Atrial fibrillation (AF) is the most common cardiac arrhythmia. The prevalence of AF increases with age, from less than 0.2% in adults younger than 55 years to about 10% in those 85 years or older, with a higher prevalence in men than in women. It is uncertain whether the prevalence of AF differs by race and ethnicity. Atrial fibrillation is a major risk factor for ischemic stroke and is associated with a substantial increase in the risk of stroke. Approximately 20% of patients who have a stroke associated with AF are first diagnosed with AF at the time of the stroke or shortly thereafter.

Atrial fibrillation is a major risk factor for ischemic stroke and is associated with a substantial increase in the risk of stroke. Approximately 20% of patients who have a stroke associated with AF are first diagnosed with AF at the time of the stroke or shortly thereafter.
Atrial fibrillation (AF) burden refers to the amount or percentage of time a person’s heart rate is above a certain threshold, typically defined by spontaneous or intermittent AF. Clinical AF is an atrial tachyarrhythmia that has traditionally been defined by documentation of the arrhythmia on a standard surface (typically 12-lead) electrocardiogram (ECG). Atrial fibrillation can be persistent or paroxysmal, and symptomatic or asymptomatic. As implantable cardiac devices and the use of portable or wearable cardiac monitors have become more common, a new category of AF, called subclinical AF, has emerged. Subclinical AF refers to device-detected AF that is asymptomatic and not clinically apparent. It may be detected by intracardiac, implantable, or wearable cardiac monitors. The duration of subclinical AF can vary, ranging from a few seconds to more than 24 hours. Atrial fibrillation burden refers to the amount or percentage of time that is spent in AF. Atrial fibrillation burden is often described as low or high, although there is no exact definition or consensus about what constitutes low vs high AF burden. Clinical AF is known to increase stroke risk, but the stroke risk associated with subclinical AF, particularly low-burden or short-duration AF, is less well understood.

Screening Tests
Although the USPSTF did not find sufficient evidence to recommend for or against screening, several technologies have been proposed for screening for AF. ECG records the electrical activity of the heart and can be performed using 12 leads, fewer than 12 leads, or a single lead. Several other medical devices (eg, automated blood pressure cuffs or pulse oximeters) have been designed with algorithms to detect an irregular heartbeat, which may or may not be AF. Several consumer-oriented devices, such as smartwatches and smartphone apps, are available that aim to detect an irregular heart rhythm using ECG technology or photoplethysmography. It is important to note that the USPSTF considers pulse palpation to be routine or usual care.

Different intensities (eg, frequencies, intervals, and durations) of screening for AF are also being studied. Screening can be performed once, for example, by using ECG or a device with an AF detection algorithm at a clinician visit. Screening can also be performed intermittently on multiple occasions, for example, by having a patient briefly record their heart rhythm using a portable device several times a day or several times a week for a period of time; or continuously (eg, by having a patient wear a portable monitoring device for several days or weeks). The USPSTF categorizes these as 1-time screening strategies, intermittent screening strategies, and continuous screening strategies, respectively. Continuous screening strategies yield the longest overall duration of screening. Intermittent or continuous screening may be more likely to detect AF but also may be more likely to detect paroxysmal AF that occurs infrequently or is of short duration.

Treatment or Intervention
Treatment of AF generally has 2 components—managing symptomatic arrhythmia and preventing stroke. Symptomatic arrhythmia can be managed by controlling the heart rate to minimize symptoms (usually through medication) or by restoring a normal rhythm. Methods for restoring normal rhythm include electrical or pharmacologic cardioversion and surgical or catheter ablation.

To reduce the risk of stroke, anticoagulants are used. Oral anticoagulants include warfarin (a vitamin K antagonist) and target-specific anticoagulants, also known as direct oral anticoagulants. In general, guidelines recommend anticoagulant therapy for persons at high risk of stroke. It is important to note that stroke risk stratification instruments (eg, CHA2DS2-VASc [congestive heart failure, hypertension, age ≥75 years (doubled), diabetes, stroke/transient ischemic attack/thromboembolism (doubled), vascular disease (prior myocardial infarction, peripheral artery disease, or aortic plaque), age 65-74 years, sex category (female)]) were developed from populations of patients with clinically diagnosed, not screen-detected, AF.
Potential Preventable Burden

