

# Screening for Abdominal Aortic Aneurysm: U.S. Preventive Services Task Force Recommendation Statement

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**Description:** Update of the 2005 U.S. Preventive Services Task Force (USPSTF) recommendation on screening for abdominal aortic aneurysm (AAA).

**Methods:** The USPSTF commissioned a systematic review that assessed the evidence on the benefits and harms of screening for AAA and strategies for managing small (3.0 to 5.4 cm) screen-detected AAAs.

**Population:** These recommendations apply to asymptomatic adults aged 50 years or older.

**Recommendation:** The USPSTF recommends 1-time screening for AAA with ultrasonography in men aged 65 to 75 years who have ever smoked. (B recommendation)

The USPSTF recommends that clinicians selectively offer screening for AAA in men aged 65 to 75 years who have never smoked. (C recommendation)

The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for AAA in women aged 65 to 75 years who have ever smoked. (I statement)

The USPSTF recommends against routine screening for AAA in women who have never smoked. (D recommendation)

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\* For a list of USPSTF members, see the **Appendix** (available at [www.annals.org](http://www.annals.org)).

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**T**he U.S. Preventive Services Task Force (USPSTF) makes recommendations about the effectiveness of specific preventive care services for patients without related signs or symptoms.

It bases its recommendations on the evidence of both the benefits and harms of the service and an assessment of the balance. The USPSTF does not consider the costs of providing a service in this assessment.

The USPSTF recognizes that clinical decisions involve more considerations than evidence alone. Clinicians should understand the evidence but individualize decision making to the specific patient or situation. Similarly, the USPSTF notes that policy and coverage decisions involve considerations in addition to the evidence of clinical benefits and harms.

## SUMMARY OF RECOMMENDATION AND EVIDENCE

The USPSTF recommends 1-time screening for abdominal aortic aneurysm (AAA) with ultrasonography in men aged 65 to 75 years who have ever smoked. (B recommendation)

The USPSTF recommends that clinicians selectively offer screening for AAA in men aged 65 to 75 years who have never smoked rather than routinely screening all men in this group. Evidence indicates that the net benefit of screening all men aged 65 to 75 years who have never smoked is small. In determining whether this service is appropriate in individual cases, patients and clinicians should consider the balance of benefits and harms on the basis of evidence relevant to the patient's medical history,

family history, other risk factors, and personal values. (C recommendation)

See the Clinical Considerations section for additional information on risk assessment.

The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for AAA in women aged 65 to 75 years who have ever smoked. (I statement)

See the Clinical Considerations section for suggestions for practice regarding the I statement.

The USPSTF recommends against routine screening for AAA in women who have never smoked. (D recommendation)

These recommendations apply to asymptomatic adults aged 50 years or older.

For the purposes of this recommendation, an "ever-smoker" is a person who has smoked at least 100 cigarettes in his or her lifetime.

See the **Figure** for a summary of the recommendation and suggestions for clinical practice.

See also:

Summary for Patients. . . . . I-26

Related article: *Ann Intern Med.* 2014;160:321-32.

### Web-Only

CME quiz

Consumer Fact Sheet

Figure. Screening for abdominal aortic aneurysm: clinical summary of U.S. Preventive Services Task Force recommendation.

SCREENING FOR ABDOMINAL AORTIC ANEURYSM  
CLINICAL SUMMARY OF U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATION

Population	Men aged 65 to 75 y who have ever smoked*	Men aged 65 to 75 y who have never smoked	Women aged 65 to 75 y who have ever smoked*	Women who have never smoked
Recommendation	Screen once for abdominal aortic aneurysm (AAA) by ultrasonography.  Grade: B	Selectively screen for AAA.  Grade: C	No recommendation.  Grade: I statement	Do not screen for AAA.  Grade: D

Risk Assessment	Risk factors for AAA include older age; a positive smoking history; having a first-degree relative with an AAA; and having a history of other vascular aneurysms, coronary artery disease, cerebrovascular disease, atherosclerosis, hypercholesterolemia, obesity, or hypertension.  Factors associated with a reduced risk for AAA include African American race, Hispanic ethnicity, and diabetes.			
Screening Tests	Abdominal duplex ultrasonography is the standard approach for AAA screening. Screening with ultrasonography is noninvasive and easy to perform and has high sensitivity (94% to 100%) and specificity (98% to 100%) for detection.			
Treatment	Patients with large AAAs (≥5.5 cm) are referred for open surgical repair or endovascular aneurysm repair. Patients with smaller aneurysms (3.0 to 5.4 cm) are generally managed conservatively via surveillance (e.g., repeated ultrasonography every 3 to 12 mo).  Early open surgery for the treatment of smaller AAAs does not reduce AAA-specific or all-cause mortality. Surgical referral of smaller AAAs is typically reserved for rapid growth (>1.0 cm per year) or once the threshold of ≥5.5 cm on repeated ultrasonography is reached.  Short-term treatment with antibiotics or β-blockers does not seem to reduce AAA growth.			
Balance of Benefits and Harms	There is a moderate net benefit of screening for AAA with ultrasonography in men aged 65 to 75 y who have ever smoked.	There is a small net benefit of screening for AAA with ultrasonography in men aged 65 to 75 y who have never smoked.	The evidence of screening for AAA in women aged 65 to 75 y who have ever smoked is insufficient, and the balance of benefits and harms cannot be determined.	The harms of screening for AAA in women who have never smoked outweigh any potential benefits.

For a summary of the evidence systematically reviewed in making this recommendation, the full recommendation statement, and supporting documents, please go to [www.uspreventiveservicestaskforce.org](http://www.uspreventiveservicestaskforce.org).

\* “Ever smoked” is defined as having smoked at least 100 cigarettes during a lifetime.

Appendix Table 1 describes the USPSTF grades, and Appendix Table 2 describes the USPSTF classification of levels of certainty about net benefit (both tables are available at [www.annals.org](http://www.annals.org)).

**RATIONALE**  
**Importance**

Abdominal aortic aneurysms are typically defined by an aortic diameter of 3.0 cm or larger. Population-based studies in adults older than 50 years have found that the prevalence of AAA is 3.9% to 7.2% in men and 1.0% to 1.3% in women (1, 2). It is important to consider poten-

tial screening strategies for AAA because most AAAs are asymptomatic until they rupture. Although the risk for rupture varies greatly by aneurysm size, the associated risk for death is as high as 75% to 90% (1, 2).

**Detection**

Evidence is adequate that ultrasonography is a safe and accurate screening test for AAA.

