the issue of the underestimate of the benefit of mammography, judging the value of screening for women in their 40s based on the number needed to invite to screening to save 1 life is even more counterintuitive. Even if the USPSTF had used recent estimates of the number needed to screen, which are considerably more intuitive, accurate, and favorable from the standpoint of judging the value of screening, how does anyone draw conclusions about the value of screening from this number?
alone or relative to any other estimate of the number needed to screen? This estimate equates screening with treatment, but they are not the same. As Sasieni noted in a similar debate over the value of population-based screening in terms of costs, yield, and harm, screening should be thought of as a form of insurance, and thus it is not particularly relevant how many need to be insured to prevent an adverse event, but rather that the insurance is in place to prevent the adverse consequences of an unlikely event. He noted further that women needed to be aware of the common negative consequences of regular screening, and that they might think of screening as a “costly and imperfect insurance policy” that may nonetheless save them from the very real harm of treatment for an advanced cancer or even worse, a premature death.104

The recent discussions in the media seem to have missed this fundamental point. Individual risk prediction is inherently imperfect. We have no way of predicting whether an otherwise healthy woman will develop breast cancer, and if so, whether she will develop a breast cancer in which prognosis is dependent on being found early. If she does develop breast cancer, perhaps detection by screening was not necessary to save her life, but even in this case it may have offered her the option of breast-conserving therapy and avoidance of debilitating chemotherapy and possibly the eventual development of lymphedema. In this light, Sasieni’s comparison of screening to insurance is quite a sensible approach.104 Adults and health care professionals need to have a better understanding of the limits of screening, but also need to appreciate that recommended cancer screening, even with its attendant downsides and possible harms, is an important part of an individual’s ongoing preventive care.

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