Atrial fibrillation is the most common type of cardiac arrhythmia. In the US, estimates of the prevalence of clinical AF ranged from 2.7 to 6.1 million in 2010. The prevalence of AF is highly correlated with age. Its prevalence increases from 0.2% among adults younger than 55 years to 10% among those 85 years or older. Additional risk factors for AF include diabetes, previous cardiothoracic surgery, smoking, prior stroke, underlying heart disease, hypertension, sleep apnea, obesity, alcohol/drug use, ECG features such as left ventricular hypertrophy and left atrial enlargement, and hyperthyroidism. The primary rationale for screening for AF in asymptomatic persons is to initiate oral anticoagulant medications in persons at sufficiently high risk to prevent a thromboembolic event.

The prevalence of AF increases with age, from less than 0.2% in adults younger than 55 years to about 10% in those 85 years or older. Patients with AF have a substantially increased risk of stroke, and strokes associated with AF tend to be more severe than strokes attributed to other causes. However, the stroke risk associated with subclinical AF (AF that is only device-detected, not clinically apparent, and may be of short duration), as might be detected by some screening approaches, is uncertain. It is also unclear whether or when (ie, based on duration or frequency of episodes) subclinical AF warrants anticoagulant therapy.

Why is this recommendation and topic important?

AF is the most common type of irregular heartbeat. It is a major risk factor for stroke and often goes undetected. Patients with clinical AF not receiving anticoagulant therapy have an increased risk of stroke, and strokes associated with AF tend to be more severe than strokes attributed to other causes. Atrial fibrillation does not always cause symptoms, and for approximately 20% of patients who have a stroke associated with AF, stroke is the first sign that they have the condition. However, the current evidence is insufficient for the USPSTF to recommend for or against screening for AF. Additionally, the stroke risk associated with subclinical AF, particularly subclinical AF of shorter duration (less than several to 24 hours) or lower burden (amount or percentage of time spent in AF), as might be detected by some screening approaches, is uncertain, and the duration of subclinical AF that might warrant anticoagulant therapy is unclear.

Potential Harms

The performance of ECG or use of portable or wearable rhythm monitoring devices is not associated with significant harm, although abnormal test results may cause anxiety. Misinterpretation of a screening test result may lead to misdiagnosis and unnecessary treatment. Treatment of AF can include anticoagulant therapy for stroke prevention, which is associated with a risk of bleeding, and pharmacologic, surgical, endovascular (eg, ablation), or combined treatments to control heart rhythm or heart rate. In addition, ECG may detect other abnormalities (either true- or false-positive results)
that can lead to further testing and treatments that have the potential for harm.

Current Practice
Few data are available on the current prevalence of screening for AF with ECG or other modalities in the US.

Additional Tools and Resources

The Million Hearts initiative provides information on improving cardiovascular health and preventing myocardial infarction and stroke at https://millionhearts.hhs.gov/index.html.

Other Related USPSTF Recommendations
The USPSTF has made recommendations on many factors related to the prevention of cardiovascular disease and stroke, including screening for high blood pressure, use of statins, counseling on smoking cessation, and counseling to promote a healthy diet and physical activity.

Update of Previous USPSTF Recommendation
This recommendation replaces the 2018 USPSTF recommendation statement on screening for AF with ECG. In 2018, the USPSTF concluded that the evidence was insufficient to assess the balance of benefits and harms of using ECG to screen for AF. For the current recommendation statement, the USPSTF expanded its review to include other screening tests in addition to ECG. The USPSTF again concludes that the evidence is insufficient to assess the balance of benefits and harms of screening for AF in asymptomatic adults.

Supporting Evidence
Scope of Review
To update its 2018 recommendation statement, the USPSTF commissioned a systematic review of the evidence on the benefits and harms of screening for AF in older adults, the accuracy of screening tests, the effectiveness of screening tests to detect previously undiagnosed AF compared with usual care, and the benefits and harms of anticoagulant therapy for the treatment of screen-detected AF in asymptomatic adults.