**Benefits of Detection and Early Treatment**  
**Men Aged 65 to 75 Years Who Have Ever Smoked**

Four large, population-based, randomized, controlled trials (RCTs) show that invitation to 1-time screening for

AAA is associated with reduced AAA-specific mortality in men. This benefit begins 3 years after testing and persists up to 15 years (1, 2). In addition, risk reduction for AAA rupture and emergency surgery persists up to 10 to 13 years (1, 2).

In the 2 highest-quality trials, the relative reduction in AAA-specific mortality after 13 years was 42% to 66% (3, 4). In the largest trial, where prevalence of AAA was approximately 5% in the screened group, screening was associated with an absolute risk reduction in death of 1.4 per 1000 men (3).

Abdominal aortic aneurysms are most prevalent in men who have ever smoked, occurring in approximately 6% to 7% of this population (5, 6). This prevalence increases the importance of screening in these men because it maximizes the absolute benefit that could be achieved (that is, it improves the likelihood that men in this group will benefit from screening). Convincing evidence shows that 1-time screening with ultrasonography results in a moderate benefit in men aged 65 to 75 years who have ever smoked.

#### **Men Aged 65 to 75 Years Who Have Never Smoked**

Screening men overall reduces AAA-specific death, rupture, and emergency surgery. However, the lower prevalence in men who have never smoked (approximately 2%) (5) substantially reduces the absolute benefit (that is, it greatly lowers the probability that men in this group will benefit from screening). Adequate evidence shows that 1-time screening with ultrasonography results in a small benefit in men aged 65 to 75 years who have never smoked.

#### **Women Aged 65 to 75 Years Who Have Ever Smoked**

Only 1 RCT on screening for AAA included women (7). It detected no difference in the rate of rupture, AAA-specific mortality, or all-cause mortality between women invited for screening and the control group (8). However, the trial was ultimately underpowered to detect differences in health outcomes by sex; as such, the results do not rule out the possibility of a small benefit of screening in this population.

Women aged 70 years who have ever smoked have a relatively low prevalence of AAA (approximately 0.8% overall and approximately 2.0% for current smokers) (9). Evidence is inadequate to conclude whether 1-time screening for AAA with ultrasonography is beneficial in women aged 65 to 75 years who have ever smoked.

#### **Women Who Have Never Smoked**

The prevalence of AAA in women who have never smoked is low (0.03% to 0.60% in women aged 50 to 79 years) (5, 9). The evidence also shows no apparent benefit of screening for AAA in women (8). The USPSTF therefore concludes that adequate evidence shows that the ab-

solute benefit of 1-time screening for AAA with ultrasonography in women who have never smoked can effectively be bounded at none or almost none.

#### **Harms of Detection and Early Treatment**

In the available trials, groups invited to screening were approximately twice as likely as control groups to have any AAA surgery within 3 to 5 years, predominantly driven by an increase in elective surgeries. More than 90% of AAAs identified by screening were below the 5.5-cm threshold for immediate repair. Detecting smaller AAAs generally leads to long-term (potentially lifelong) surveillance (1, 2).

A person's risk for death related to elective surgery for AAA is lower than that for death related to emergency surgery for rupture. However, the increase in the overall rates of detection and surgery in the screening groups still potentially represents a harm. A proportion of AAAs will never rupture because they do not advance or because a person dies of a competing cause.

The exact extent of overdiagnosis and overtreatment is difficult to estimate. One study from Massachusetts General Hospital reviewed 24 000 consecutive autopsies between 1952 and 1975 and found that 75% of the 473 patients who died with an undetected or unoperated AAA had a cause of death not related to the AAA (41% were >5.1 cm in diameter) (10). Given that even elective treatment is associated with some risk for perioperative mortality, overtreatment is an important issue to consider when deciding whether to screen for this condition.

One study reported that women had a higher risk for death related to AAA surgery than men; death rates of women and men were approximately 7% versus 5% for open repair and 2% versus 1% for endovascular repair, respectively (11). Evidence is limited and conflicting about the effect of screening on quality of life or psychological status (for example, anxiety) (1, 2). Convincing evidence shows that the harms associated with 1-time screening with ultrasonography are at least small in all populations and potentially higher in women because of the greater risk for operative mortality.

#### **USPSTF Assessment**

The USPSTF concludes with high certainty that screening for AAA with ultrasonography in men aged 65 to 75 years who have ever smoked has a moderate net benefit.

The USPSTF concludes with moderate certainty that screening for AAA with ultrasonography in men aged 65 to 75 years who have never smoked has a small net benefit.

The USPSTF concludes that the evidence is insufficient to determine the balance of benefits and harms of screening for AAA in women aged 65 to 75 years who have ever smoked.

The USPSTF concludes with moderate certainty that the harms of screening for AAA outweigh any potential benefits in women who have never smoked.

## CLINICAL CONSIDERATIONS

### Patient Population Under Consideration

This recommendation applies to asymptomatic adults aged 50 years or older.

### Assessment of Risk

#### Smoking Status

Smoking 100 or more cigarettes is commonly used in epidemiologic literature to define an “ever-smoker.” However, the randomized trials of screening for AAA did not gather specific data about participants’ smoking histories. Occasional tobacco use for a short time in the past (for example, occasional “social” smoking as an adolescent or young adult) is unlikely to have a pronounced biological effect, and the odds ratio (OR) of developing a large ( $\geq 5.0$  cm) AAA is actually less than 1.0 for prior smokers who have quit for at least 10 years (12). However, observational studies have found that even a relatively modest smoking history (for example, smoking a half-pack or less per day for fewer than 10 years) does increase the likelihood of developing a large AAA (12).

#### Screening in Men Aged 65 to 75 Years Who Have Never Smoked

Despite the demonstrated benefits of screening for AAA in men overall, the lower prevalence in male never-smokers versus male ever-smokers suggests that clinicians should consider a patient’s risk factors and the potential for harm before screening for AAA rather than routinely offering screening to all male never-smokers. Important risk factors include older age and a first-degree relative with an AAA; other risk factors include a history of other vascular aneurysms, coronary artery disease, cerebrovascular disease, atherosclerosis, hypercholesterolemia, obesity, and hypertension. Factors associated with a reduced risk include African American race, Hispanic ethnicity, and diabetes (5, 12, 13).

### Suggestions for Practice Regarding the I Statement

#### Screening in Women Aged 65 to 75 Years Who Have Ever Smoked

*Potential Preventable Burden.* A screening study in Sweden found that the prevalence of AAA in women aged 70 years was low (0.8%) for ever-smokers but increased to 2.0% for current smokers (9). A meta-analysis of individual-patient data found that women have a higher risk than men for rupture at the same diameter (hazard ratio [HR], 3.76 [95% CI, 2.58 to 5.47]) (14). However, AAA-associated deaths occur at an older age in women (at a time of increased competing causes of death and a declining benefit–risk ratio for operative interventions), with 70% of deaths occurring after age 80 years in women compared with fewer than 50% in men (1, 2). In the only screening RCT that included women, most screen-detected AAAs in women were small (3.0 to 3.9 cm) and AAA-specific mortality was low in screened and unscreened women ( $<0.2\%$ ) after 10 years (8).

*Potential Harms.* Four RCTs (primarily done in men) showed that screening doubled the rate of AAA-associated surgeries, largely driven by an increase in elective surgeries. Most screen-detected AAAs were below the 5.5-cm threshold for immediate repair. This finding generally results in long-term or lifelong surveillance and is probably associated with some amount of overtreatment, although the magnitude of this burden is difficult to quantify.

Most screening trials reported an associated decrease in emergency repairs and a reduced 30-day mortality rate associated with emergency surgery in populations invited to screen, although mortality associated with elective surgery was not reduced (1, 2). Operative mortality associated with AAAs is higher in women than in men (7% vs. 5% for open repair and 2% vs. 1% for endovascular repair, respectively) (11).

*Costs.* In addition to the cost of ultrasonography screening (approximately \$100) (15), the estimated potential associated cost of elective surgery to repair a screen-detected AAA ranges from \$37 000 to \$43 000 (16). Potential opportunity costs also may arise, because screening may take the place of other preventive activities that may be more beneficial to the patient.

*Current Practice.* Screening for AAA is provided as part of the “welcome-to-Medicare visit” for women who have a family history of AAA (17). However, the evidence is insufficient to accurately characterize current practice patterns related to screening for AAA in women.

A retrospective analysis from 2000 to 2010 used the National Inpatient Sample, a database that has a stratified 20% random sample of all nonfederal inpatient hospital admissions in the United States. This analysis found that women are more likely than men to have open surgery versus endovascular aneurysm repair (EVAR) for unruptured AAA (24% vs. 17%, respectively), potentially because of issues with access to the iliac artery (that is, smaller artery size) that may preclude endovascular management (18).

A retrospective review of 4026 AAA repairs in the Vascular Study Group of New England database (a voluntary registry from 30 academic and community hospitals in the 6 New England states) reported that women were more likely than men to have open surgery versus EVAR and to be older and have smaller aortic diameters at the time of repair. Postoperative complications were higher in women than in men after elective EVAR or open repair, including emergency reoperations, dysrhythmias, leg ischemia or emboli, bowel ischemia, or need for discharge to another medical facility rather than home (19).

### Screening Methods

Conventional abdominal duplex ultrasonography was the primary method used in the available trials of AAA screening, and primary care physicians and vascular surgeons widely accept it as the standard approach to screening. Screening with ultrasonography is noninvasive and



easy to do and has high sensitivity (94% to 100%) and specificity (98% to 100%) for detecting AAA (1, 2). In addition, it has shown high rates of reproducibility, does not expose patients to radiation, and is relatively low-cost.

The use of handheld, portable ultrasonography devices in clinician office settings has been proposed as an alternative approach to conventional abdominal duplex ultrasonography done in the radiology setting. Several small observational studies suggest that in-office handheld ultrasonography has reasonable sensitivity and specificity for AAA detection compared with conventional ultrasonography. However, it has not been formally evaluated in a clinical trial (20, 21).

### Screening Intervals

Evidence is adequate to support 1-time screening in men who have ever smoked. All of the population-based RCTs of AAA screening used a 1-time screening approach, and several fair- to good-quality prospective cohort studies show that AAA-associated mortality over 5 to 12 years is low (0.0% to 2.4%) in men with initially normal results on ultrasonography (1, 2).

### Treatment

In the available screening trials, immediate referral for open surgery in patients with large AAAs ( $\geq 5.5$  cm) and conservative management via repeated ultrasonography every 3 to 12 months for smaller AAAs (3.0 to 5.4 cm) achieved the observed AAA-related mortality benefit. Surgical referral of smaller AAAs was reserved for those that grew rapidly ( $>1.0$  cm per year) or reached a threshold of 5.5 cm or larger on repeated ultrasonography (1, 2).

Although early open surgery for smaller AAAs reduces the risk for rupture compared with surveillance, it does not reduce AAA-specific or all-cause mortality (22, 23). Endovascular aneurysm repair is an alternative to open surgery. As with open surgery, early EVAR did not differ from surveillance for smaller AAAs in all-cause or AAA-related mortality in randomized trials that evaluated these interventions. Unlike early open surgery, early EVAR does not reduce the incidence of rupture (24, 25).

Pharmacotherapy has been proposed to slow the growth of smaller AAAs. Short-term treatment with antibiotics or  $\beta$ -blockers does not seem to reduce growth, and the trials were underpowered to draw conclusions about effects on health outcomes (1, 2).

## OTHER CONSIDERATIONS

### Research Needs and Gaps

Although evidence shows that women who smoke are at increased risk for AAA compared with nonsmoking women, evidence that screening this population confers a net benefit is insufficient. The same is true for men and women with a family history of AAA. Ideally, appropriately powered RCTs with planned a priori subgroup analyses would be done to answer these critical questions. In the

absence of new trial data, high-quality modeling studies should be done to determine whether screening is beneficial in women who smoke or in men and women with a family history of AAA.

Several risk-scoring tools have been developed and, if prospectively validated, could be used to identify patients most likely to benefit from screening. Thus, validation studies of these tools should be prioritized. Because of the importance of family history as a risk factor, the role of genetic markers of AAA development should be explored.

Alternative strategies to reduce growth, such as antibiotics, statins, or other novel pharmacologic agents, need to be further explored. Interventions to address modifiable risk factors (particularly smoking) may be worth considering. Effective strategies for smoking cessation may improve the care of patients with small AAAs. Seven ongoing RCTs are evaluating pharmacotherapeutic effects on small AAAs; however, the outcome in most trials is aneurysm growth, and the trials are underpowered to detect changes in health outcomes. Appropriately powered studies that can assess health outcomes should evaluate whether such treatments are viable options in preventing death.

One screening RCT, the VIVA (Viborg Vascular) trial, is currently evaluating the effectiveness of combined screening for AAA, peripheral artery disease, and hypertension in 50 000 men aged 65 to 74 years; results are not expected until after 2018. Participants who screen positive for AAA or peripheral artery disease are advised on exercise, low-fat diet, and smoking cessation and are managed with statins and aspirin. They receive annual surveillance for AAA and peripheral artery disease, and those with an AAA measuring 5.0 cm or larger are referred for surgery.

Follow-up will occur at 3.5, 10, and 15 years for the primary outcome of all-cause mortality. Secondary outcomes include cardiovascular mortality, AAA-specific mortality, AAA prevalence and progression, health-related quality of life, and cost-effectiveness. This study may also provide evidence of whether a screen-detected AAA can be used as a marker and improve outcomes for other cardiovascular diseases (26).