Detection of Previously Undiagnosed AF
The USPSTF reviewed 9 studies on the accuracy of potential screening tests for AF. Two studies of single-lead ECG devices with automated AF detection algorithms used as a 1-time screening test reported sensitivities of 0.88 and 0.99 and specificities of 1.0 and 0.76 when compared with a single 12-lead ECG interpreted by a cardiologist. One study of a 6-lead ECG device with AF detection reported sensitivity of 0.95 and specificity of 0.99 vs a single 12-lead ECG interpreted by a cardiologist. Three studies reported 5 comparisons of 2 different oscillometric blood pressure monitoring devices with automated AF detection compared with a 12-lead ECG interpreted by a cardiologist. In 4 of the comparisons, sensitivity ranged from 0.92 to 1.0 and specificity ranged from 0.90 to 0.95. In the fifth comparison, sensitivity for 1 of the devices was reported as 0.3 and specificity as 0.97. The reason for the lower sensitivity reported in that study is uncertain.

One study of a 72-hour continuous Holter monitor compared with an insertable cardiac monitor found a sensitivity of 1.0 when considering cases of AF detected during the 72-hour monitoring period covered by both devices. Over the entire duration of insertable cardiac monitoring (mean, 588 days), several additional cases of subclinical paroxysmal AF were detected, giving an overall sensitivity of 0.12 for the 72-hour Holter monitor. The specificity of Holter monitoring was 1.0. Data on the accuracy of screening tests reported in or calculated from randomized clinical trials of screening are discussed below. It is important to note that estimates of sensitivity and specificity for any given test to detect AF may vary depending on the reference standard used (12-lead ECG interpreted by a cardiologist or an insertable cardiac monitor) and with the duration of the reference standard measurement.

The USPSTF found 4 randomized clinical trials that compared different 1-time screening approaches for the detection of AF with usual care or no screening. The mean age of participants in these trials was 74 to 76 years. Of these trials, only 1, the Screening for Atrial Fibrillation in the Elderly (SAFE) trial, found a statistically significant increased detection rate of AF (0.6% absolute increase) when comparing no intervention with ECG; however, there was no difference between clinician reminders for pulse palpation (considered usual care by the USPSTF) and screening with ECG in the detection of new cases of AF. Fidelity to the intervention was low to modest in all 4 studies, ranging from 11% to 69%.

Two of these trials reported on measures of accuracy of screening tests. The SAFE trial reported that the sensitivity of ECG interpreted by a general practitioner compared with 12-lead ECG interpreted by a cardiologist ranged from 0.80 to 0.85, and specificity ranged from 0.86 to 0.92. The Detecting and Diagnosing Atrial Fibrillation trial did not report sensitivity or specificity. However, in that trial, if the screening test result is considered positive if any of its components (pulse palpation, oscillometric blood pressure measurement with automated AF detection, and single-lead ECG with automated AF detection) were positive, the positive predictive value was 6% and the negative predictive value was 100%.

The USPSTF found 2 trials that used an intermittent screening approach and 2 trials that used a continuous screening approach. The mean age in these trials ranged from 72 to 80 years. The Assessment of Remote Heart Rhythm Sampling Using the AliveCor Heart Monitor to Screen for Atrial Fibrillation (REHEARSE-AF) trial (n = 1001) randomized participants to twice-weekly screening with a single-lead, handheld ECG for 30 seconds or to no screening for 12 months. STROKESTOP randomized more than 28,000 persons aged 75 or 76 years in a defined geographical region in Sweden to an index ECG at baseline, followed by 2 weeks of intermittent handheld single-lead ECG monitoring; follow-up was a median of 6.9 years. REHEARSE-AF found a statistically significant 2.8% absolute risk increase in detection of AF for screening vs no screening at 12 months. STROKESTOP found a statistically significant 1.0% absolute risk increase in detection of AF at 6 months after
screening, a difference that was maintained through 7 years of follow-up but which was no longer statistically significant (21.3% vs 20.3%; P = .28). Approximately 12% of persons enrolled in STROKESTOP had known AF at baseline, and only 13% of AF cases detected after the intervention in the screening group were new cases not known at baseline.