## DISCUSSION

### Burden of Disease

Abdominal aortic aneurysms, defined by an aortic diameter of 3.0 cm or larger, affect an estimated 3.9% to 7.2% of men and 1.0% to 1.3% of women aged 50 years or older. Several recent studies from population-based screening programs in men aged 65 years or older have reported a declining prevalence of AAA over the past 2 decades in the United Kingdom, New Zealand, and Sweden (overall prevalence estimates range from 1.5% to 1.7%) (1, 2). One recent study in 70-year-old women in Sweden reported a similar decline in the overall prevalence of AAA (to approximately 0.5%) (9). This decline may be due to a reduced rate of smoking and improved treatment

of hypertension and hyperlipidemia in these populations. However, prevalence in male and female smokers does not seem to have declined.

The primary risk associated with AAA is rupture, which may occur suddenly and without symptoms and is often fatal. However, the risk for rupture varies substantially by the size of the aneurysm. The annual risk for rupture is nearly 0% for AAAs between 3.0 and 3.9 cm in diameter, 1% for those between 4.0 and 4.9 cm in diameter, and 11% for those between 5.00 and 5.99 cm in diameter (1, 2).

An estimated 59% to 83% of patients with AAA rupture die before hospitalization; operative mortality (in-hospital or 30-day) is approximately 40%. Thus, at most, 10% to 25% of persons with a ruptured AAA survive. Almost all deaths from rupture occur after age 65 years, and most deaths in women occur after age 80 years (1, 2).

### Scope of Review

The USPSTF commissioned a systematic review to update its 2005 recommendation on screening for AAA. The review assessed the evidence on the benefits and harms of screening and strategies for managing small (3.0 to 5.4 cm) screen-detected AAAs.

### Accuracy of Screening Tests

Feasible or referable primary care screening tests for AAA include ultrasonography, computed tomography (CT), and physical examination. The performance characteristics of these screening methods were not systematically reviewed for this updated recommendation.

Ultrasonography is the primary technology used to screen for AAA because it is noninvasive, low-cost, and easy to do; does not expose patients to radiation; and has high sensitivity (94% to 100%), specificity (98% to 100%), and rates of reproducibility for detection (1, 2). Computed tomography has relatively high sensitivity (90%) and specificity (91%) for detecting AAA but exposes patients to radiation and detects aneurysms that are generally 2 mm larger than those measured by ultrasonography, probably because the cross-section of the aorta obtained by axial CT imaging is not in the transverse plane and therefore yields an overestimate of AAA size (27). Physical examination has far lower sensitivity (approximately 39% to 68%) and specificity (75%) than ultrasonography or CT (1, 2).

### Effectiveness of Screening and Treatment

#### Screening Studies

Four large, population-based RCTs that predominantly enrolled men aged 65 years or older examined the effectiveness of 1-time screening for AAA: the good-quality MASS (Multicentre Aneurysm Screening Study) ( $n = 67\ 800$ ) (28); the good-quality Viborg County, Denmark, screening trial ( $n = 12\ 639$ ) (29); the fair-quality Chichester, United Kingdom, screening trial ( $n = 15\ 775$ ) (7); and the fair-quality Western Australia screening trial ( $n = 41\ 000$ ) (30). Reported mean (or median) ages ranged

from 67.7 to 72.7 years; the oldest participants were aged 80 years (1, 2).

*Men.* The prevalence of AAA in male screening participants ranged from 4.0% to 7.7% across the studies. Most screen-detected AAAs were small; only 0.4% to 0.6% of screened participants had an AAA measuring 5.0 or 5.5 cm or larger (1, 2).

*AAA-Related Mortality.* MASS and the Viborg trial each found a statistically significant reduction in AAA-related mortality in the groups invited to screening compared with the control groups up to 13 years after screening (13-year HR, 0.58 [CI, 0.49 to 0.69] vs. 0.34 [CI, 0.20 to 0.57], respectively) (3, 4). The absolute risk reduction in MASS was 0.14% (0.19% of men in the screened group vs. 0.33% in the control group) or 1.4 fewer AAA-related deaths per 1000 men screened (3). The Western Australia and Chichester trials also had results favoring the screening group, but they were not statistically significant (30, 31).

*All-Cause Mortality.* None of the individual trials showed a statistically significant benefit of screening for all-cause mortality at up to 15-year follow-up. Pooled analysis of all available trials using a prespecified random-effects model also showed no effect on all-cause mortality (risk ratio, 0.98 [CI, 0.97 to 1.00]); sensitivity analysis using a profile likelihood estimation method yielded identical results. Sensitivity analysis using ORs and a fixed-effects model found a statistically significant result at the longest period (OR, 0.973 [CI, 0.950 to 0.997]) (1, 2). A lack of an all-cause mortality benefit is not entirely unexpected, because fewer than 3% of participant deaths were attributable to AAA across the trials.

*Rupture.* Invitation to screening was associated with a statistically significant reduced rate of rupture in MASS (HR, 0.57 [CI, 0.49 to 0.66]) and the Viborg trial (HR, 0.44 [CI, 0.24 to 0.79]) at 13-year follow-up (3, 4). The Chichester trial found no statistically significant reduction in rupture rate at 15 years, although the point estimate was in the direction of benefit (HR, 0.88 [CI, 0.61 to 1.26]) (31). The Western Australia trial found no statistically significant difference at a median follow-up of 3.6 years (33 ruptures in the intervention group vs. 38 ruptures in the control group) (30).

*Emergency Surgery.* The rate of emergency AAA repair for rupture in the screened population was approximately halved after 13 years in MASS (3). In the Viborg trial, acute surgeries were reduced at up to 15 years (HR, 0.50 [CI, 0.15 to 1.65]), although the result was not statistically significant after 10-year follow-up (HR, 0.32 [CI, 0.17 to 0.60]) (4, 29). The Chichester and Western Australia trials found no differences in the rate of emergency surgeries (30, 31).

*Older Men.* Two of the population-based screening trials analyzed AAA-associated mortality by age. The Viborg trial found similar risk reduction in AAA-related mortality with screening men aged 64 to 65 years and men aged 66 to 73 years (4). The Western Australia trial found

no difference in AAA-associated mortality with screening men aged 65 to 74 years (OR, 0.82 [CI, 0.37 to 1.84]) versus those aged 75 years or older (OR, 1.13 [CI, 0.56 to 2.29]) (30).

**Women.** As noted previously, only the Chichester study included women (aged 65 to 80 years). It found a low prevalence of AAA in women (1.3%), and 75% of screen-detected AAAs in women measured 3.0 to 3.9 cm. Rupture rates (0.06% in both groups), AAA-specific mortality (<0.2% in both groups), or all-cause mortality (10.7% vs. 10.2%) at 5 years did not statistically significantly differ in the invitation-to-screening and control groups (8).