The mHealth Screening to Prevent Strokes (mSToPS) trial (n = 2659) randomized participants to screening with 2 14-day episodes of continuous ambulatory ECG monitoring with a patch 3 months apart or to delayed screening.19 SCREEN-AF randomized 856 participants to a similar intervention, with the addition of a home blood pressure monitor with automated AF detection to be used twice daily during each 2-week ECG monitoring period. The mean age of participants in this study was 80 years, and all were required to have hypertension.40 These 2 trials reported statistically significant absolute risk increases of 3% and 4.8% in detection of AF for screening vs no screening or delayed screening. The USPSTF found no trials that compared screening for AF with consumer-oriented devices vs no screening.2,23

SCREEN-AF also reported on a measure of screening accuracy. It found that screening with an oscillometric blood pressure monitor with an AF detection feature twice daily over a total of 4 weeks had a sensitivity of 0.35 (95% CI, 0.15-0.59) and specificity of 0.81 (95% CI, 0.77-0.85) compared with continuous ECG monitoring over the same 4 weeks.40 The low sensitivity observed for the intermittent blood pressure monitor is likely because a continuous ECG is better suited for identifying paroxysmal AF.

Intermittent or continuous screening approaches may be more likely to detect short episodes of nonpersistent AF. The mSToPS trial reported that the longest individual episode of AF detected during its total of 28 days of monitoring was less than 5 minutes in 7.2% of participants, 5 minutes to 6 hours in 55%, 6 to 24 hours in 25%, and more than 24 hours in 13%.39 In the SCREEN-AF trial, the longest individual episode of AF detected was 5 minutes or less in 13% of participants, more than 5 minutes to 6 hours in 43%, more than 6 to 24 hours in 30%, and more than 24 hours in 13%.40 It is uncertain to what degree short episodes of subclinical AF increase stroke risk, and the duration of subclinical AF that warrants anticoagulant therapy is unclear.5,30

**Benefits of Early Detection and Treatment**

The USPSTF found 3 trials, REHEARSE-AF,37 SCREEN-AF,40 and STROKESTOP,28 that compared screening with no screening and that reported on health outcomes; however, only STROKESTOP was powered to detect health outcomes. STROKESTOP reported no significant difference in ischemic stroke (the originally specified primary outcome), systemic embolism, or all-cause mortality in the invitation to screening group compared with the control group at a median follow-up of 6.9 years (hazard ratio, 0.92 [95% CI, 0.83-1.01] for ischemic stroke; 1.10 [95% CI, 0.76 to 1.59] for systemic embolism; and 0.96 [95% CI, 0.92-1.01] for all-cause mortality). The study reported that the rate of a composite end point consisting of ischemic stroke, hemorrhagic stroke, systemic embolism, bleeding leading to hospitalization, and all-cause mortality was significantly lower in the invitation to screening group (5.45 events/100 person-years) compared with the control group (5.68 events/100 person-years), with an unadjusted hazard ratio of 0.96 (95% CI, 0.92-1.00; P = .045). STROKESTOP has several limitations, including: the composite end point includes both benefits and harms; the primary trial outcome was originally specified as ischemic stroke in 2012 but was subsequently changed to this composite end point in 2017; and, approximately 12% of persons enrolled in STROKESTOP had known AF at baseline, and approximately 11% had a history of transient ischemic attack, stroke, or systemic embolism. The other 2 studies, REHEARSE-AF37 and SCREEN-AF,40 found no significant difference in health outcomes (stroke, transient ischemic attack, systemic embolism, and death) between the screening and no screening groups, although they were not designed or powered to detect these outcomes and events were rare.

The USPSTF found no trials that reported on the benefits of anticoagulant therapy in screen-detected populations. Several trials reported on the benefits of anticoagulant therapy for clinical AF. In a pooled analysis of 5 trials, warfarin treatment over a mean of 1.5 years was associated with reductions in all-cause mortality (pooled relative risk [RR], 0.68 [95% CI, 0.50-0.93]; 2415 participants), ischemic stroke (pooled RR, 0.32 [95% CI, 0.20-0.51]), and moderately to severely disabling stroke (pooled RR, 0.38 [95% CI, 0.19-0.78]) compared with the control group.2,23 A network meta-analysis of 21 studies found that all anticoagulant treatments (warfarin or direct oral anticoagulants) were associated with a lower risk of outcomes such as stroke, systemic embolism, and all-cause mortality compared with placebo or control groups.41

Trials of anticoagulant treatment enrolled participants with clinically long-standing, persistent AF; none focused on participants who were detected by screening.2,23 As discussed above, the extent to which short episodes of subclinical (ie, asymptomatic or device-detected) AF increase stroke risk is uncertain, and the duration or burden of AF that warrants anticoagulation therapy is unclear.5,30 Thus, the applicability of treatment benefits to screen-detected populations, particularly those with short-duration or low burden AF, is uncertain.