Event rates in women were low, and the trial was ultimately underpowered to draw definitive conclusions about health outcomes in women. Although the individual risk for rupture at a smaller aneurysm diameter seems to be higher in women than in men (14), the overall rupture rate in women is low. More than two thirds of deaths from AAA occur in women aged 80 years or older, as the Chichester trial reported (8).

### Treatment Studies

**Standard Intervention for Large ( $\geq 5.5$  cm) AAAs.** Management strategies for large AAAs include open surgery and EVAR to avoid arterial rupture. Randomized trials have substantially evaluated open surgical repair, the conventional method for repairing large AAAs, which has been shown to consistently reduce AAA-related mortality in patients with screen-detected AAA (1, 2).

Endovascular aneurysm repair may provide selective short-term advantages over open surgery, such as avoidance of general anesthesia and reduced operative time, blood loss, and postoperative pain. Three major trials (the EVAR 1 trial, the OVER [Open Versus Endovascular Repair] trial, and the DREAM [Dutch Randomized Endovascular Aneurysm Management] trial) compared open surgery with EVAR for large AAAs; findings suggest that EVAR has a lower operative mortality rate than open surgery, but AAA-specific and all-cause mortality do not differ between the 2 interventions (32–34). Endovascular aneurysm repair has a higher reintervention rate than open repair and generally requires lifelong, regular follow-up via ultrasonography or CT (1, 2).

**Early Intervention for Small (3.0 to 5.4 cm) AAAs.** In total, 8 RCTs assessed the effects of early surgery compared with surveillance or pharmacotherapy compared with placebo for small AAAs. Two good-quality RCTs (UKSAT [United Kingdom Small Aneurysm Trial] and the ADAM [Aneurysm Detection and Management] trial) compared early open surgery with surveillance for AAAs measuring 4.0 to 5.4 cm (22, 23). In both trials, early open surgery (HR, 0.94 [CI, 0.75 to 1.17]) and surveillance for all-cause mortality (relative risk, 1.21 [CI, 0.95 to 1.54]) did not statistically significantly differ after approximately 5 years.

During 12-year follow-up, UKSAT continued to find no benefit to early surgery versus surveillance for all-cause mortality (1, 2).

In the ADAM study, risk for AAA-associated mortality in the immediate repair group versus the surveillance group (relative risk, 1.15 [CI, 0.58 to 2.31]) did not decrease; 30-day postoperative mortality also did not differ (23). In UKSAT, more deaths from ruptured AAA occurred in the surveillance group than in the early intervention group (17 vs. 6 deaths); however, 43% of the fatal ruptures were from AAAs measuring larger than 5.5 cm in diameter, and autopsy confirmed cause of death in only 29% of cases (22). Further, the relative magnitude of effect decreased with additional follow-up. Mortality related to AAAs accounted for approximately 7% of all deaths recorded (1, 2).

In addition, these 2 trials also reported all-cause mortality by age and AAA diameter subgroups, which did not statistically significantly differ between early open surgery and surveillance (22, 23). All-cause mortality between the groups did not differ by sex in UKSAT (23).

Two fair-quality RCTs (the CAESAR [Comparison of Surveillance Versus Aortic Endografting for Small Aneurysm Repair] and PIVOTAL [Positive Impact of Endovascular Options for Treating Aneurysms Early] trials) evaluating early EVAR versus surveillance showed that AAA-specific or all-cause mortality and the AAA rupture rate after 2 years of follow-up did not differ between the 2 groups; however, the number of reported events for these outcomes in both trials was small, limiting the certainty of these findings (24, 25).

One good-quality, placebo-controlled, randomized trial of the  $\beta$ -blocker propranolol showed that 2 years of treatment did not statistically significantly affect growth rate, AAA-specific mortality, or all-cause mortality (35). Pooled analysis of 1 good- and 2 fair-quality RCTs evaluating the use of several antibiotics for 4 to 15 weeks revealed no differences in all-cause mortality or surgical procedure rate compared with placebo. Results were inconsistent for the effect on growth rate (1, 2).

### Potential Harms of Screening and Treatment

#### Screening

Each of the 4 available population-based screening RCTs showed an approximate doubling of all AAA-related surgeries at 3 to 5 years, driven primarily by an increase in elective surgeries. This overall increase in surgeries persisted at 13 to 15 years, although the magnitude of difference decreased to some extent (1, 2).

Five small observational studies evaluated quality of life, anxiety, and depression, with conflicting results. One study showed that physical functioning, social functioning, and mental health scores statistically significantly decreased from baseline in participants who screened positive for AAA at 12 months (36); however, the other 4 studies did not show similar clinically important effects (1, 2). No



studies evaluated labeling in patients who screened positive for AAA, although it is a potential harm.

### Treatment

Two good-quality RCTs showed that early open repair compared with surveillance for small AAAs (3.0 to 5.4 cm) increased the number of surgeries by 50% (313 additional surgeries per 1000 patients) but did not affect AAA-specific or all-cause mortality, the surgical mortality rate, or short-term quality of life (22, 23). Similarly, 2 fair-quality trials found that early EVAR doubled the rate of AAA-associated surgeries (approximately 484 to 582 more surgeries per 1000 patients) compared with surveillance, with no resulting AAA-specific mortality benefit or improvements in quality of life (24, 25).

One RCT of propranolol versus placebo for treating small AAAs reported a high discontinuation rate over 2 years (60% of participants receiving the active intervention) due to adverse events, such as fatigue, shortness of breath, and bradycardia (35). Three RCTs of antibiotics found a low rate of adverse events over 4 to 15 weeks (1, 2).

### Estimate of Magnitude of Net Benefit

The USPSTF found convincing evidence that screening for AAA in men aged 65 to 75 years who have ever smoked provides a moderate benefit in reducing AAA-specific mortality. Adequate evidence indicates that the harms of screening for AAA in this population are at least small. The USPSTF concludes with high certainty that screening for AAA in men aged 65 to 75 years who have ever smoked is of moderate net benefit.

The USPSTF found adequate evidence that screening for AAA in men aged 65 to 75 years who have never smoked provides a small benefit in reducing AAA-specific mortality. Adequate evidence indicates that the harms of screening for AAA in this population are at least small. The USPSTF concludes with moderate certainty that screening for AAA in men aged 65 to 75 years who have never smoked is at best of small net benefit.

Only a single screening trial of AAA included women, and it showed no benefit in preventing AAA-specific mortality, overall mortality, or rupture in this population. However, the trial was underpowered for drawing sex-specific conclusions and, as such, does not definitively rule out the possibility of a small benefit, especially in women who are current smokers.

Overall, women have a lower prevalence than men at any age and seem to develop AAA at a later age than men. Most ruptures in women occur after age 80 years, when many competing causes of death are present. The USPSTF therefore found inadequate evidence that screening for AAA in women aged 65 to 75 years who have ever smoked provides a benefit in reducing AAA-specific mortality. Adequate evidence indicates that the harms of screening for AAA in this population are at least small and may be

higher than those in men because of higher rates of operative mortality. The USPSTF concludes that the evidence is insufficient to determine the net benefit of screening for AAA in women aged 65 to 75 years who have ever smoked.

The USPSTF found adequate evidence that the AAA-specific mortality benefit of screening for AAA in women who have never smoked can effectively be bounded at small to none. Adequate evidence indicates that the harms of screening in this population are at least small and may be higher than those in men because of higher rates of operative mortality. The USPSTF concludes with moderate certainty that screening for AAA in women aged 65 to 75 years who have never smoked is of no net benefit.

### How Does Evidence Fit With Biological Understanding?

An AAA is a weakening in the wall of the abdominal section of the aorta. Once a section of the aortic wall is weakened, pressure from the blood flowing through the vessel causes it to bulge or balloon, resulting in an aneurysm. A large proportion of AAAs are asymptomatic until rupture. Rupture can be acute and is life-threatening. Therefore, considering an effective method for screening and treating appropriate patients before rupture is important.

### RESPONSE TO PUBLIC COMMENTS

A draft version of this recommendation statement was posted for public comment on the USPSTF Web site from 28 January to 24 February 2014. In response to the comments received, the USPSTF clarified the definition of an “ever-smoker.” It provided information about the absolute benefits of screening for AAA as reported in MASS to provide additional context for the reported relative risk reductions. The USPSTF also expanded the discussion relating to the risks and benefits of screening and treatment in women compared with those in men (see Suggestions for Practice Regarding the I Statement: Current Practice). Finally, the USPSTF emphasized that more research—including high-quality modeling studies—is required to better understand the relative benefits and harms of screening for AAA in men and women with a family history of AAA and for women who have ever smoked.

### UPDATE OF PREVIOUS USPSTF RECOMMENDATION

This recommendation updates the 2005 USPSTF recommendation on screening for AAA. It differs in that instead of one D recommendation for screening for AAA in all women, the USPSTF now has two recommendations: an I statement for women who have ever smoked and a D recommendation for women who have never smoked. There continues to be no direct experimental evidence that screening female ever-smokers reduces AAA rupture, AAA-specific mortality, or overall mortality. However, the single screening RCT that included women was underpowered to draw definitive conclusions by sex, and the prevalence of



AAA in women who currently smoke approaches that of men who have never smoked. As such, a small net benefit might exist for this population and appropriate, high-quality research designs should be used to address this question.

## RECOMMENDATIONS OF OTHERS

The American College of Cardiology and the American Heart Association jointly recommend 1-time screening for AAA with physical examination and ultrasonography in men aged 65 to 75 years who have ever smoked and in men aged 60 years or older who are the sibling or offspring of a person with AAA. These organizations do not recommend screening for AAA in men who have never smoked or in women (37). The Society for Vascular Surgery recommends 1-time ultrasonography screening for AAA in men aged 55 years or older with a family history of AAA, all men aged 65 years or older, and women aged 65 years or older who have smoked or have a family history of AAA (27). The American College of Preventive Medicine recommends 1-time screening in men aged 65 to 75 years who have ever smoked; it does not recommend routine screening in women (38).

The Canadian Society for Vascular Surgery recommends ultrasonography screening for AAA in men aged 65 to 75 years who are candidates for surgery and willing to participate. In individualized cases, some women older than 65 years with multiple risk factors (smoking history, cerebrovascular disease, or family history) may be considered for screening (39). The European Society for Vascular Surgery recommends that men should be screened for AAA with a single ultrasonography at age 65 years, but screening should be considered at an earlier age in men at higher risk (for example, those who smoke, have other cardiovascular disease, or have a family history). It notes that screening in older women generally does not reduce the incidence of aneurysm rupture but that screening women who smoke may require further investigation (40).

From the U.S. Preventive Services Task Force, Rockville, Maryland.

**Disclaimer:** Recommendations made by the USPSTF are independent of the U.S. government. They should not be construed as an official position of the Agency for Healthcare Research and Quality or the U.S. Department of Health and Human Services.

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**Requests for Single Reprints:** Reprints are available from the USPSTF Web site ([www.uspreventiveservicestaskforce.org](http://www.uspreventiveservicestaskforce.org)).