**Harms of Screening and Treatment**

Several of the randomized clinical trials discussed above also reported on the harms of screening for AF. In STROKESTOP, the rates of hemorrhagic stroke and hospitalization for major bleeding did not significantly differ between the invitation to screening group and the control group.38 In the SAFE study, anxiety levels were not significantly different between participants randomized to ECG screening vs pulse palpation reminders. Participants who had a positive screening result had higher mean anxiety scores compared with those who had a negative result, although most did not have clinically meaningful levels of anxiety symptoms.30 The mSToPS trial reported incidentally detected, potentially actionable arrhythmias other than AF in 70 participants (2.6% of participants), although the balance of benefits or harms of these findings is unknown.39 Another potential harm of screening is ECG misinterpretation, leading to false-positive results and possibly unnecessary treatment.

The USPSTF reviewed several trials, systematic reviews, and an observational study that reported on harms associated with anticoagulant therapy. Anticoagulant therapy was associated with an increased risk of bleeding, including major bleeding, extracranial bleeding, intracranial bleeding, and minor bleeding events, although the increased risk was not statistically significant for all outcomes.2,23 Similar to the body of evidence on the benefits of anticoagulant treatment, the studies reporting on harms were focused on persons with...
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Response to Public Comment

A draft version of this recommendation statement was posted for public comment on the USPSTF website from April 20, 2021, to May 17, 2021. Several comments agreed with the USPSTF recommendation. In response to comments, the USPSTF wants to clarify that the I statement is not a recommendation against screening for AF; it indicates that the evidence is insufficient to recommend either for or against screening. The USPSTF also wants to highlight that it considers pulse palpation to be usual care, as noted in the Practice Considerations and Detection of Previously Undiagnosed AF sections. Some comments noted that the inclusion age for studies on the benefits and harms of screening for AF was lowered to age 50 years for the current recommendation, compared with age 65 years in the prior recommendation. The USPSTF did this to be inclusive of all potential evidence on screening for AF. Lowering the inclusion age was not intended to dilute the evidence in older adults in any way, nor did it. Some comments suggested adding specific research gaps, such as determining the optimal strategy for screening, the optimal populations to screen, or the association between subclinical AF or AF detected on consumer devices and stroke risk. In response, the USPSTF specified understanding the stroke risk associated with AF detected with use of consumer devices, how that risk varies among persons older than 65 years using pulse assessment followed by ECG, as indicated, can be useful.42

The American Academy of Family Physicians supports the 2018 USPSTF recommendation on screening for AF with ECG.43

Research Needs and Gaps

More studies are needed that address the following:

- Randomized trials enrolling asymptomatic persons that directly compare screening with usual care and that assess both health outcomes and harms are needed to understand the balance of benefits and harms of screening for AF. It is important that screening trials enroll sufficient participants of both sexes and diverse racial and ethnic groups to enable assessment of whether the detection of AF or the benefits or harms of screening vary in different population groups.
- How to best optimize the accuracy of screening tests or strategies for AF.
- Understanding the risk of stroke associated with subclinical AF, or AF detected with use of consumer devices, how that risk varies with duration or burden of AF, and the potential benefit of anticoagulation therapy among persons with subclinical AF.

Recommendations of Others

The American Heart Association and the American Stroke Association state that active screening for AF in the primary care setting among persons older than 65 years using pulse assessment followed by ECG, as indicated, can be useful.42

The American Academy of Family Physicians supports the 2018 USPSTF recommendation on screening for AF with ECG.43

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Additional Information: The US Preventive Services Task Force (USPSTF) makes recommendations about the effectiveness of specific preventive care services for patients without obvious 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 research needs and gaps. The USPSTF added the recently published SCREEN-AF and STROKESTOP studies to those it reviewed for this recommendation.
notes that policy and coverage decisions involve considerations in addition to the evidence of clinical benefits and harms. Published by JAMA—Journal of the American Medical Association under arrangement with the Agency for Healthcare Research and Quality (AHRQ). ©2022 AMA and United States Government, as represented by the Secretary of the Department of Health and Human Services (HHS), by assignment from the members of the United States Preventive Services Task Force (USPSTF). All rights reserved.

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