## References

1. Guirguis-Blake JM, Beil TL, Sun X, Senger CA, Whitlock EP. Primary Care Screening for Abdominal Aortic Aneurysm: An Evidence Update for the U.S. Preventive Services Task Force. Evidence synthesis no. 109. AHRQ publication no. 14-05202-EF-1. Rockville, MD: Agency for Healthcare Research and Quality; 2014.
2. Guirguis-Blake JM, Beil TL, Senger CA, Whitlock EP. Ultrasonography screening for abdominal aortic aneurysms: a systematic evidence review for the U.S. Preventive Services Task Force. *Ann Intern Med.* 2014;160:321-9. [PMID: 24473919]
3. Thompson SG, Ashton HA, Gao L, Buxton MJ, Scott RA; Multicentre Aneurysm Screening Study (MASS) Group. Final follow-up of the Multicentre Aneurysm Screening Study (MASS) randomized trial of abdominal aortic aneurysm screening. *Br J Surg.* 2012;99:1649-56. [PMID: 23034729]
4. Lindholt JS, Sørensen J, Sogaard R, Henneberg EW. Long-term benefit and cost-effectiveness analysis of screening for abdominal aortic aneurysms from a randomized controlled trial. *Br J Surg.* 2010;97:826-34. [PMID: 20473995]
5. Lederle FA, Johnson GR, Wilson SE, Chute EP, Littoo FN, Bandyk D, et al. Prevalence and associations of abdominal aortic aneurysm detected through screening. Aneurysm Detection and Management (ADAM) Veterans Affairs Cooperative Study Group. *Ann Intern Med.* 1997;126:441-9. [PMID: 9072929]
6. Chun KC, Teng KY, Van Spyk EN, Carson JG, Lee ES. Outcomes of an abdominal aortic aneurysm screening program. *J Vasc Surg.* 2013;57:376-81. [PMID: 23141680]
7. Scott RA, Wilson NM, Ashton HA, Kay DN. Influence of screening on the incidence of ruptured abdominal aortic aneurysm: 5-year results of a randomized controlled study. *Br J Surg.* 1995;82:1066-70. [PMID: 7648155]
8. Scott RA, Bridgewater SG, Ashton HA. Randomized clinical trial of screening for abdominal aortic aneurysm in women. *Br J Surg.* 2002;89:283-5. [PMID: 11872050]
9. Svensjö S, Björck M, Wanhainen A. Current prevalence of abdominal aortic aneurysm in 70-year-old women. *Br J Surg.* 2013;100:367-72. [PMID: 23192439]
10. Darling RC, Messina CR, Brewster DC, Ottinger LW. Autopsy study of unoperated abdominal aortic aneurysms. The case for early resection. *Circulation.* 1977;56:II161-4. [PMID: 884821]
11. Schermerhorn ML, Bensley RP, Giles KA, Hurks R, O'malley AJ, Cotterill P, et al. Changes in abdominal aortic aneurysm rupture and short-term mortality, 1995-2008: a retrospective observational study. *Ann Surg.* 2012;256:651-8. [PMID: 22964737]
12. Greco G, Egorova NN, Gelijns AC, Moskowitz AJ, Manganaro AJ, Zwolak RM, et al. Development of a novel scoring tool for the identification of large  $\geq 5$  cm abdominal aortic aneurysms. *Ann Surg.* 2010;252:675-82. [PMID: 20881774]
13. Kent KC, Zwolak RM, Egorova NN, Riles TS, Manganaro A, Moskowitz AJ, et al. Analysis of risk factors for abdominal aortic aneurysm in a cohort of more than 3 million individuals. *J Vasc Surg.* 2010;52:539-48. [PMID: 20630687]
14. Sweeting MJ, Thompson SG, Brown LC, Powell JT; RESCAN collaborators. Meta-analysis of individual patient data to examine factors affecting growth and rupture of small abdominal aortic aneurysms. *Br J Surg.* 2012;99:655-65. [PMID: 22389113]
15. Consumer Reports. What's behind the ratings for heart screening tests? February 2013. Accessed at [www.consumerreports.org/cro/2013/01/whats-behind-the-ratings-for-heart-screening-tests/index.htm](http://www.consumerreports.org/cro/2013/01/whats-behind-the-ratings-for-heart-screening-tests/index.htm) on 17 January 2014.
16. Lederle FA, Stroupe KT; Open Versus Endovascular Repair (OVER) Veterans Affairs Cooperative Study Group. Cost-effectiveness at two years in the VA Open Versus Endovascular Repair Trial. *Eur J Vasc Endovasc Surg.* 2012; 44:543-8. [PMID: 23116986]
17. Centers for Medicare & Medicaid Services. Your Medicare coverage: abdominal aortic aneurysm screening. 2014. Accessed at [www.medicare.gov/coverage/ab-aortic-aneurysm-screening.html](http://www.medicare.gov/coverage/ab-aortic-aneurysm-screening.html) on 17 January 2014.
18. Dua A, Kuy S, Lee CJ, Upchurch GR Jr, Desai SS. Epidemiology of aortic aneurysm repair in the United States from 2000 to 2010. *J Vasc Surg.* 2014;59: 1512-7. [PMID: 24560865]

19. Lo RC, Bensley RP, Hamdan AD, Wyers M, Adams JE, Schermerhorn ML; Vascular Study Group of New England. Gender differences in abdominal aortic aneurysm presentation, repair, and mortality in the Vascular Study Group of New England. *J Vasc Surg*. 2013;57:1261-8. [PMID: 23384493]
20. Lin PH, Bush RL, McCoy SA, Felkai D, Pasnelli TK, Nelson JC, et al. A prospective study of a hand-held ultrasound device in abdominal aortic aneurysm evaluation. *Am J Surg*. 2003;186:455-9. [PMID: 14599606]
21. Blois B. Office-based ultrasound screening for abdominal aortic aneurysm. *Can Fam Physician*. 2012;58:e172-8. [PMID: 22518906]
22. Lederle FA, Wilson SE, Johnson GR, Reinke DB, Littooy FN, Acher CW, et al; Aneurysm Detection and Management Veterans Affairs Cooperative Study Group. Immediate repair compared with surveillance of small abdominal aortic aneurysms. *N Engl J Med*. 2002;346:1437-44. [PMID: 12000813]
23. Mortality results for randomised controlled trial of early elective surgery or ultrasonographic surveillance for small abdominal aortic aneurysms. The UK Small Aneurysm Trial Participants. *Lancet*. 1998;352:1649-55. [PMID: 9853436]
24. Cao P, De Rango P, Verzini F, Parlani G, Romano L, Cieri E; CAESAR Trial Group. Comparison of surveillance versus aortic endografting for small aneurysm repair (CAESAR): results from a randomised trial. *Eur J Vasc Endovasc Surg*. 2011;41:13-25. [PMID: 20869890]
25. Ouriel K, Clair DG, Kent KC, Zarins CK; Positive Impact of Endovascular Options for treating Aneurysms Early (PIVOTAL) Investigators. Endovascular repair compared with surveillance for patients with small abdominal aortic aneurysms. *J Vasc Surg*. 2010;51:1081-7. [PMID: 20304589]
26. Randomized preventive vascular screening trial of 65-74 year old men in the central region of Denmark. *ClinicalTrials.gov*: NCT00662480. Accessed at <http://clinicaltrials.gov/ct2/show/NCT00662480> on 17 January 2014.
27. Chaikof EL, Brewster DC, Dalman RL, Makaroun MS, Illig KA, Sicard GA, et al; Society for Vascular Surgery. The care of patients with an abdominal aortic aneurysm: the Society for Vascular Surgery practice guidelines. *J Vasc Surg*. 2009;50:S2-49. [PMID: 19786250]
28. Ashton HA, Buxton MJ, Day NE, Kim LG, Marteau TM, Scott RA, et al; Multicentre Aneurysm Screening Study Group. The Multicentre Aneurysm Screening Study (MASS) into the effect of abdominal aortic aneurysm screening on mortality in men: a randomised controlled trial. *Lancet*. 2002;360:1531-9. [PMID: 12443589]
29. Lindholt JS, Juul S, Fasting H, Henneberg EW. Screening for abdominal aortic aneurysms: single centre randomised controlled trial. *BMJ*. 2005;330:750. [PMID: 15757960]
30. Norman PE, Jamrozik K, Lawrence-Brown MM, Le MT, Spencer CA, Tuohy RJ, et al. Population based randomised controlled trial on impact of screening on mortality from abdominal aortic aneurysm. *BMJ*. 2004;329:1259. [PMID: 15545293]
31. Ashton HA, Gao L, Kim LG, Druce PS, Thompson SG, Scott RA. Fifteen-year follow-up of a randomized clinical trial of ultrasonographic screening for abdominal aortic aneurysms. *Br J Surg*. 2007;94:696-701. [PMID: 17514666]
32. Greenhalgh RM, Brown LC, Powell JT, Thompson SG, Epstein D, Sculpher MJ; United Kingdom EVAR Trial Investigators. Endovascular versus open repair of abdominal aortic aneurysm. *N Engl J Med*. 2010;362:1863-71. [PMID: 20382983]
33. Lederle FA, Freischlag JA, Kyriakides TC, Padberg FT Jr, Matsumura JS, Kohler TR, et al; Open Versus Endovascular Repair (OVER) Veterans Affairs Cooperative Study Group. Outcomes following endovascular vs open repair of abdominal aortic aneurysm: a randomized trial. *JAMA*. 2009;302:1535-42. [PMID: 19826022]
34. Blankensteijn JD, de Jong SE, Prinssen M, van der Ham AC, Buth J, van Sterkenburg SM, et al; Dutch Randomized Endovascular Aneurysm Management (DREAM) Trial Group. Two-year outcomes after conventional or endovascular repair of abdominal aortic aneurysms. *N Engl J Med*. 2005;352:2398-405. [PMID: 15944424]
35. Propranolol Aneurysm Trial Investigators. Propranolol for small abdominal aortic aneurysms: results of a randomized trial. *J Vasc Surg*. 2002;35:72-9. [PMID: 11802135]
36. Wanhainen A, Rosén C, Rutegård J, Bergqvist D, Björck M. Low quality of life prior to screening for abdominal aortic aneurysm: a possible risk factor for negative mental effects. *Ann Vasc Surg*. 2004;18:287-93. [PMID: 15354629]
37. Hirsch AT, Haskal ZJ, Hertzner NR, Bakal CW, Creager MA, Halperin JL, et al; American Association for Vascular Surgery. ACC/AHA 2005 Practice guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic): a collaborative report from the American Association for Vascular Surgery/Society for Vascular Surgery, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, Society of Interventional Radiology, and the ACC/AHA Task Force on Practice Guidelines (Writing Committee to Develop Guidelines for the Management of Patients With Peripheral Arterial Disease): endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation; National Heart, Lung, and Blood Institute; Society for Vascular Nursing; Trans-Atlantic Inter-Society Consensus; and Vascular Disease Foundation. *Circulation*. 2006;113:e463-654. [PMID: 16549646]
38. Lim LS, Haq N, Mahmood S, Hoeksema L; ACPM Prevention Practice Committee. Atherosclerotic cardiovascular disease screening in adults: American College of Preventive Medicine position statement on preventive practice. *Am J Prev Med*. 2011;40:381. [PMID: 21335273]
39. Mastracci TM, Cinà CS; Canadian Society for Vascular Surgery. Screening for abdominal aortic aneurysm in Canada: review and position statement of the Canadian Society for Vascular Surgery. *J Vasc Surg*. 2007;45:1268-1276. [PMID: 17543696]
40. Moll FL, Powell JT, Fraedrich G, Verzini F, Haulon S, Waltham M, et al; European Society for Vascular Surgery. Management of abdominal aortic aneurysms clinical practice guidelines of the European Society for Vascular Surgery. *Eur J Vasc Endovasc Surg*. 2011;41 Suppl 1:S1-58. [PMID: 21215940]

## APPENDIX: U.S. PREVENTIVE SERVICES TASK FORCE

Members of the U.S. Preventive Services Task Force at the time this recommendation was finalized† are Michael L. LeFevre, MD, MSPH, Chair (University of Missouri School of Medicine, Columbia, Missouri); Albert L. Siu, MD, MSPH, Co-Vice Chair (Mount Sinai School of Medicine, New York, and James J. Peters Veterans Affairs Medical Center, Bronx, New York); Kirsten Bibbins-Domingo, MD, PhD, Co-Vice Chair (University of California, San Francisco, and San Francisco General Hospital, San Francisco, California); Linda Ciofu Baumann, PhD, RN (University of Wisconsin, Madison, Wisconsin); Susan J. Curry, PhD (University of Iowa College of Public Health, Iowa City, Iowa); Karina W. Davidson, PhD, MAsc (Columbia University Medical Center, New York, New York); Mark Ebell, MD, MS (University of Georgia, Athens, Georgia); Francisco A.R. García, MD, MPH (Pima County Department of Health, Tucson, Arizona);

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† For a list of current Task Force members, go to [www.uspreventiveservicestaskforce.org/members.htm](http://www.uspreventiveservicestaskforce.org/members.htm).

**Appendix Table 1. What the USPSTF Grades Mean and Suggestions for Practice**

Grade	Definition	Suggestions for Practice
A	The USPSTF recommends the service. There is high certainty that the net benefit is substantial.	Offer/provide this service.
B	The USPSTF recommends the service. There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.	Offer/provide this service.
C	The USPSTF recommends selectively offering or providing this service to individual patients based on professional judgment and patient preferences. There is at least moderate certainty that the net benefit is small.	Offer/provide this service for selected patients depending on individual circumstances.
D	The USPSTF recommends against the service. There is moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.	Discourage the use of this service.
I statement	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of the service. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.	Read the Clinical Considerations section of the USPSTF Recommendation Statement. If the service is offered, patients should understand the uncertainty about the balance of benefits and harms.

**Appendix Table 2. USPSTF Levels of Certainty Regarding Net Benefit**

Level of Certainty*	Description
High	The available evidence usually includes consistent results from well-designed, well-conducted studies in representative primary care populations. These studies assess the effects of the preventive service on health outcomes. This conclusion is therefore unlikely to be strongly affected by the results of future studies.
Moderate	The available evidence is sufficient to determine the effects of the preventive service on health outcomes, but confidence in the estimate is constrained by such factors as: the number, size, or quality of individual studies; inconsistency of findings across individual studies; limited generalizability of findings to routine primary care practice; and lack of coherence in the chain of evidence. As more information becomes available, the magnitude or direction of the observed effect could change, and this change may be large enough to alter the conclusion.
Low	The available evidence is insufficient to assess effects on health outcomes. Evidence is insufficient because of: the limited number or size of studies; important flaws in study design or methods; inconsistency of findings across individual studies; gaps in the chain of evidence; findings that are not generalizable to routine primary care practice; and a lack of information on important health outcomes. More information may allow an estimation of effects on health outcomes.

\* The USPSTF defines *certainty* as “likelihood that the USPSTF assessment of the net benefit of a preventive service is correct.” The net benefit is defined as benefit minus harm of the preventive service as implemented in a general primary care population. The USPSTF assigns a certainty level on the basis of the nature of the overall evidence available to assess the net benefit of a preventive service.